SECTION C: IMPACT ASSESSMENT

CHAPTER C6: BIODIVERSITY AND ECOSYSTEM SERVICES

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6. BIODIVERSITY AND ECOSYSTEM SERVICES IMPACT ASSESSMENT AND MITIGATION

6.1 INTRODUCTION

This Chapter of the ESIA describes the potential impacts on biodiversity and identified priority ecosystem services associated with the construction, operation and closure phases of the Oyu Tolgoi Project. The Chapter describes the direct measures which have been implemented to avoid adverse impacts as well as specific measures aimed to minimise and restore project-related impacts. Actions to offset or compensate for unavoidable residual impacts are also discussed. Construction-phase management and monitoring measures are described in detail in *Chapter D6: Flora and Fauna Management Plan.*

Project-related direct and indirect impacts are assessed in terms of the nature of the impact, the existing and planned mitigation measures, the potential significance of the impact to biodiversity, including priority ecosystem services, and the magnitude of the residual impact and significance after mitigation measures have been implemented. Long-term measures for impacts during operations and post-closure phase will be described by the Oyu Tolgoi Biodiversity Action Plan. This assessment incorporates the findings of the 'Biodiversity Impacts and Mitigation Actions' report developed by The Biodiversity Consultancy and Fauna & Flora International ("TBC/FFI") as part of the independent Rapid Biodiversity Assessment (RBA) of the Oyu Tolgoi Area of Influence ("AoI") and annexed to this report (see Annexes A-D and *Chapter B7a: Biodiversity Baseline* Annex C). The focus of this impact assessment is on the priority biodiversity features, and priority ecosystem services identified in *Chapters B7a and B7b* of this ESIA.

6.2 SCOPE

6.2.1 Definitions

- **Direct Impact:** An impact caused by Project activities or personnel within the Project footprint;
- **Indirect Impact:** An impact that occurs beyond the Project footprint as a result of Project activities, infrastructure, or personnel; and
- **Ecosystem Services:** Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits.

Chapter B7b: Ecosystem Services Baseline Assessment, adopts a system of classifying Ecosystem Services based on the International Finance Corporation Performance Standard 6 (PS 6), including PS 6 Version 2 dated December 1, 2010 (IFC 2010), Guidance Note 6 (IFC 2007) and the Draft Guidance Note 6 V2 (IFC 2011). The assessment of which ecosystem services trigger Critical Habitat follows PS 6 and the European Bank for Reconstruction and Development Performance Requirement 6 (PR 6) (following the Oyu Tolgoi project guidance note, IFC 2009; see *Chapter B7a: Biodiversity Baseline* Annex C: RBA Critical Habitat report). Based upon this system, each Ecosystem Services is categorized as Type I or Type 2 priority defined as:

- **Priority Service Type I:** Ecosystem service over which the client has direct control or significant influence and where impacts on such services may adversely affect communities;
- **Priority Service Type II:** Ecosystem service over which the client has direct management control or significant influence, and on which the Project directly depends for it operations;
- **Replaceability:** As described in a draft IFC guidance document (IFC, Guidance Note 6, January, 2011), replaceability is the extent to which the loss of the area will compromise regional conservation targets. This definition for Ecosystem Services is broadened to include the extent of potential loss to the regional provision of a service. This ranking is intended to assess the rarity, or uniqueness of the area where the Ecosystem Services occurs on a regional level. A degree of irreplaceability exists when there are few or no substitutes available;
- **Mitigation:** An action intended to moderate or alleviate in quality, condition, or intensity, the direct or indirect adverse impact of a Project action;

- **Residual Impact:** The known or potential impacts of a project which remain after measures to mitigate (avoid, minimise and rehabilitate) project impacts have been implemented or otherwise taken into account;
- **Net Positive Impact ("NPI"):** A NPI on biodiversity means that the biodiversity features (species, habitats etc) of a region ultimately benefits as a result of a project's presence. NPI is achieved through application of the mitigation hierarchy and appropriate use of biodiversity offsets to compensate for the unavoidable residual impacts of a project;
- **Offsets:** Actions to create gains or avert ongoing losses in features which are impacted by the project. Offsetting involves actions and locations which are additional to the project's mitigation actions;
- **Priority Biodiversity Features:** These are species and habitats identified as having high conservation value due to categorization by the IUCN global Red List, Mongolian national Red Lists, national legislation, regional uniqueness or identified importance to stakeholders. These are listed in *Chapter B7a Biodiversity Baseline;* and
- **Project Footprint:** The aggregate of the areas to be occupied by the Oyu Tolgoi mine, infrastructure, and facilities, including temporary laydown and work areas but excluding buffer zones.

6.2.2 Topical Scope

This chapter assesses impacts on priority biodiversity features and priority ecosystem services, and identifies mitigation actions for each impact.

6.2.3 Spatial Scope

This assessment examines potential impacts in the direct and indirect areas of influence of the Oyu Tolgoi project, including impacts on populations of migratory and nomadic species of fauna for which impacts may operate at a regional or landscape scales. Impacts on vegetation and flora are primarily within the Project footprint and secondarily within the dustfall zone of dust generating components or activities, although Tall Saxaul Forest and possibly other species suffer from harvesting and collecting across a larger indirect area of influence.

6.2.4 Temporal Scope

The temporal scope covers the life of the mine from construction through to closure and the post-mine legacy.

6.3 BIODIVERSITY-SPECIFIC IMPACT SIGNIFICANCE AND RISK LEVELS

This biodiversity impact assessment is based largely upon the findings of the RBA of the Oyu Tolgoi AoI performed by an independent team of biodiversity and conservation specialists lead by The Biodiversity Consultancy and Fauna & Flora International ("TBC/FFI") and are provided in Annexes A-D and *Chapter B7a: Biodiversity Baseline* Annex C. The impact significance criteria and categorisations utilised in this assessment are specific to biodiversity features and thus vary slightly from those utilised in the assessment of the physical and human environments in this ESIA.

The standard biodiversity risk assessment matrix outlined in the Rio Tinto Biodiversity Action Planning guidance (Rio Tinto 2010) was used to assess the level of risk to each priority biodiversity feature arising from the various project-related direct and indirect impacts. This risk assessment method classifies risks based on the consequence and the likelihood of an event. A set of qualitative but practical 'Biodiversity Likelihood and Consequence Descriptors' have been developed (*Table 6.1* and *Table 6.2*) for use in the risk assessment matrix (*Table 6.3*). The likelihood, consequence and therefore risk of each identified project impact were assessed for each priority biodiversity feature (See *Chapter B7a: Biodiversity Baseline*) known or likely to occur within the AoI of each infrastructure unit (i.e., Gunii Hooloi borefield, pipeline and powerline, permanent airport, Mine Licence Area, Oyu Tolgoi to Gashuun Sukhait road and High-voltage (220kV) transmission line). At the outset, to identify a baseline, the likelihood and consequence assessment assumes no mitigation is put in place.

Mitigation actions were subsequently identified for all impacts assessed as High or Critical Risk to priority biodiversity features. These mitigation actions will be articulated in biodiversity-specific construction and operational management plans currently in development by Oyu Tolgoi (See *Chapter D6: Flora and Fauna Management Plan*).

Table 6.1: Biodiversity-specific descriptors for likelihood

A- Almost Certain	B- Likely	C- Possible	D- Unlikely	E- Rare
Degradation/loss of some/all of biodiversity feature is *inevitable* because of the company's existing/proposed activities. E.g. tailings site will be located where individuals of an endangered plant species are present.	**Degradation/loss of some/all of biodiversity feature *would occur in the majority of cases* because of the company's existing/proposed activities.** E.g. berry crops harvested by native communities are in the company's airshed and may receive some particulate matter under prevailing wind conditions.	**Degradation/loss of some/all of biodiversity feature will not occur in the majority of cases, *but is not unexpected*, because of the company's existing/proposed activities.** E.g. high precipitation event (once in 10 years) increases sedimentation to river from company lands.	**Degradation/loss of some/all of biodiversity feature is *not impossible but should not occur under normal circumstances* because of the company's existing/proposed activities.** E.g. unpredicted subsidence from block caving causes loss of natural features important to local indigenous community.	**Degradation/loss of some/all of biodiversity feature *will only occur under force majeure* under the company's existing/proposed activities.** E.g. an act of sabotage results in dam malfunction causing excessive flooding and scouring of fish habitat.

Table 6.2: Biodiversity-specific descriptors for consequence

1- Minor	2- Medium	3- Serious	4- Major	5- Catastrophic
The company's existing/proposed activities cause an insignificant portion of the biodiversity feature to be degraded/lost. E.g. reduction in forest cover in mine concession causes slight reduction of water availability in dry season, with no discernible effect for downstream users.	**The company's existing/proposed activities cause a noticeable portion of the biodiversity feature to be degraded/lost, but the viability/function of feature is not reduced.** E.g. company activities cause the loss of several individuals of a threatened plant species, but this does not reduce the viability of the local population.	**The company's existing/proposed activities cause a significant portion of the biodiversity feature to be degraded/lost, and the viability/function of some portion of the feature *is* reduced.** E.g. company activities reduce the viability of the local population of a threatened plant species, but national and global conservation status of the species is unchanged.	**The company's existing/proposed activities cause a significant portion of the biodiversity feature to be degraded/lost, and the viability/function of the entire feature is reduced.** E.g. reduction in forest cover in mine concession causes significant reduction of water availability in dry season, resulting in regular dry season water shortages for downstream users.	**The company's existing/proposed activities cause the entire biodiversity feature to be degraded/lost.** E.g. company activities cause the extinction of a threatened plant species known only at that site. E.g. reduction in forest cover in mine concession permanently eliminates dry season water flow for downstream users.

Table 6.3: Biodiversity risk assessment matrix

Likelihood	Consequence				
	1 – Minor	2 - Medium	3 - Serious	4 - Major	5 - Catastrophic
A – Almost Certain	Moderate	High	Critical	Critical	Critical
B – Likely	Moderate	High	High	Critical	Critical
C - Possible	Low	Moderate	High	Critical	Critical
D - Unlikely	Low	Low	Moderate	High	Critical
E - Rare	Low	Low	Moderate	High	High

For comparison, the impacts categorization and significance approach used in non-biodiversity assessments of this ESIA (see *Chapter A3: Methodology*) is provided in *Table 6.4.*

Table 6.4: Biodiversity risk categories in relation to non-biodiversity ESIA impact categorisation and significance descriptors described in Chapter A3: Methodology

Likelihood	Adverse Impact Category			
	Negligible	Minor	Moderate	Major
Certain	Low	Moderate	High	Critical
Likely	Low	Moderate	High	Critical
Unlikely	Low	Low	Moderate	High
Highly Unlikely	Low	Low	Moderate	High

6.4 HIGH TO CRITICAL RISK IMPACTS ON BIODIVERSITY

The Critical and High Risk impacts identified by this assessment are listed in *Table 6.5.* These impacts could affect priority biodiversity features that require the connectivity of the landscape to support their populations, species that might avoid project infrastructure, birds that could suffer mortality from collision or electrocution from contact with transmission line infrastructure, species that could be subjected to increased levels of hunting or collecting, species susceptible to indirect loss of habitat around project infrastructure, and species that could be affected by increased populations of natural predators. A full list of priority biodiversity features within the Project area of analysis is provided in *Chapter B7b: Ecosystem Services Baseline Section 7.6.*

***Table 6.5:* Priority biodiversity features at Critical and High Risk from Potential Project Impacts (in approximate order of significance)**

Feature	Impact	Likelihood	Consequence	Risk
Asiatic Wild Ass, Goitered Gazelle	Indirect habitat loss due to avoidance of infrastructure	Likely	Serious	Critical
Asiatic Wild Ass	Indirect mortality from hunting facilitated by increased access	Possible	Major	Critical
Argali, Goitered Gazelle, Saker Falcon, Houbara Bustard, Tall Saxaul Forest	Indirect mortality from hunting and collecting facilitated by increased access	Possible	Serious	High
Argali, Houbara Bustard	Indirect habitat loss due to avoidance of infrastructure	Likely	Medium	High
Great Bustard, Houbara Bustard, Saker Falcon	Direct mortality from collision with and electrocution by power transmission lines	Almost Certain / Likely	Medium	High

Feature	Impact	Likelihood	Consequence	Risk
Mongolian Chesney, Asiatic Wild Ass, Goitered Gazelle, Houbara Bustard, Mongolian Ground-Jay	Direct habitat loss under infrastructure	Almost Certain	Medium	High
Houbara Bustard, Mongolian Ground-Jay	Indirect mortality from increased predation rates	Likely	Medium	High

Each of the impacts identified in *Table 6.5* above is described in detail in the following sections, together with a description of the actions that will be adopted by Oyu Tolgoi to mitigate those impacts (discussed in detail *Section 6.7*). An assessment of residual impacts is also provided.

Chapter A5: Analysis of Alternatives sets out the processes for site and route selection undertaken by Oyu Tolgoi to avoid and minimise impacts to ecosystems. In some cases, avoidance has not been possible due to governmental planning constraints. In addition, Oyu Tolgoi has also had to undertake trade-offs between longer route lengths that would involve more extensive impacts versus shorter routes crossing potentially more sensitive areas. Information on the power transmission line alignment is provided in *Section 5.5,* the water supply pipeline alignment in *Section 5.9*, and the export road alignment in *Section 5.10.*

6.4.1 Indirect habitat loss due to avoidance of infrastructure

Many priority biodiversity features are predicted to avoid areas close to project infrastructure and activities. Such avoidance is not complete and total. For example, avoidance may be 100% within several metres of a road, 50% within 500 m, 25% within 1 km, etc. Avoidance distances depend on factors such as noise, dust, local topography and vegetation, and hunting pressure. Within the Oyu Tolgoi Area of Influence, background hunting pressure is the strongest driver of avoidance, especially for Asiatic Wild Ass and other ungulates avoiding vehicles and people. Avoidance distances are likely to be higher during construction, when noise and dust pollution will be greatest, and animals have not yet habituated to the infrastructure.

Most of the soil, at least in the Mine Licence Area, comprises a 10-15 cm thick layer of fine to very fine particles (0.1 mm-0.001 mm in diameter) beneath a gravelly protective surface layer (Amendment to Mine and Processing DEIA, 2010). Once the protective surface layer is eroded, e.g. by vehicles, the fine particular material, which is usually very dry, will be carried by winds and contribute to the avoidance impact. Noise may contribute to the avoidance but is likely to be less significant than people, vehicles and dust. Avoidance of powerlines by Houbara and Great Bustards during construction activities that take place within the lekking season for these species, 15 April to 30 June, may be increased due to construction related activities associated with pylon construction and line stringing.

Some data on avoidance distances may be possible to obtain empirically (e.g. by aerial surveys) and monitoring. For example, Asiatic Wild Ass in the southern Gobi region are estimated to avoid areas within 5 km of vehicles (P. Kaczensky *in litt.* 2011). However, given likely habituation to static infrastructure, it has been necessary to infer and extrapolate avoidance distances. There is however predicted to be a significant avoidance of powerlines by Houbara and Great Bustards based on avoidance measured up to 800 m and possibly up to 1600 m for Great Bustard (Lane et al. 2001; Raab 2011) and strong avoidance by Little Bustard within 400 m of powerlines (J.-P. Silva in litt. 2011; Silva et al. 2010). Based on these limited data, a precautionary estimate of 1 km avoidance distance was made for Bustards and powerlines. Complete avoidance creates a barrier effect and fragmentation but powerlines are not expected to act as full functional barriers to any species in the Oyu Tolgoi AoI (see Annex B, Section II.3).

Reindeer have shown reduced population effects up to 17 km from similar infrastructure where historically hunted (Benítez-López *et al.* 2009). Complete avoidance creates a barrier effect and fragmentation but powerlines and fully mitigated roads are not expected to act as full functional barriers to any species.

Avoidance of powerlines by (hunted) ungulates is predicted to be significantly less than from other infrastructure associated with human or vehicular activity. There is however predicted to be a significant avoidance of powerlines by Houbara and Great Bustards based on avoidance measured up to 800 m and

possibly up to 1600 m for Great Bustard (Lane et al. 2001; Raab 2011) and strong avoidance by Little Bustard within 400 m of power lines (J.-P. Silva in litt. 2011; Silva et al. 2010). Based on these limited data, a precautionary estimate of 1 km avoidance distance was made for Bustards and powerlines. Similar data for roads and agricultural buildings lead to similar estimates of 1 km avoidance distances for Bustards. Avoidance distances from Khanbogd town for all species was estimated to be much greater given the likelihood of regular human and vehicular traffic radiating out from the town.

Provisional estimates of avoidance distances are given in *Table 6.6.*

Table 6.6: Provisional estimates of avoidance distances for priority biodiversity features from project infrastructure

Priority biodiversity feature	Hunted?	Mine site/airport	Busy roads	Powerlines	Khanbogd town
Mongolian Chesney	n/a	n/a	n/a	n/a	n/a
Asiatic Wild Ass	yes	5 km	5 km	500 m	10 km
Argali	yes	500 m	1 km	0	5 km
Goitered Gazelle	yes	1 km	5 km	500 m	10 km
Mongolian Gazelle	yes	1 km	5 km	500 m	10 km
Swan Goose	yes?	likely some avoidance but very limited habitat for this rare migrant			
Ferruginous Duck	yes?	likely some avoidance but very limited habitat for this rare migrant			
Short-toed Snake-eagle	no	0	0	0	0
Saker Falcon	(no)	0	0	0	0
Egyptian Vulture	no	0	0	0	0
Great Bustard	yes	1 km	1 km	1 km	5 km
Houbara Bustard	yes	1 km	1 km	1 km	5 km
Relict Gull	no?	likely some avoidance but very limited habitat for this rare migrant			
Pallas' Sandgrouse	No	0	0	0	0
Mongolian Ground-Jay	no	0	0	0	0
Yellow-breasted Bunting	no	0	0	0	0
Riverine Elm Trees	no*	n/a	n/a	n/a	n/a
Tall Saxaul Forest	no*	n/a	n/a	n/a	n/a
Granite outcrops floral communities	no	n/a	n/a	n/a	n/a
Eastern Gobi desert-steppe	no	n/a	n/a	n/a	n/a
Alashan Plateau semi-desert	no	n/a	n/a	n/a	n/a

*Although not hunted and not showing avoidance distances, plants and habitats may be collected or otherwise impacted. The estimated impact distances of collection are currently not well understood and may require further social and ecological research.

The Oyu Tolgoi road upgrade to Gashuun Sukhait is likely to act as a deterrent to some animal populations, causing avoidance of habitat near the road and thus indirect habitat loss. The impacts of this indirect habitat loss are factored into the discussion of road mitigations and Net Positive Impact calculations.

Indirect loss of habitat due to avoidance of infrastructure is categorised as a **Critical Risk impact for Asiatic Wild Ass and Goitered Gazelle** and a **High Risk impact for Argali and Houbara Bustard**.

Mitigation actions

The following actions (detailed in *Section 6.7*) will be undertaken in order to mitigate impacts associated with indirect habitat loss due to avoidance of infrastructure:

- Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi to airport roads (probably by using immoveable boulders or side ditches or posts but this needs further research), to prevent vehicles leaving either side of the road except for agreed herder crossings;
- Provide driver awareness and training for all Oyu Tolgoi staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds);
- Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert);
- Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait Road;
- Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue;
- Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue; and
- Restrict infrastructure construction activities to minimise potential disturbance of habitat during the Houbara Busard lekking season from 15 April to 30 June.

Residual Impacts

Significant adverse residual impacts are predicted for many priority biodiversity features after the application of available mitigation actions for indirect habitat loss due to avoidance of infrastructure.

6.4.2 Mortality from illegal hunting and collecting facilitated by increased access and in-migration

The primary current threat to the global survival of Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard is illegal hunting. Hunting for sale of meat caused catastrophic declines of Asiatic Wild Ass in Central Asia in the 1990s, including extirpation from Kazakhstan, Uzbekistan and Ukraine (IUCN 2010). Likewise, high levels of hunting in the 1980s severely decreased the species' populations in northern China (IUCN 2010). Wingard & Zahler (2006) reported that approximately 3,000 Asiatic Wild Ass were illegally hunted and traded in Mongolia in 2004, out of an estimated total of 17,513-19,309 in Mongolia (Lhagvasuren 2007). This rate is unsustainable and would lead to the species' extirpation (Moehlman *et al.* 2008). Total numbers of Argali in Mongolia appear to have declined from about 60,000 in 1985 to 13,000-15,000 in 2001 (Amgalanbaatar *et al.* 2002). Hunting levels are less well known for Goitered Gazelle. Houbara Bustard are currently primarily hunted in their non-breeding range outside of Mongolia, where declines in some areas have reached 30% per annum (Tourenq *et al.* 2005). Saker Falcon is also at risk of being collected for the Falconry trade although there is currently a moratorium on the export of Saker Falcons. Tall Saxaul Forest is at risk from collection for firewood, which is largely illegal. Saxaul collection in the Oyu Tolgoi AoI is increasing as more people move to Khanbogd *soum*, remote areas become more accessible by road and there is increased demand by roadside restaurants for fuelwood (Schmidt *et al.* 2011).

The Mongolian 'Law on Fauna' prohibits hunting of 'very rare' and 'rare' species including Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard except under licence. Mongolia has also ratified the 'Convention on International Trade of Endangered Species' (CITES) which strictly regulates trade in Appendix I species including Asiatic Wild Ass, and regulates trade in Appendix I species including Argali and Saker Falcon.

The Oyu Tolgoi project prohibits hunting by employees. The project may indirectly lead to an increase in hunting and collecting levels within Khanbogd *soum* and surrounding *soums* due to the regional influx of people not employed by the project, and by increased use of the roads by public traffic. In-migration associated with economic activities at the Oyu Tolgoi project may see an influx of up to 32,000 people into the *soum* (*Chapter D16, Influx Management Plan*). Hunting is a traditional activity for many Mongolian and Chinese people, and subsistence hunting alone is unlikely to pose a significant threat. However, pursuit with fast-moving vehicles and hunting with fire-arms are a much higher threat. Hunters can and will drive off-road, but will tend to follow better (faster) roads where available. Furthermore, the upgraded road to the border at Gashuun Sukhait increases accessibility to China, the world's biggest

market for wild animal products. The rate of such hunting will be determined by factors such as local access to fire-arms and ammunition and enforcement of laws against hunting these species by non-Oyu Tolgoi project road users. At present these variables are poorly understood and further research and monitoring is required.

Fuel needs of local people within the project AoI are primarily met by dried livestock dung and, in winter, when heating needs are high, woody plants – primarily Saxaul (Damdin 2011). Elm, poplar and tamarisk are not commonly used for fuel in the area (Damdin 2011). The majority (93%) of local households used wood, charcoal and dung in unknown proportions (Centre for Policy Research 2009 in Environ 2011). Availability of trucks has enabled recent over-harvesting of woody plants, notably Saxaul (Damdin 2011; Environ 2011; K. Olson pers. comm. 2011; S. Schmidt *in litt.* 2011).

Mortality from hunting facilitated by increased access has been assessed as a **Critical Risk to the Asiatic Wild Ass** and as a **High Risk impact to Argali, Goitered Gazelle, Saker Falcon, and Houbara Bustard**.

Increased removal or harvesting facilitated by indirect increased access and in-migration is assessed as a **High Risk impact to Tall Saxaul Forest**.

Mitigation actions

The following actions (detailed in *Section 6.7*) will be undertaken in order to mitigate mortality from hunting or collecting facilitated by increased access and in-migration:

- Control illegal hunting by Oyu Tolgoi personnel when at work (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties);
- Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels);
- Inspect an adequate proportion of all aircraft under Oyu Tolgoi control for illegal wild animal products;
- Inspect all vehicles entering the Oyu Tolgoi site for illegal wild animal products;
- Provide all project operations staff and contractors fuel for fires to remove the need for collection of local timber (i.e. Saxaul);
- Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue;
- Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue; and
- Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd *soum* (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team).

Residual Impacts

Adverse residual impacts are expected after the application of available mitigation actions for increased collecting or hunting for many priority biodiversity features.

6.4.3 Mortality or injury related to vehicles and power lines

Several priority biodiversity features are susceptible to injury or death from collision with vehicles. This risk increases with the speed and size of vehicles as large or fast-moving vehicles are less able to brake or take evasive action. In a study of animal collisions in Israel, 31% of 226 collisions were with (domestic) horses and donkeys and 3 of 18 collisions with wild animals were with gazelle (Inbar *et al.* 2006). Asiatic Wild Ass, a close relative of the domesticated horse and donkey, may potentially be at elevated risk owing to their propensity to run when alarmed. However, another study found medium-sized animals most at risk of collisions (BarthElmess and Brooks 2010), perhaps owing to greater avoidance of more easily observed large animals. Overall, direct mortality from collision with vehicles is likely to be limited,

with impacts manifested more as avoidance of roads with heavy traffic unless hunting is controlled and animals habituate to traffic.

Although a range of bird species suffer mortality from collisions with wires, Bustards and birds of prey are particularly susceptible to collisions with power lines (Martin & Shaw 2010). Mortality from such power lines can be severe; appearing to have exceeded 10% of total population in the short-term in some studies of Houbara Bustard (Martin *et al.* 2006) and accounting for high percentages of overall mortality in many studies (e.g. >80% of mortality in adult Great Bustard in one study was caused by collision with power lines and fences; García-Montijano *et al.* 2002). Estimates of total bird collision rates vary from about 0.1 to 80 casualties per km per year (Jenkins *et al.* 2010). Ludwig's Bustard (*Neotis ludwigii*), which is particularly susceptible (as it undertakes daily flights to and from roost sites as well as longer distance movements; Allan 2005) has an average of several casualties per km per year (> 0.63 corpses found per km plus those removed by scavengers; Jenkins *et al.* 2011).

The high-voltage power transmission lines are planned to be suspended at 25.8 - 49.5 m above ground level (three vertically parallel sets of lines plus two optical ground wires [OPGWs]). These heights are above normal flight heights (which are typically limited to a few meters above ground, N. Batbayar pers. comm. 2011; O. Combreau pers. comm. 2011) by Houbara Bustards during the breeding season but within the range of migration flight heights (mostly below 100 m altitude; O. Combreau *in litt.* 2011). Houbara Bustard migrates east-west in the Gobi region (Tourenq *et al.* 2004; Judas *et al.* 2006; Gao *et al.* 2009), which is more or less perpendicular to the high-voltage power line and borefield medium-voltage power line infrastructure of the project. Thus the project power line infrastructure represents a significant collision threat for the Houbara Bustard and Great Bustard. Houbara Bustard is also known to migrate both by day and at night (O. Combreau pers. comm. 2011). At night, Houbara Bustard may suffer a higher rate of collisions because wires are less visible, as is the case for little Bustard (J.-P. Silva pers. comm. 2011). Thinner wires (such as the earth wires) pose more of a risk of collision owing to their lower visibility (e.g. Faanes 1987). The risk to other priority bird species is less well known but resident Egyptian Vulture and migrating Swan Goose, Great Bustard and Relict Gull are assessed as being at moderate risk.

There is also a risk of electrocution to any medium or large bird that can span the distance between the conductors or grounded and energised hardware (e.g. Tintó *et al.* 2010). Several priority bird species, in particular the Saker Falcon, are known to perch and nest on power line poles and pylons (Potapov *et al.* 2001), which makes them particularly susceptible to electrocution. The conductors on the high voltage pylons used at the Oyu Tolgoi project are at least 2.5 m from any grounded hardware and so do not represent a significant electrocution risk for birds. However, the designs chosen for the Oyu Tolgoi medium-voltage power distribution lines do cause significant risk owing to short distances between conductors and grounded/energised hardware. Electrocutions, mostly from medium voltage power lines, were responsible for 54% of 64 Saker Falcon found dead in Mongolia 1998-2004 (Sundev *et al.* 2004) and Harness *et al.* (2008) found 0.7 dead birds/km under concrete poles along medium-voltage power lines in Mongolia, of which 19% were Saker Falcons (many fewer were found under older wooden poles).

Death and injury from collision with power lines and from electrocution by power distribution lines is assessed as a **High Risk for Great Bustard, Houbara Bustard, and Saker Falcon**.

Mitigation actions

The following mitigation actions (detailed in *Section 6.7*) will be employed to reduce the likelihood of collisions and electrocution with powerlines and pylons:

- Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m);
- Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary; and
- Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals.

Residual Impacts

Adverse residual impacts from mortality from collisions or electrocution are expected after application of available mitigations for many priority biodiversity features.

6.4.4 Direct habitat loss under infrastructure

Description of Impact

Habitat supporting many priority biodiversity features will be lost under the Oyu Tolgoi project's direct infrastructure footprint. This includes up to 64 km^2 in the Mine Licence Area[1], 1.5 km^2 for the airport and 1.3 km^2 for the borefield/pipeline corridor. The additional direct footprint of the road upgrade to Gashuun Sukhait is small, primarily comprising 19.4 km of linear infrastructure of ca.15 m width, as the remainder of the road will be constructed over an existing track. The existing track has deteriorated in places to a series of informal tracks where vehicles have followed parallel routes. There will be very little direct habitat loss under the medium-voltage and high-voltage power distribution lines as there will be no vegetation clearance except for very small direct losses under the pylon supports.

The vast majority of this area is open dry rangeland habitat. However, the Mine Licence Area footprint will also destroy ca. 52 ha of the ephemeral Undai river habitat, including the Bor-Ovoo Spring, and ca. 7 ha of numerous small ephemeral water courses which flow into Budaa water course (Purevsuren Nyambuu pers. comm. 2011).

The Southern Oyu open pit will extend into the ephemeral Undai River flood plain and waste rock dumps (WRDs) will be located directly across 6.8 km of the Undai river channel. The section of the Undai River covered by the WRD will also include the Bor Ovoo Spring, a permanent freshwater spring. The loss of the Bor Ovoo Spring may have significant impacts on priority biodiversity features which use the spring as a source of drinking water.

While the great majority of the species in the Oyu Tolgoi AoI are widespread and will thus not experience any significant impacts at landscape, regional, or global scales due to direct loss of habitat under the project footprint, the local, regional and global distributions of the Mongolian Chesney (*Chesniella mongolica*) and 17 other rare or very rare plant species is currently poorly known. Adopting a precautionary approach, it has been assumed that **direct habitat loss under infrastructure may constitute a High Risk impact for these plant species.**

Impacts on other priority biodiversity features are not expected to be significant because they are not likely to use the footprint area substantially or are largely passage migrants that only fly through the area. Three individual Siberian Elm Trees are known to have been impacted – these were transplanted away from the mine site but their long-term survival prospect is uncertain. Tall Saxaul Forest may be impacted by the Gunii Hooloi borefield but most Saxaul Forest is low and typically degraded.

Mitigation actions

This risk assessment assumes that the Oyu Tolgoi project will follow standard practice for minimisation and restoration of construction (including construction camps, access roads, borrow pits and temporary parking areas; see *Chapter D6: Flora and Fauna Management Plan*) and operation footprints.

Additional specific actions (detailed in *Section 6.7*) that will be employed to mitigate impacts of direct habitat loss under infrastructure include:

- Rehabilitate and restore of at least equal areas or numbers of features impacted (in line with Oyu Tolgoi Interim Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice); and

[1] The loss of 64 km^2 within the Mine Licence Area assumes all current habitats within the Mine Licence Area will be made unavailable to priority biodiversity features due either to direct removal for project infrastructure, physical exclusion (i.e. fencing) or through avoidance of the Mine Licence Area by some priority biodiversity features. This is a precautionary estimate as not all of the Mine Licence Area will be cleared/disturbed and there is some anecdotal evidence that fencing of the Mine Licence Area (and therefore exclusion of livestock) has improved the habitat quality with the Mine Licence Area for some native species. It is predicted that many small or highly mobile vertebrate species (e.g. small mammals, reptiles and birds) and large number of invertebrates will continue to use undisturbed habitats within the Mine Licence Area.

- Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of Bor Ovoo spring in terms of maintaining similar surface and subsurface flow patterns and seasonal variations throughout the year.

The Bor Ovoo spring will be recreated south of the Mine Licence Area at the location where the subsurface flow diversion pipeline terminates. The spring will be designed such that it is available for use by a range of different fauna groups, including but not limited to large herbivores, and will be available for use by livestock as well as wildlife. In addition the spring will be designed such that any water not consumed by wildlife or livestock will infiltrate the alluvium of the river bed and contribute to downstream alluvial groundwater resources. However, the replacement spring is likely to be positioned too close to the fenced mine site for it to be fully used by large ungulates given their likely avoidance of human activity and associated infrastructure. The key design features of the Bor Ovoo Spring replacement are presented in *section 6.7.18 below*.

Residual Impact

After the application of appropriate mitigations, the project is still likely to result in some residual impacts due to direct habitat loss under infrastructure. In particular, residual impacts may occur for the Mongolian Chesney and for other rare plants.

6.4.5 Mortality from increased populations of natural predators

Among priority biodiversity features, this impact is mainly applicable to Houbara Bustard nesting in the area. The primary predators of breeding and migrant Houbara Bustard in the region are mammals, notably foxes (*Vulpes* spp.) (Combreau *et al.* 2002; Yang *et al.* 2002). A range of other predators, including smaller mammals and birds such as long-legged buzzard (*Buteo rufinus*) and common raven (*Corvus corax*), are likely to predate eggs and chicks (Heredia 1995; Combreau & Smith 1998; Combreau *et al.* 2002). Although Saker Falcon is commonly used by Falconers to hunt Houbara Bustard, Wild Saker Falcon appear to very rarely hunt Houbara Bustard in this region (Sundev *et al.* 2001; G. Sundev, pers.comm)).

Terrestrial predation levels are often elevated along roads and other linear infrastructure. Vehicles and power lines will inevitably kill and injure at least small mammals and birds, resulting in some dead and injured animals along the route. These, along with litter that has been thrown from vehicles along the road, are likely to increase populations of scavengers such as raven, black kite, foxes and long-eared hedgehog (*Hemiechinus auritus*) (all potential predators of nests, including those of Houbara Bustard) along the route. Increased use of linear routes and predation rates has been demonstrated for wolves (*Canis lupus*) (James and Stuart-Smith 2000; Whittington *et al.* 2011). Avian predators, including buzzards, black kite, Saker Falcon and common raven, perch and nest on all types of power line towers and raised artificial structures where there is a lack of elevated perching and nesting sites (e.g. Potapov *et al.* 2001). Thus, susceptible species including Houbara Bustard are likely to suffer increased terrestrial and avian predation rates along road and power line routes. The sum of elevated mortality from these varied types of elevated predation pressure is difficult to calculate without monitoring actual impacts. This was assessed for the ground-nesting Houbara Bustard and Mongolian Ground-Jay as having a 'medium' consequence (i.e. a noticeable portion degraded/lost, but viability/function not reduced) and hence a 'high' risk following Rio Tinto's risk assessment matrix (Annex B).

Mortality from increased populations of natural predators is assessed as a High Risk impact for Houbara Bustard and Mongolian Ground-Jay.

Mitigation actions

The following actions (detailed in *Section 6.7*) will be undertaken to mitigate the impacts to priority biodiversity features associated with increased populations of natural predators:

- Enforce no unauthorised waste disposal/littering from Oyu Tolgoi vehicles or around work place;
- Inspect and remove litter and other anthropogenic waste from along the Oyu Tolgoi to Gashuun Sukhait Road, Oyu Tolgoi to Khanbogd Road and Oyu Tolgoi Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces);

- Document and remove collision carcasses and nests from medium voltage and high-voltage power lines during inspections; and
- Remove nests of birds which predate Bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure.

Residual Impacts

The application of the mitigation actions outlined above are likely to significantly remove threats to priority biodiversity features associated with increased populations of natural predators. However, there will still be some residual impact from increased mortality due to increased populations of natural predators.

6.5 LOW TO MODERATE RISK IMPACTS

This section addresses impacts rated by the RBA risk assessment process (Annex B) as having low to moderate risks to specific biodiversity features, including those species not considered to be priority biodiversity features. While the types of impacts may be the same, the significance of the impacts and level of risk may vary among biodiversity features; hence, some of the High to Critical Risk impacts discussed above are repeated in the following sections. As outlined by the RBA risk assessment process, mitigation options for low to moderate risks are also addressed by mitigation options proposed for critical and high risk issues, as well as being outline in *Chapter D6: Flora and Fauna Management Plan.*

6.5.1 Fragmentation of effect of roads on habitat and populations of wild ungulates and Bustards

Oyu Tolgoi is currently upgrading an existing improved earth road between the Mine Licence Area and Gashuun Sukhait. While few empirical data are available for the Gobi region, traffic volumes of > 2,000 vehicles/day have been shown to have a barrier effect to wildlife (Sawyer & Rudd 2005; Clevenger & Huijser 2011) and volumes of > 4,000 vehicles/day are considered "strong to complete barriers to wildlife movements" in North America (Mueller & Berthoud 1997). In the open environments of southern Mongolia, where wild animals have a much clearer view of long stretches of road and are very wary of vehicles due to hunting pressure and harassment, it is likely that functional barriers to wild ungulates (i.e., some individuals are able to cross, but functional ecological and genetic connectivity may have been lost) may be created by lower traffic volumes than those reported from North American studies.

P. Kaczensky (*in litt.* 2011 in TBC & FFI 2011) has estimated a serious barrier effect for Asiatic Wild Ass at traffic volumes as low as 400 vehicles/day and a complete ecological barrier at 1,000 vehicles/day[2]. A recent traffic census undertaken by Oyu Tolgoi (and reported in *Chapter B11: Transport Baseline*) identified approximately 800 vehicles/day on the coal transportation route and 250 vehicles/day on the Oyu Tolgoi to Gashuun Sukhait road[2], the implication being that while traffic volumes on the Oyu Tolgoi to Gashuun Sukhait road are not yet at levels predicted to cause a significant barrier effect for the Asiatic Wild Ass, traffic volumes on the coal transportation route are already approaching levels at which a complete ecological barrier are created. The World Bank's *South Gobi Regional Environmental Assessment* (Walton, 2010, p. *vx* and p. 34) states that, according to information provided by the SGSPA Director in 2008, "Gazelle and Asiatic Wild Ass no longer move between the two sections of the Small Gobi Strictly Protected Area because of traffic volume on the road that passes between them to the border crossing".

Traffic volumes on the Oyu Tolgoi to Gashuun Sukhait road are expected to decline immediately after construction; however, the upgraded Oyu Tolgoi to Gashuun Sukhait Road will eventually become part of the national highway network and as such, over time, non-mine traffic volumes are expected to increase (>1,600 vehicles/day by 2030). Traffic on the Tavan Tolgoi road will also increase significantly one mining

[2] The figure of 400 is based on fleeing distances of c. 1 km, maximum speeds of 4 km/h, and thus a need for a break in traffic of 15 minutes for an animal to feel comfortable crossing. This equates to an average of 96 vehicles/day if evenly spaced. Assuming vehicles are not evenly spaced (i.e. bunched), perhaps four times as many cars could still leave similar gaps in traffic – i.e. 400. These are of course very rough approximations, and based on continued hunting (and thus car avoidance). They do, nonetheless, provide some level of assessment tailored to the situation in the area.

[2] Oyu Tolgoi Traffic Census Data. 801 vehicle movements were recorded on the coal transportation route on 28th March 2011. 278 and 225 vehicle movements on the Oyu Tolgoi to Gashuun Sukhait roads were recorded respectively on 30th and 31st March 2011.

of the main Tavan Tolgoi coal deposit commences. Thus, the marginal cumulative impacts of Oyu Tolgoi-related traffic on the upgraded road will be minor due to existing fragmentation effects of the coal truck traffic in the region (especially in consideration of future coal truck traffic volumes). This means that, activities by Oyu Tolgoi to mitigate and minimise the fragmentation impacts of its road cannot be expected to mitigate road fragmentation impacts at a broader scale unless similar measures are also implemented for the coal transportation route.

While complete avoidance of roads creates a barrier effect and fragmentation, fully mitigated roads are not expected to act as full functional barriers to any species in the Oyu Tolgoi AoI (see Annex B, Section II.3). Thus, the fragmentation effect of roads to be upgraded or constructed by Oyu Tolgoi is categorized as a Moderate Risk impact for Asiatic Wild Ass and Goitered Gazelle and a Low Risk impact for Argali and Houbara Bustard.

The Oyu Tolgoi project has made a world-leading commitment to put in place appropriate and sufficient underpasses along the road upgrade to Gashuun Sukhait. This demonstration is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure. These are planned to be appropriate for the wide-ranging species of conservation concern in the region, given best international knowledge to date, and are planned to be sufficient to allow ecological permeability, given known animal daily ranging distances. Given this, the fragmentation impacts of this road upgrade are expected to be negligible in the medium- to long-term (after animals have habituated to the road, and a concurrent anti-poaching programme has sufficiently reduced hunting such that animals have reduced fear of vehicles). In particular, it is considered that cumulative impacts will be negligible given the existing presence of the unmitigated Tavan Tolgoi 'coal road' and its heavy traffic volumes. The 'coal road' runs approximately parallel to the Gashuun Sukhait road upgrade, and is likely to have already fragmented ungulate populations (as discussed below). The residual, cumulative risk of the Oyu Tolgoi road upgrade to Gashuun Sukhait causing fragmentation of ungulate populations was assessed as of likely likelihood (loss of some of the feature would occur in majority of cases) and of minor consquence (would cause an insignificant noticeable portion to be lost), and, therefore, of 'medium' risk.

Although few data yet exist to assess impacts, the pre-existing 'coal road' from Tavan Tolgoi to Gashuun Sukhait, and its heavy traffic volumes, is likely to be having a significant fragmentation effect on wide-ranging species in the southern Gobi region. Cumulatively (i.e. over and above this existing road), a well-mitigated Oyu Tolgoi road upgrade to Gashuun Sukhait would be likely to have negligible fragmentation impacts.

Oyu Tolgoi's forward looking approach to mitigating and reducing impacts by means of underpasses and other management actions (detailed in *Section 6.7*) to mitigate the fragmentation impact of roads to habitats and wildlife populations includes:

- Construct appropriate and sufficient underpasses (at ecologically suitable locations such as river beds, approximately every 6 km along the Oyu Tolgoi to Gashuun Sukhait road, as long as practically possible but minimum 12 m long, at least 4.5 m high along the whole length, with solid sides at least as high as highest Oyu Tolgoi vehicles, a natural, non-waterlogged substrate with no obstacles, affording a view of the horizon from either side, and with earth berm along edge of road either side of underpass to funnel wildlife towards underpasses; to be constructed before hand-over to Government of Mongolia);
- Control illegal hunting in the wider landscape which will help to reduce avoidance distances and encourage use of wildlife crossings;
- Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi airport roads (probably by using immoveable boulders or side ditches or posts but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings);
- Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue;
- Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue; and

- Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd *soum*.

6.5.2 Fragmentation effect of roads on habitat and populations of other organisms

For plants and smaller fauna, the effects of population fragmentation by roads are not anticipated to have major impacts over the timeframe of the Oyu Tolgoi Project. While the road is considered a barrier to the movement of individuals and their genes, it is a barrier that may be occasionally breached by random dispersal events by pollinators, seeds, and individuals that will maintain some level of genetic flow across the road. Also, the barrier effect will be reduced after the cessation of Project-related traffic. There is a potential that access to springs or temporary pools utilised either as a water source or as breeding areas (e.g., the toad *Pseudepidalea raddei*) may be affected by roads for some species. This effect is considered to be of minor risk of all non-priority biodiversity features given that the impact, while likely, is expected to have only minor or medium consequence for relatively common and broadly distributed species within the project AoI. Mitigation actions described for priority biodiversity features in *Section 6.4.3* are also expected to mitigate impacts of fragmentation on many non-priority biodiversity features.

6.5.3 Mortality from land clearing and earthmoving activities

The clearing of land and movement of earth materials for the construction of Project infrastructure and mining activities will result in the mortality of large numbers of individuals of sessile or low-mobility organisms ranging from plants to invertebrates to small vertebrates, including some belonging to species identified as priority biodiversity features such as the Mongolian Chesney. Larger, more mobile fauna are unlikely to be directly impacted by land clearing and earthmoving activities given that they are generally expected to flee well in advance of machinery. These impacts will not result in any appreciable reduction of populations at landscape, regional, or global scales given the magnitude of the project footprint relative to the ranges of the species affected (but see *Section 6.4.1* for discussion of direct habitat loss impacts on Mongolian Chesney). This impact is considered to be of low to moderate risk at local population levels for all priority and non-priority biodiversity features.

6.5.4 Mortality from contact with vehicles on roadways

Individuals of common and widespread fauna species (including invertebrates, amphibians, lizards and snakes, birds, and mammals) will inevitably be hit or run over by vehicles on Project roadways. These impacts are not predicted to result in any appreciable reduction of populations at the local scale given the low proportion of individuals likely to be affected relative to the local population size and distribution of these species. These impacts will be restricted to a limited number of linear features in an extensive landscape which suggests a low probability of risk to a given individual within the populations of the Project AoI for a particular species. Anecdotal information from Oyu Tolgoi has not indicated that wildlife mortality related to road transportation has been identified as a significant issue (i.e., reconnaissance of roads by Oyu Tolgoi biologists has not found appreciable road kill of small to large vertebrates)[3]. While the consequence is catastrophic for the affected individuals, this impact is considered to be of low to moderate risk at population levels for all species of non-priority fauna. Traffic speed controls, driver education, signage, and underpasses (see *Section 6.7.1* below) will reduce the likelihood of fauna-vehicle interactions.

6.5.5 Mortality from collision with power lines and pylons or electrocution from power lines

A small number of individuals of non-priority bird and bat species may suffer fatal collisions with power lines and pylons installed for energy supply. In addition, large birds, particularly some raptors, may suffer fatal electrocution from contact with charged elements when attempting to perch or nest on electrical

[3] There have been no traffic accidents to date involving Oyu Tolgoi vehicles which have affected people, livestock or wildlife. In Khanbogd there were 9 recorded traffic incidents in 2009 and 8 in 2010 involving road users (non Oyu Tolgoi-related traffic), according to the Khanbogd *soum* Governor's Office. No accidents involving Oyu Tolgoi vehicles have occurred during 2011 on the Khanbogd/ Oyu Tolgoi road (as confirmed by the *soum* Mayors office) although 3 traffic incidents (not involving Oyu Tolgoi vehicles) have been recorded on this section of road year to date.

distribution or transmission infrastructure. These impacts will not result in any appreciable reduction of populations at local, landscape, regional, or global scales given the low proportion of individuals likely to be affected relative to the populations of the species (but see *Section 6.4.4*). While the consequence is catastrophic for the affected individuals, this impact is considered to be of low to moderate risk for all species except for the priority biodiversity features; Great Bustard, Houbara Bustard, Saker Falcon, Short-toed Snake-eagle and Egyptian Vulture, for which it rates as a high risk. Mitigation actions such as the use of bird flight diverters and power line insulation (see *Section 6.4.4*) will reduce the risks to non-priority fauna arising from collision with power lines and pylons or electrocution from power lines

6.5.6 Mortality from collision with communications towers

A small number of individuals of non-priority and priority bird species may suffer fatal collisions with the two communications towers that were installed by the Oyu Tolgoi Project. The two communication towers are not located within any identified Important Bird Areas. To date, no bird deaths have been reported in relation to these towers. The locations of these towers are not known to be in specific important bird habitats or any know local migratory corridors. This impact is not likely to result in any appreciable reduction of populations at local, landscape, regional, or global scales given the low proportion of individuals likely to be affected relative to the populations of the species. While the consequence is catastrophic for the affected individuals, this impact is considered to be of low risk for all bird species given that the likelihood is considered to be possible and the consequence at the local population level at worst, minor.

6.5.7 Direct loss of habitat under infrastructure

The conversion of existing habitat to Project infrastructure (including the mining areas) will result in the direct loss of habitat available for plants and animals in the Oyu Tolgoi AoI (separate to the loss of individuals unable to move away from the area). This will result in displacement of fauna into the home range of other individuals, leading to potential territorial conflicts, additional displacement, and increased competition for resources.This impact will be temporary or permanent depending on the species and the ability of the Project to rehabilitate or restore suitable habitats at mine closure. This impact is considered to present a low to moderate risk for all non-priority biodiversity features known or likely to occur within the project AoI. Land disturbance procedures currently used by Oyu Tolgoi will minimise the direct loss of habitat due to project infrastructure. Oyu Tolgoi will apply its interim Rehabilitation Management Plan and procedures (a Rehabilitation Management Plan will be formalised prior to commencement of operations) and Topsoil Management Plan and procedures to ensure rehabilitation of project-disturbed flora and fauna habitat is undertaken in a timely manner and using best-practice rehabilitation techniques. In accordance with the 2011 Environmental Protection Plan, a pre-clearing flora survey was completed for the Tailings Storage Facilities Area. This survey identified three Siberian Elm (*Ulmus pumila*) in the construction area. Although Siberian Elm Trees are regionally abundant[4], the relocation of these three mature Elm Trees was deemed necessary based on consultation with a herder family who had used this area for grazing for the past two decades. Relocation was undertaken in February and March 2011 (dormant season) under the close supervision of the Oyu Tolgoi Senior Botanist. A detailed report on this relocation was submitted to the Khanbogd *soum* Governor.

It was agreed that Oyu Tolgoi would relocate these trees, following consultation with, and agreement by, local herders, specifically to the eastern bank of the nearby Undai River for the following reasons:

- It was critical that the new Siberian Elm locations are in close proximity to the key stakeholders to allow regular visitation without the need to organise vehicles for travel;
- It was critical that the new Siberian Elm locations are on a major drainage line, so as the Elm Trees have a continual groundwater supply and therefore maximum likelihood of survival. Groundwater studies have revealed that the Undai River is the only river maintaining a perennial subsurface flow in the area. It was also important that the new locations be planted up-stream from the diversion point, which may create a temporary impact on the groundwater supply; and

[4] Siberian elm tres are abundant in the southern Gobi region and Oyu Tolgoi has identified 2,566 individual trees along the Undai.

- It was preferable that the new location was next to the Oyu Tolgoi mining lease to allow surveillance and visual monitoring from within the mining lease and ease of access for watering the trees (where required).

6.5.8 Decreased plant productivity and sexual reproduction due to dustfall upon vegetation

The southern Gobi region is a dusty environment however project construction and operation will add significantly to the ambient dust levels. When deposited on surrounding vegetation, dust may have significant adverse impacts on photosynthesis, gas exchange, thermal regulation, pollination, and other physical or physiological plant processes. These impacts may lead to reduced plant productivity and sexual reproduction of affected populations, which in turn may have flow-on effects throughout the ecosystem. The spatial extent of this impact is highly localized at the landscape scale and the impact is predicted to have negligible to minor impacts on the availability of forage for herbivores in the Oyu Tolgoi AoI. The Oyu Tolgoi to Gashuun Sukhait Road is currently a significant source of dust from the Oyu Tolgoi project and as such, upgrading and sealing this road will greatly reduce dust emissions. Specific actions to control dust generation have been developed and are being implemented as part of an overall site Air Quality Management Plan (see *Chapter D2: Atmospheric Emissions Management Plan*).

6.5.9 Decreased animal health and reproduction due to dust exposure

There is evidence for a positive association between exposure to road dust and the incidence of pneumonia, pleurisy and conjunctivitis (pinkeye) in sheep (McCrea 1984). However, the fact that larger wildlife in the area are not confined to or concentrated in habitats along roadways (and that they may also avoid these areas) makes the probability of chronic exposure to road-generated dust unlikely for larger fauna. While there is no evidence for direct dust-related effects among small fauna groups that may tend to persist along roads, such as lizards and small mammals, there is at least a small potential for such impacts. While it is conceivable that any birds nesting in areas exposed to increased dustfall could be affected by dust falling upon eggs or nestlings, there are no studies available to document such impacts. Although adverse impacts on animal health can be expected under chronic exposure to high levels of anthropogenic dust, the impacts of dust on native fauna in the Oyu Tolgoi AoI are expected to be unlikely at landscape level and of low to moderate consequence, rating as a low risk.

6.5.10 Indirect habitat loss due to avoidance of Project infrastructure

Some species of lower priority will, at least temporarily, avoid Project infrastructure due to increased levels of noise, vibrations, dust, movement, and human presence. Although there is a predicted significant avoidance of power lines by Bustards (higher priority), there are no know avoidances of power lines by lower priority bird species. However, many species of birds, small mammals, and lizards can be found in the immediate vicinity of the existing Oyu Tolgoi facilities and along roads, showing little or no avoidance of disturbed areas and ongoing activities. This impact will not result in any appreciable loss of habitat or reduction of populations at landscape, regional, or global scales given the magnitude of the project footprint and number of affected individuals relative to the ranges and populations of the species affected. This impact is rated as a low to moderate risk for all non-priority fauna species (but see *Section 6.4.2* for discussion of impacts on priority biodiversity features).

6.5.11 Mortality from illegal hunting and collecting facilitated by increased access and in-migration

There is a potential that increased access and human population may lead to an increase in hunting and collecting of a wide range of plant and animal species, especially those used for traditional medicinal or culinary purposes. This impact is rated as a low (species without traditional or commercial value) to moderate (species with traditional or commercial value) risk for non-priority biodiversity features (see *Section 6.4.5* above for discussion of impacts to priority biodiversity features).

6.5.12 Mortality from increased populations of natural predators

Some species of lower priority fauna will suffer increased levels of predation due to increased populations of natural predators such as some species of raptors, ravens, and foxes. This impact will not result in any appreciable loss of populations at landscape, regional, or global scales given the number of potentially

affected individuals relative to the ranges and populations of the species. This impact is rated as a low to moderate risk for all non-priority fauna species (see *Section 6.4.6* for discussion of impacts to priority biodiversity features).

6.6 BIODIVERSITY IMPACTS RELATED TO POTENTIAL ALTERATION OF HYDROLOGY

The detailed hydrological and hydrogeological investigations undertaken to date have enabled Oyu Tolgoi to have a good appreciation of where the most likely impacts on surface hydrology and surficial aquifers will occur, and to develop mitigation measures to address these (see *Chapter C5*: *Water Resources Impact Assessment*). There are however, a number of uncertainties relating to the likelihood and magnitude of project-induced impacts that merit further discussion here in terms of potential biodiversity impacts. These uncertainties relate to the likelihood for impacts to shallow water systems, and associated biodiversity features, resulting from drawdown of the deeper regional aquifer and mine dewatering. The biodiversity risk assessments completed accept that the likelihood of impacts to shallow hydrological systems from mine dewatering and regional aquifer abstraction is low, and therefore the risk is assessed as medium/low. However, it is important that the uncertainties related to the risk assessment are understood and recognised. The discussion provided below allows the hydrological risks to be considered in light of these uncertainties.

6.6.1 Dewatering of the mine area

Riverine Elm Trees, Tall Saxaul Forest, Asiatic Wild Ass, Argali and Goitered Gazelle are all dependent on groundwater resources – Elms and Saxaul tap groundwater through their deep (up to approximately 40 m) root systems and ungulates rely on groundwater fed springs. Saker Falcon is dependent on Elm and Saxaul trees for nesting but may be able to nest on electricity transmission pylons being erected by the project. The current groundwater modelling indicates that the impact of the effects of dewatering on groundwater resources outside of the Mine Licence Area will be negligible, but this requires further refinement to provide a more definitive conclusion. The impact assessment is based on assumptions presented in *Chapter C5: Water Resources Impact Assessment,* and the Amendment to the Mine & Processing DEIA (2010), which state that the shallow groundwater system present within the surface materials and weathered bedrock across the Mine Licence Area has some limited hydrological connectivity with the alluvial aquifer beneath the Undai. Until actual flow rates are established and investigation of intersected aquifers takes place (during construction of the underground mine and open pit), the actual impact on groundwater dependent priority biodiversity features there naturally remains some uncertainty in any modelled assessment.

Priority biodiversity features would suffer significant consequences if mine dewatering causes significant draw down of groundwater in the Undai channel. The likelihood of Riverine Elm Trees in the dewatering zone being impacted by mine dewatering is considered possible but the consequence only medium - given the very small number of trees – resulting in a moderate risk. However, the consequence of Riverine Elm Trees downstream of the dewatering zone being impacted by mine dewatering is serious given that this section of river supports a globally significant population (H. von Wehrden *in litt.* 2011) of Riverine Elm Trees. Whilst it is recognised that the Undai is not the sole ephemeral watercourse (based on measurements of the catchment it comprises approximately 50% of the catchment immediately downstream of the Mine Licence Area). The likelihood of this second impact is uncertain as discussed in Box 1; if possible or likely, this would imply a high risk (if it were assumed the Undai flowing through the Mine Licence Area was the sole source of alluvial groundwater flow), and mitigation measures need to ensure that this potential impact is minimised. Impacts on Saker Falcon and ungulates are assessed as unlikely or possible, resulting in minor or moderate risk.

If the effects of dewatering are shown to have a significant impact on groundwater resources in the Undai then the likelihood and threat rating for all groundwater dependent biodiversity features will be elevated – the degree of elevation will depend on how far the impacts are felt from the Mine Licence Area. Box 3 summarises the potential risk from hydraulic connectivity, and primary mitigation and monitoring actions.

Box 1: Potential risk from mine dewatering

Construction of the open pit will dewater sediments around the pit, some of which form surficial aquifers (Amendment to the Mine & Processing DEIA 2010). There is a risk that these surficial aquifers have functional hydrological connectivity with the alluvial aquifer beneath the Undai. Dewatering could then affect the downstream hydrology of the Undai. The relative contribution of the Undai to downstream alluvial aquifers is poorly-known, but mine dewatering, if unmitigated, could potentially affect a very large area of alluvial aquifers which support a large proportion of the Riverine Elm Trees and the best-quality Tall Saxaul Forest in the unit of analysis. This would have a serious or major impact, and is potentially a critical risk.

Currently and provisionally, the risk of hydrological connectivity is considered low based on the limited evidence from current monitoring. Water abstraction for construction activities has resulted in groundwater levels dropping by up to 8 m (although a limited (<1 m) drop in water level has occurred in some boreholes) since baseline conditions were established in 2003 but water levels away from these active bores has remained relatively constant suggesting low hydrological conductivity. A full risk assessment cannot be completed without better hydrological modelling of the connectivity between these aquifers. However, the primary mitigation action is the design of the river diversion which transfers subsurface flows to a point on the downstream reach of the Undai down-gradient, which will protect downstream springs and users.

As well as modelling and monitoring hydrological flows, the health of Riverine Elm Trees will be monitored within the zone of predicted drawdown from dewatering, and in control areas outside this zone.

6.6.2 Maintained surface water and groundwater flow in the Undai river

Under the current mine plan, the Undai River will be diverted to allow both the flood water and subsurface flows to pass safely around the open pit and waste dumps and to re-join the course of the Undai River south of the Mine Licence Area.

The current level of investigation provides a reasonable degree of confidence in the understanding of the physical attributes of the alluvial substrates, including the existence of palaeochannels. Further work planned in late 2011/early 2012 will add further understanding of the potential for any actual impact on groundwater-dependent priority biodiversity features downstream of the planned river diversion (Box 2).

Box 2: Uncertain downstream impacts

If the river diversion fails to maintain the original hydrological connectivity and flows, sustainability of groundwater flow and springs downstream of the Mine Licence Area may be compromised. Further research and monitoring will be undertaken to fully quantify the potential hydrological changes. The consequence of a significant reduction in flow on Riverine Elm Trees (of which the Undai supports a globally significant population (H. von Wehrden *in litt.* 2011) and Tall Saxaul Forest would be serious. Although considered unlikely based on the current data, if the likelihood of significant reduction in flows was possible or likely, this would imply a high risk; if almost certain, this would imply a critical risk.

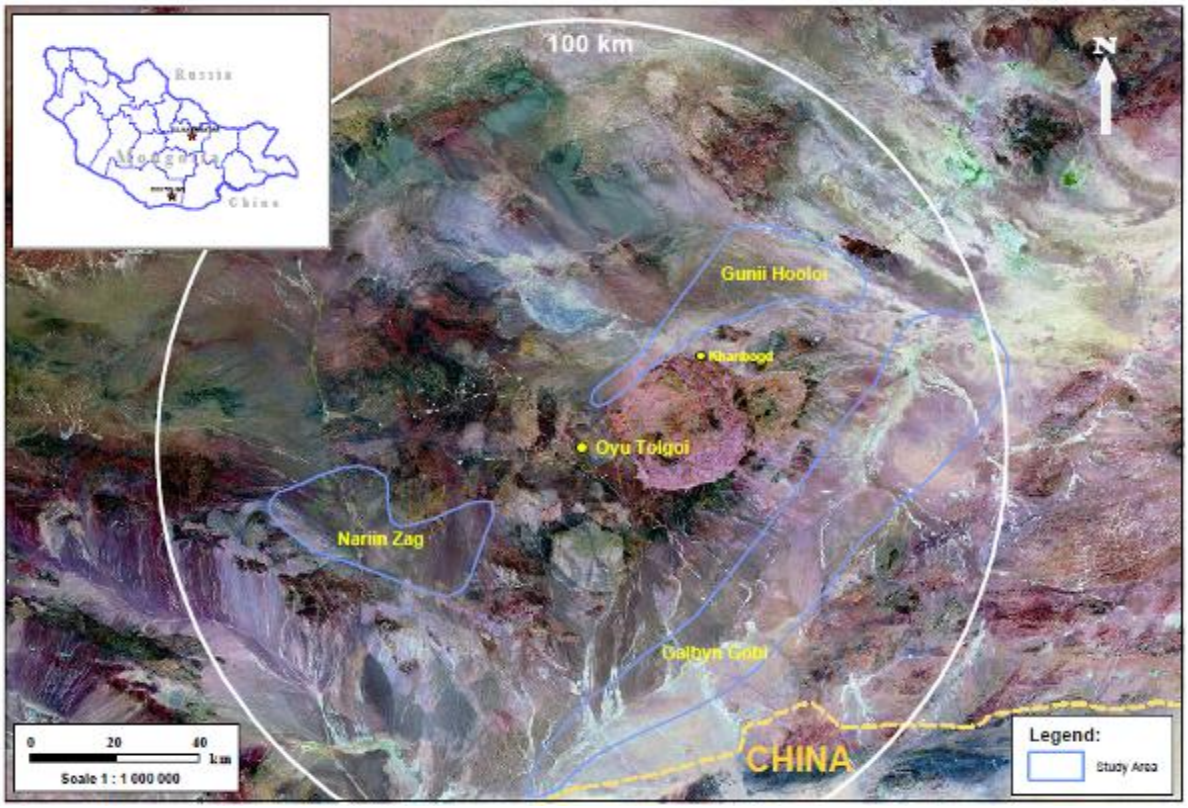
Chapter C5: Water Resources Impact Assessment discusses how Oyu Tolgoi will work with local herders to monitor water resources and identify any potential adverse impacts that may be related to the project and require appropriate adaptive management responses.

6.6.3 Connectivity between the deep Gunii Hooloi aquifer and overlying surficial and alluvial aquifers and deep Galbyn Gobi aquifers

The baseline data for the main aquifer units in the Project area can be separated into three main hydrogeological units which have varying degrees of hydrological connectivity in the different parts of the Project area: Alluvial, Bedrock and Late Cretaceous aquifers. Full characterisation of the aquifers has not been completed; however, additional monitoring and investigation are underway.

The most significant aquifers (volume) in the Project Area of Influence are the Late Cretaceous aquifers which comprise a thick sequence of clastic sediments deposited into rift basins with a predominant WSW-ENE trend. In the vicinity of the Project area, Oyu Tolgoi identified and subsequently investigated three basins based on the gravity surveys of the area. The results of this investigation identified the Gunii Hooloi as the best option to supply the Project's water supply with the Galbyn Gobi a potential future resource (*Figure 6.1).*

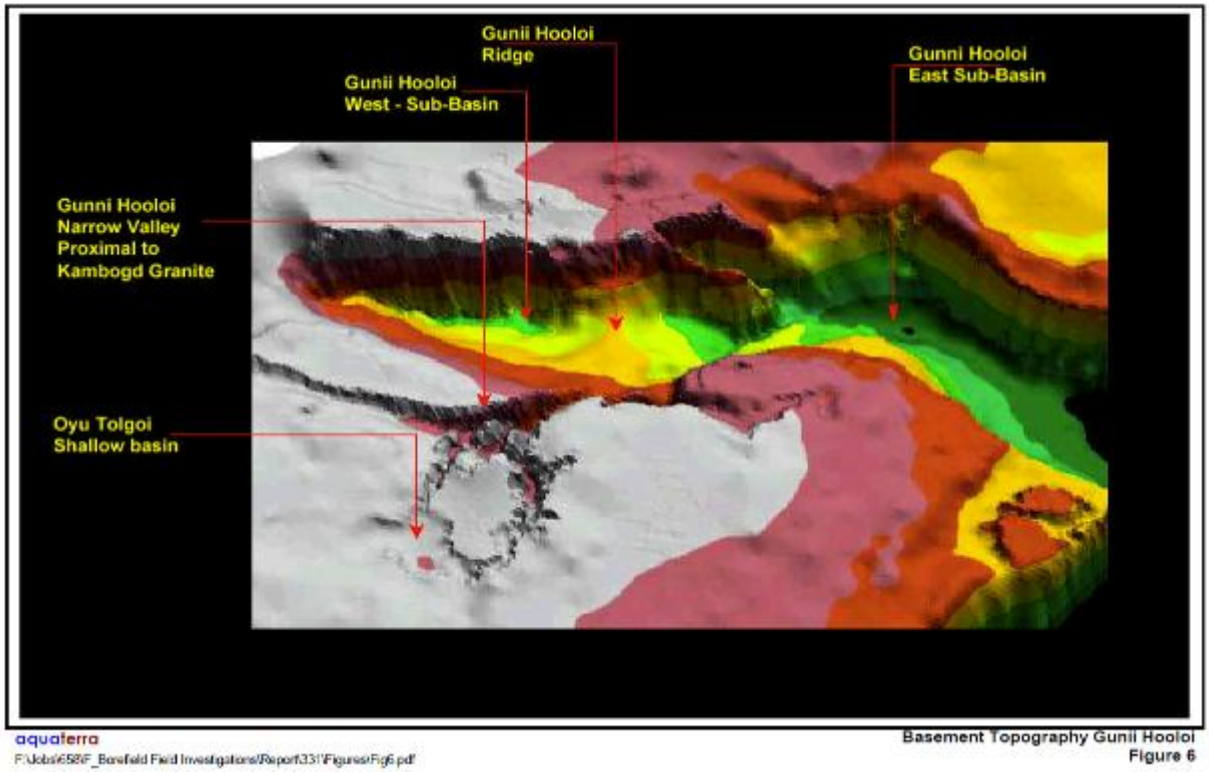
Figure 6.1: Significant aquifers around the Oyu Tolgoi project



The primary aquifer for the Oyu Tolgoi development is the Gunii Hooloi Aquifer (Late Cretaceous), from which the primary Gunii Hooloi Borefield is being developed to supply water to the mine operations. There are no short to medium term plans to pump water from the Galbyn Gobi Aquifer (Late Cretaceous) because; a) significant resources are defined within the Gunii Hooloi aquifer, and b) initial concerns relating to environmental impacts to groundwater-dependent vegetation in the Galbyn Gobi area. Although the Gunii Hooloi and Galbyn Gobi basins essentially merge at their eastern ends in the Duut Toirem area, partly separated by a low fault defined ridge of basement (*Figure 6.2*), for the purposes of this assessment they are treated as individual units because the proposed exploitation area is in the central and western parts of Gunii Hooloi, a significant distance (over 50 km) from where the basins merge. Further monitoring of the Galbyn Gobi aquifer as part of the Oyu Tolgoi project long term ground water monitoring programme will be undertaken to provide baseline data on the relationship between the Gunii Hooloi and Galbyn Gobi aquifers (which are thought to have a degree of connectivity) and to determine potential impacts (if any) of drawdown of the Gunii Hooloi on the Galbyn Gobi system.

Aquifers abstracted from during the construction phase of the project are dispersed across the zone of influence of the Mine Licence Area and will be affected by the open pit development and Undai diversion. The potential impacts arising from this are considered under the discussion around the zone of influence of the drawdown in the Mine Licence Area above.

Figure 6.2: Major Cretaceous Aquifers within the scope of exploitation for Oyu Tolgoi (Aquaterra 2004)



The Gunii Hooloi borefield extends to the northeast of the Oyu Tolgoi mine. The Late Cretaceous aquifer is inferred to extend over 40 km, thickening to the northeast where it is approximately 10 km wide. It is generally separated from the shallow surficial aquifers by the low permeability/impermeable sediments. The surficial aquifer is variably developed within the alluvium that exists over the surface of most of the Gunii Hooloi catchment area, however, it is only strongly developed along the ephemeral watercourses. Recharge to this surficial aquifer occurs directly by rainfall infiltration through the soils and more significantly by infiltration along the drainage courses during flow events. These surficial aquifers, mostly in the stream channel environments, are accessed by hand dug wells and are used by local herders for domestic and stock water supplies.

There are no apparent discharge areas for the groundwater in the basin, with no areas of springs or permanent deep rooted vegetation along the eastern edges of the basin. Subsurface flows from the basin may pass to a basin located further to the east (Gunii Hooloi NE Basin) or south-eastwards to merge with the Galbyn Gobi basin. The current hydrogeological information indicates that the Late Cretaceous aquifer has no strong hydraulic connectivity with shallow surficial aquifers in the area of abstraction and therefore abstraction from the Gunii Hooloi aquifer is considered to pose the lowest risks (c.f. other Cretaceous aquifers) to groundwater dependent vegetation.

Tall Saxaul Forest, Asiatic Wild Ass, Argali and Goitered Gazelle are all dependent on groundwater resources. Saker Falcon is dependent on Elm and Saxaul Trees for nesting but may be able to nest on electricity transmission pylons being erected by the project. At present, there is some uncertainty as to what impact drawdown of water from the deep, late cretaceous aquifer will have on the shallow groundwater aquifers, upon which these features depend (Box 3).

Box 3: Connectivity between aquifers

The extent of connection between the late cretaceous deep aquifer and the shallow groundwater aquifers is crucial to understand the impact of pumping from the deep aquifer on water levels in the streambed aquifers. Most of the potential impacts and their implications (on priority biodiversity features and existing wells) depend on the lowering of the water table in the shallow aquifer caused by pumping from the deep aquifer. The hydrological studies undertaken by Oyu Tolgoi have been focused on developing a robust understanding of the relationship of these separate aquifer systems.

According to *Chapter C5: Water Resources,* as a deep clastic aquifer, the Gunii Hooloi is reported to receive little or no recharge from annual rainfall. However, this is some evidence which suggest that, in the west of the groundwater study area, there is likely to be recharge (which implies connectivity) to the system where the confining sediments are thinner and/or more permeable allowing surface water infiltration.

This is based on data from the Oyu Tolgoi project's monitoring borehole system which shows that in the west of the groundwater study area the piezometric head of the deep aquifer may coincide with the shallow aquifer associated with the water course in this area, indicating that some recharge may occur. Although there is acknowledged hydraulic connection in this western area; it is outside of the area of drawdown associated with the Gunii Hooloi borefield.

Priority biodiversity features may suffer significant consequences if drawdown of groundwater resources in the deep aquifer causes a corresponding drawdown in the shallow surficial aquifer. The consequence of this is assessed as serious for Tall Saxaul Forest, and moderate for Saker Falcon and ungulates. Given that the Oyu Tolgoi project recognises that there may be limited hydrological connectivity, and therefore a risk of drawdown in one area of the shallow aquifer, these impacts are assessed as possible, resulting in a High Risk rating.

Further hydrological investigations to address some uncertainties in late 2011/2012 along with long-term hydrological and hydrogeological monitoring will be undertaken by Oyu Tolgoi in order further understand the relationship between surface flows, shallow surficial aquifers and groundwater abstraction. Monitoring will enable the detection of any measurable drawdown impacts to shallow aquifers associated with abstraction from the Gunii Hooloi borefield.

Although monitoring is not considered to be a mitigation action per se, here it is considered pre-requisite to establishing effective mitigation actions. The deep aquifer is fairly well studied and, with the monitoring during operation of the borefield, the understanding of the groundwater system will further improve. A similar approach has been adopted for shallow, surficial aquifers; dedicated monitoring will be undertaken to define the baseline and build the understanding of this aquifer.

A detailed understanding of the response of surficial aquifers to groundwater abstraction will be important for the project because any future changes in the (ground) water system (wells falling dry, changes to vegetation) are likely to be attributed to the deep groundwater abstraction by local stakeholders (A. Tuinhof *in litt*. July 2011).

Tall Saxaul Forest and priority ungulate species will all be adversely impacted if groundwater availability in the shallow alluvial aquifers is reduced. In this event, if abstraction from highly water stressed areas is halted and the surficial aquifer recharges, then it may be possible to rehabilitate Tall Saxaul Forest, and priority ungulates will return to the area. However, in the event that it is not possible to re-establish groundwater in the surficial aquifer, no rehabilitation of Tall Saxaul Forest would be possible and a suitable offset would need to be identified.

6.6.4 Connectivity between the deep Durulj Mount Southern aquifer and overlying surficial aquifers

Khanbogd centre is located at the foothill of the Khanbogd massif on the southern side of the Gunii Hooloi basin. Water is supplied from a mixture of private and public wells which abstract groundwater from the surficial quaternary sediments. These sediments are believed to be recharged by groundwater flowing through the fractures and fissures of the weathered zones of the granite body immediately to the south and the associated sedimentary formations (*Chapter C5: Water Resources Impact Assessment*). These

sediments, which appear to be separated from the Gunii Hooloi aquifer system by a basement ridge, are present around the periphery of the Khanbogd massif in a sub-basin to the south of, and separate from the Gunii Hooloi basin by, the Durulj Mount. .

In order to satisfy the demands of the predicted in-migration, the Oyu Tolgoi project has undertaken a geophysical investigation covering a 20 by 10 km area around Khanbogd *soum* centre to study the potential groundwater resources. The geophysical survey has identified a prospective groundwater aquifer called the Durulj Mount Southern Basin (Geomaster Engineering 2010) which is located 2-6 km from Khanbogd *soum* centre. The Oyu Tolgoi project has commissioned the drilling of seven exploration boreholes in this aquifer (water level is anticipated to be at an average depth of 150-200 m) and the results will be used to prepare a submission of a water reserve estimate to enable the design of the water abstraction system.

Until the results of the groundwater investigations at the Durulj Mount Southern aquifer are available in 2012, it is not possible to infer whether or not groundwater abstraction from this aquifer will cause a drawdown in groundwater in any of the shallow surficial aquifers upon which these features depend (Box 4) or, indeed, whether abstraction will go ahead at all (This is discussed in *Chapter 5: Water Resources Impact Assessment, Section 5.4.8*).

Box 4: Uncertain impacts of water abstraction from Durulj Mount Southern Aquifer

Priority biodiversity features would suffer significant consequences if drawdown of groundwater resources in the deep Durulj Mount Southern aquifer impacted any of the shallow surficial aquifers. Until studies are completed to characterise this aquifer and its hydrological connectivity with adjacent shallow surficial aquifers, it is not possible to make any estimates of surficial groundwater drawdown and therefore impact on priority biodiversity features. If significant connectivity is detected between the deep and shallow aquifers, the likelihood of impacts would be Likely or Almost Certain, and if this impact occurs over an extensive area, this implies Critical or High Risks/ threats to Riverine Elm Trees and Tall Saxaul Forest and High Risks/ threats to ungulates. In this case, re-design of the abstraction system of investigation of an alternative source of water supply to Khanbogd *soum* Centre would be investigated.

6.7 BIODIVERSITY MITIGATION ACTIONS

This section primarily describes mitigation actions for all Critical Risk and High Risk potential impacts to priority biodiversity features. In addition, owing to concerns about connectivity issues prior to mitigation actions taking affect, wildlife underpasses for the Oyu Tolgoi to Gashuun Sukhait Road are discussed – even though the loss of connectivity was only ranked as a 'medium risk'. The critical and high risk mitigation actions are summarised in *Table 6.7* and described in detail in the following subsections.

Actions that will be undertaken by Oyu Tolgoi to mitigate low and moderate risk impacts to priority biodiversity features or impacts to lower priority biodiversity features are described in *Chapter D6: Flora and Fauna Construction Management Plan* and in various other management plans including:

- *Chapter D7: Water Resources Construction Management Plan;*
- *Chapter D2 Atmospheric Emissions Construction Management Plan;*
- Interim Rehabilitation Management Plan and Land Disturbance Procedures;
- *Chapter D4: Topsoil Management Plan;*
- *Chapter D8: Waste Management Plan; and*
- *Chapter D12 Hazardous Materials Construction Management Plan.*

Table 6.7: Mitigation actions for all Critical and High Risk impacts

Infrastructure Component or Impact Type	Step in the mitigation hierarchy	Action
Roads	Minimise	Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings)
	Minimise	Provide driver awareness and training for all Oyu Tolgoi staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds)
	Minimise	Enforce no unauthorised waste disposal/littering from Oyu Tolgoi vehicles or around work place
	Minimise	Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert).
	Minimise	Engage with key stakeholders[5] to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait Road
	Minimise	Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue
	Minimise	Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue
	Minimise	Erect signage on roads to warn drivers of risk of collision with wild animals
	Minimise	Inspect and remove litter and other anthropogenic waste from along the Oyu Tolgoi to Gashuun Sukhait Road, Oyu Tolgoi to Khanbogd Road and Oyu Tolgoi Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces).
Hunting and collecting	Minimise	Control illegal hunting by Oyu Tolgoi personnel when at work (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties)
	Minimise	Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels)
	Minimise	Provide all project operations staff and contractors fuel for fires to remove the need for collection of local timber (i.e. Saxaul)
	Minimise	Inspect an adequate proportion of all aircraft under Oyu Tolgoi control for illegal wild animal products
	Minimise	Inspect all vehicles entering the Oyu Tolgoi site for illegal wild animal products
Regional	Minimise	Seek opportunities to engage with key stakeholders and provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions, including those that minimise cumulative fragmentation effects of linear infrastructure, to be integrated into regional planning, including infrastructure development, within Khanbogd *soum*. (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team).
Power Lines	Avoidance	During the design phase, the alignment of the high voltage transmission line was moved to the west of the Gashuun Sukhait border crossing to avoid crossing through the SGSPA.
	Minimise	Restrict infrastructure construction activities to minimise potential disturbance of habitat during the Houbara Bustard lekking season from 15 April to 30 June.

[5] Engagement with key stakeholders will be coordinated via *Chapter D14: Stakeholder Engagement Plan* under the management of the Oyu Tolgoi Community Relations and Social Performance team.

Infrastructure Component or Impact Type	Step in the mitigation hierarchy	Action
	Minimise	Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m).
	Minimise	Insulate conductors on medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary. The Oyu Tolgoi project has sought advice from bird electrocution experts to determine the exact insulation needs
	Rehabilitate	Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals
	Rehabilitate	Remove nests of birds which predate Bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure
Watercourse	Minimise	Divert the Undai watercourse to maintain surface and subsurface water flows within the Undai watercourse downstream of the Mine Licence Area
Rehabilitation	Rehabilitate	Rehabilitate and restore at least equal areas or numbers of features impacted (in line with Oyu Tolgoi Interim Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice)
Springs	Rehabilitate	Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of the Bor Ovoo spring.

6.7.1 Construct appropriate and sufficient underpasses

This discussion on the mitigation measures for the upgraded road from Oyu Tolgoi to Gashuun Sukhait is included here even though the impacts to wildlife from loss of connectivity were assessed as “medium” by the RBA. It is included owing to concerns about indirect habitat loss, fragmentation and reduced connectivity of wildlife populations prior to mitigation actions taking affect,

Indirect habitat loss, fragmentation and reduced connectivity of wildlife populations by roads can be mitigated by construction of appropriate and sufficient 'wildlife crossings' including overpasses (e.g. tunnels and wildlife overpasses) and underpasses (e.g. viaducts and culverts). Based on available evidence from priority species and similar species, and acting on a precautionary basis, such underpasses should be as long (where length is the axis of the road not the axis of animal movement) as possible (minimum 12 m long) and at least 4.5 m high along the entire length. It is estimated that one such underpass would be needed approximately every 6 km along roads to ensure appropriate ecological permeability for Asiatic Wild Ass and gazelles.

Underpasses designed for wildlife along the road upgrade to Gashuun Sukhait will be most effective and cost-effective when situated over river beds. In such locations, it is likely that culverts will be required at minimum (to avoid flood damage to roads). River beds in the area are likely to also be a focus for wildlife activity, given the higher availability of water (e.g. springs) in such areas. In India, Asiatic Wild Ass more frequently travel along river beds (World Bank 2002).

Wildlife crossings can also be used by domestic livestock as long as monitoring is established to ensure that livestock use does not prevent use by wildlife. If possible, vehicles will be prohibited from using wildlife crossings. If herder vehicles need to use wildlife crossings, they will be limited to only part of the width of such crossings or their damage to substrate may reduce or prevent use by wildlife. Vehicle routes can be indicated by placement of medium-sized rocks (large rocks and other blockages must be avoided as these will reduce or prevent use by wildlife). The substrate of the underpass must be natural, not waterlogged and have no obstructions or non-natural features such as litter, other anthropogenic waste, or excessive vehicle tracks.

Building screens at least as high as the highest Oyu Tolgoi project vehicles along the road sides above the wildlife underpasses will render vehicles on the bridge invisible to wild animals considering crossing, and thereby improve the likelihood of crossings. Building an earth berm along a length of road either side of any underpasses will help to hide traffic (enabling animals to approach roads), funnel animals towards the crossings and reduce incidence of collisions.

Any elevated infrastructure may provide nesting platforms for predators of Houbara Bustard. Any such structures will thus be designed with nest deterrents and/or be regularly monitored and nests removed.

Oyu Tolgoi recognises that ongoing inspection and maintenance of the road underpasses is necessary to ensure that these are effective in allowing continued use by wildlife and domestic livestock. The road infrastructure will be handed over to the Government of Mongolia, in accordance with Project agreements and approvals. Oyu Tolgoi is committed to ensure that the inspection and maintenance programme continues throughout the life of the Project, in coordination and consultation with all stakeholders, to ensure that the underpasses remain effective. The inspection and maintenance programme will be implemented to ensure:

- no obstacles are blocking the passage of wildlife or livestock through the underpass;
- all constructed underpasses remain structurally sound;
- drainage is maintained to prevent blocking or silting of the underpasses;
- livestock and human use of underpasses is identified and measures taken if this use restricts wildlife passage; and
- berms and other associated design features are maintained as designed.

This demonstration of best-practice is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure. Further background information to this recommendation is given in the annexed RBA report.

The Oyu Tolgoi project will:

- Construct appropriate and sufficient underpasses (at ecologically suitable locations such as river beds, approximately every 6 km along the Oyu Tolgoi to Gashuun Sukhait road, as long as practically possible but minimum 12 m long, at least 4.5 m high along the whole length, with solid sides at least as high as highest Oyu Tolgoi vehicles, a natural, non-waterlogged substrate with no obstacles, affording a view of the horizon from either side, and with earth berm along edge of road either side of underpass to funnel wildlife towards underpasses; construction to commence in 2013 and is expected to be complete within two years subject to detailed design, stakeholder engagement and construction approvals. All mitigation measures for the road will be finished before handover to Government of Mongolia.

Driver awareness and training:

- Vehicle drivers who are aware of and trained in safe driving techniques will have fewer collisions with wild animals, other vehicles and livestock, which have additional social and health/safety benefits.

The Oyu Tolgoi project will:

- Provide driver awareness and training for all Oyu Tolgoi staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds).

6.7.2 Enforce no waste disposal from vehicles or around work place

Organic waste, especially foodstuffs, attracts and supports predatory and scavenging birds and mammals, which may predate priority biodiversity features.

The Oyu Tolgoi project will:

- Enforce no unauthorised waste disposal/littering from Oyu Tolgoi vehicles or around work place.

6.7.3 Enforce low speed limits

Enforcing low speed limits will reduce collisions with wild animals, other vehicles and livestock, which has additional social and health/safety benefits.

The Oyu Tolgoi project will:

- Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert); and

- Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait road.

6.7.4 Prevent vehicles leaving, but facilitate wildlife crossing roads, by use of boulders, posts and/or ditches

Vehicles currently readily leave roads in the area when their quality degenerates, resulting in increased habitat loss, wildlife avoidance distances and impacts such as hunting or wildlife collisions. The road upgrade to Gashuun Sukhait will largely alleviate these problems. In order to ensure this, obstacles are necessary to prevent vehicles leaving the road at will (though vehicles will ultimately be able to leave the road at designated herder crossings). These obstacles may comprise immoveable boulders (immoveable boulders could be partially buried to leave the minimum exposure to prevent vehicle passage), or short (above vehicle axle height) but solid posts (e.g. concrete with steel cable core), either obstacle being accompanied by shallow ditches (c.1 m deep and 2 m wide). None of these features are likely to present a significant barrier to wildlife after they have habituated to their presence, though boulders (as a natural feature) and shallow ditches are likely to present the least barrier to wildlife. Boulders could be sourced from the mine provided that there is a low risk of acid leaching. Ditches may promote vegetation growth (being nearer the water table), thus attracting wildlife and livestock and increasing collision risks, but would increase difficulty of vehicles squeezing between boulders or posts. As long as ditches are designed so that wildlife cannot be trapped in them, their biodiversity benefits are likely to outweigh their costs.

The Oyu Tolgoi project will:

- Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings).

6.7.5 Prevent vehicles parking beside roads

Parking vehicles beside roads increases the barrier effect of roads to wild animals which are hunted by people in vehicles.

The Oyu Tolgoi project will:

- Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue; and
- Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue.

6.7.6 Erect warning signs

Erection of suitable signs to warn vehicle drivers of the risks of collisions with wild animals and other obstacles will reduce collisions with wild animals (Huijser *et al.* 2009), other vehicles and livestock.

The Oyu Tolgoi project will:

- Erect signage on roads to warn drivers of risk of collision with wild animals.

6.7.7 Regularly remove litter and collision carcasses

Litter, especially foodstuffs, and collision carcasses, attract and support predatory and scavenging birds and mammals, which may predate priority biodiversity features. Removing all litter and carcasses will rehabilitate the habitat (with respect to populations of predators and scavengers) as well as monitoring the impact of collisions. Other anthropogenic waste can add to the barrier effect of infrastructure towards wild animals, and reduce habitat quality. The periodicity of removal will be refined based on the design and results of the monitoring and evaluation plan.

The Oyu Tolgoi project will:

- Inspect and remove litter and other anthropogenic waste from along the Oyu Tolgoi to Gashuun Sukhait Road, Oyu Tolgoi to Khanbogd Road and Oyu Tolgoi Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces).

6.7.8 Control illegal hunting in the wider landscape

The primary impact on biodiversity arising from in-migration to Khanbogd *Soum* associated with the Oyu Tolgoi project is predicted to be mortality from illegal hunting and collecting. As well as the increase in direct mortality, hunted species show greater avoidance of infrastructure, which increases the area of indirect habitat loss and the chance of fragmentation of hunted species' populations (khulan, Goitered Gazelle, Mongolian Gazelle, Houbara Bustard). A model for control of illegal hunting exists in western Mongolia where WWF has been successfully developing national-level anti-poaching government enforcement teams and informant networks. Actions to control illegal hunting and collecting are complex and will require extensive consultation with all stakeholders in order to implement effectively.

The Oyu Tolgoi project will:

- Control illegal hunting by Oyu Tolgoi personnel when at work (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties); and
- Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels).

6.7.9 Provide all project operations, staff and contractors with fuel other than firewood

Fuel needs of local people are primarily fed by dried livestock dung and, in winter when heating needs are high, woody plants, notably Saxaul (Damdin 2011; Centre for Policy Research 2009 in Environ 2011). Tall Saxaul Forest is a priority biodiversity feature and supports other features such as Saker Falcon. Tall Saxaul Forest is currently over-collected in Khanbogd *soum*, and this is predicted to increase with increasing in-migration of people (Schmidt *et al.* 2011).

The Oyu Tolgoi project will:

- Provide all project operations staff and contractors fuel for fires to remove the need for collection of local timber (i.e. Saxaul).

6.7.10 Inspect goods being transported by plane (for hunted animals)

Inspection of all aircraft under the control of the Oyu Tolgoi project for illegal wild animal products will help reduce the potential impact of constructing an airport on the rate of illegal hunting. Inspection could be undertaken on all aircraft or an effective random proportion of aircraft. There must be adequate publicity and enforcement of punishments to act as an effective deterrent.

The Oyu Tolgoi project will:

- Inspect an adequate proportion of all aircraft under Oyu Tolgoi control for illegal wild animal products (Publicise and apply suitable penalties to offenders under Oyu Tolgoi control found trafficking illegal wild animal products).

6.7.11 Inspect vehicles (for hunted animals) entering the Oyu Tolgoi site.

Inspection of all vehicles under the control of the Oyu Tolgoi project for illegal wild animal products will help reduce the impact of upgrading roads on the rate of illegal hunting. Inspection could be undertaken on all vehicles or an effective random proportion of vehicles, at the start and end of all roads which may act as conduits for hunters or movement of hunted animal products. The road to Gashuun Sukhait is the highest priority given its length and connection to China which is a major market for wild animal products. There must be adequate publicity and enforcement of punishments to act as an effective deterrent.

The Oyu Tolgoi project will:

- Inspect all vehicles entering the Oyu Tolgoi site for illegal wild animal products.(Publicise and apply suitable penalties to offenders under Oyu Tolgoi control found trafficking illegal wild animal products).

6.7.12 Enable balanced and sustainable regional planning

Secondary impacts of the increased number of non-Oyu Tolgoi project employees in Khanbogd *soum* can be mitigated by enabling balanced and sustainable regional planning, including infrastructure development, within Khanbogd *soum.* Currently Khanbogd does not have the infrastructure or administrative capacity to manage such large transformations without significant support from both the Government of Mongolia and the major project developers in the region. The Oyu Tolgoi project is establishing a Local Regional Planning and Infrastructure (LRPI) unit to coordinate with the Southern Gobi Regional Development Council (SGRDC) that is being established by the Government of Mongolia. Moreover, a regional, landscape level approach is required to address the cumulative fragmentation effects of infrastructure development in the southern Gobi region. This is best achieved through close cooperation between key regional stakeholders on regional planning issues. The recently agreed MoU on biodiversity management and monitoring between Oyu Tolgoi and Energy Resources LLC provides an excellent example of opportunities for collaboration between key stakeholders in the southern Gobi region.

The Oyu Tolgoi project will:

- Seek opportunities to engage with key stakeholders and provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions, including those that minimise cumulative fragmentation effects of linear infrastructure, to be integrated into regional planning, including infrastructure development, within Khanbogd *soum*. (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team). Add bird flight diverters to all power lines.

Most collisions are with the highest and thinnest wires, usually the earth wire, of power line infrastructure. Various ‘bird flight diverters’ can increase visibility and avoidance of these wires. Bird flight diverters can be both visual and auditory markers of power lines. The most common visual markers are large PVC spirals (e.g. “Swan Deflectors” of 1 m length and 30 cm diameter; *Figure 6.3).* The most common auditory markers are 'flappers' – these are usually smaller (less visible) but make a noise when they blow in the breeze. PVC spirals alone have been shown to reduce bird collision mortality by up to 81% (Janss & Ferrer 1998), flappers on their own have been shown to reduce bird collision mortality by 60-63% (Brown & Drewien 1995; Yee 2008), and flappers added to spirals have been shown to reduce bird collision mortality by an additional 52% (Anderson 2002). Noise-generating flappers may be particularly important for Bustards, which show poor visual detection of power transmission lines (Martin & Shaw 2010). Because Bustards migrate during the day and at night, a particularly effective flapper may be the “Bird Mark AG” (

Figure **6.4**), which glows in the dark for up to ten hours after dark.

Frequencies of bird flight diverters of every 5-10 m along the earth wire have been shown to reduce collision rates (Jenkins *et al.* 2010; Barrientos *et al.* 2011; J. Shaw pers. comm. 2011 in TBC and FFI 2011). It is assumed that increasing these frequencies further will further reduce the collision rate, e.g. a frequency of every 1.5 m is recommended for high-risk lines for Little Bustard in Portugal (J.-P. Silva pers. comm. 2011 in TBC and FFI 2011). It has been suggested that bird flight diverters be yellow or yellow-green, or alternating contrasting colours (dark and light), to maximise effects within the avian visual spectrum (Crowder & Rhodes 2001) but this has not yet been adequately tested in the field (Jenkins et al. 2010). Nonetheless, alternating contrasting colours inherently have more likelihood of including colours that are visible to birds.

Figure 6.3: **Spiral bird flight diverter**

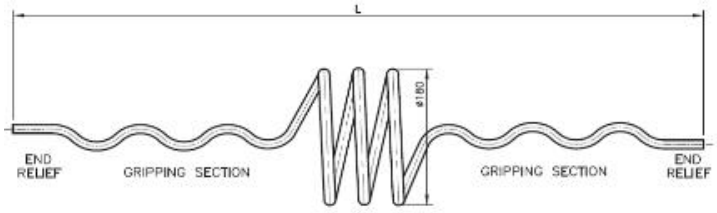


***Figure 6.4:* "Bird Mark AG" flapper bird flight diverter in daylight and at night**

The Oyu Tolgoi project will:

- Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m).

Oyu Tolgoi is planning to undertake surveys for Houbara Bustard during the lekking period from 15 April to 30 June, 2012 throughout the project area of influence and including the high voltage transmission line. The objective of these surveys is to provide improved data on lekking sites and activity in the region. The potential for Houbara Bustard surveys to be compromised due to line stringing activity being undertaken at the same time is recognised. In addition, it is recognised that stringing activity during the period from 15 April to 30 June may disturb any lekking activity occurring in the vicinity of the transmission lines, even though the RBA has estimated an avoidance distance of 1 km from the power transmission infrastructure for the Houbara Bustard.

The opportunity to schedule line stringing activity outside the period from 15 April and 30 June for the Houbara Bustard lekking period is limited due to climatic considerations; the availability of bird flight deflectors which have to be applied during the stringing phase, and; the requirement for the high voltage transmission line to be providing power for project commissioning in July 2012.

The Project has established and is proposing the following supplementary actions, in addition to the actions that have already agreed as a result of the rapid biodiversity assessment team impact assessment, to minimise the potential disturbance to Houbara Bustards during the high voltage transmission line stringing. These measures are further detailed in *Chapter D6: Flora and Fauna Construction Management Plan*.

- Oyu Tolgoi has expedited commencement of line stringing work to commence in March 2012 and has compressed the line stringing schedule in order to enable earliest possible completion, now scheduled to be complete within the IBA by the end of April and to be complete for all activities by the end of May 2012;
- Oyu Tolgoi has sourced bird flight diverters under expedited procurement process, including utilisation of air freight shipment in order to ensure that such are available on-site for installation concurrently with expedited line stringing works;
- Oyu Tolgoi will place a priority, by providing increased resources, on line stringing activities within the IBA and with an aim of having line stringing activities completed in the IBA, before end of April;
- Oyu Tolgoi will limit line stringing work to discrete line pulling points that will be checked for any nearby Bustard activity prior to being established;

- Oyu Tolgoi will ensure that all contractors implement the Oyu Tolgoi Flora and Fauna Construction Management Plan (*Chapter D6*);
- Oyu Tolgoi will ensure that a Houbara Bustard surveyor is active in the area during the breeding season to identify any specific Bustard lekking sites in the vicinity of power line stringing activities; and
- Where any individual Houbara Bustard lekking sites are identified, Oyu Tolgoi will consult with Bustard specialists in order to determine the most appropriate action to avoid disturbance.

6.7.13 Insulate medium-voltage power line poles, dead-ends and sub-stations, and on pylons where necessary

Retrofitting customised insulation to problem areas of medium-voltage (<40 kV) distribution power line infrastructure can reduce the risk of perching birds being electrocuted. Insulation will require regular inspection and will probably need replacing every few years given the harsh weather conditions (A. Dixon pers. comm. 2011 in TBA and FFI 2011). Similarly, any jump wires and sub-station wires identified as presenting a high risk to birds will be insulated or routed under conductor arms.

The Oyu Tolgoi project will:

- Insulate medium-voltage power line poles, dead-ends and sub-stations, and on pylons where necessary. The Oyu Tolgoi project has consulted with bird electrocution experts to determine the exact insulation needs.

6.7.14 Remove nests of birds which predate Bustards, where made on infrastructure

Any elevated infrastructure could provide nesting and perching areas for predatory birds. This would increase the local population densities of these predators, and increase the level of predation on Houbara Bustard and other priority biodiversity species. It is considered more cost-effective to remove nests of species that are potential predators of Houbara Bustard nests and young (e.g. buzzards *Buteo* spp., black kite *Milvus migrans* and common raven *Corvus corax*) as they are built rather than to mitigate this risk through perch-deterrents (such as the spikes commonly seen to deter perching pigeons in American and European cities). It is standard practice for Mongolian companies maintaining electricity infrastructure to remove birds' nests annually, after they have laid eggs in spring (G. Sundev pers. Comm. 2011). Although Saker Falcon is commonly used by Falconers to hunt Houbara Bustard, Wild Saker Falcon appear to very rarely hunt Houbara Bustard in this region (Sundev *et al*. 2001; G. Sundev pers. Comm. 2011). Therefore, nests known to be of Saker Falcon, which is a priority biodiversity feature, will not be removed.

The Oyu Tolgoi project will:

- Remove nests of birds which predate Bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure.

6.7.15 Regularly remove collision carcasses

Collision carcasses under power lines, attract and support predatory and scavenging birds and mammals, which may also predate priority biodiversity features. Removing every carcass will rehabilitate the habitat (with respect to populations of predators and scavengers) as well as monitoring the impact of collisions. Standard methods exist for adjusting bird carcass surveys to account for scavenging rates. Oyu Tolgoi has investigating the potential to install Bird Strike Indicators which are electronic devices mounted on power lines to detect actual collisions. These could be used to directly quantify bird collisions in sensitive areas and control areas. They could also be used to compare pre- and post-mitigation collisions in offset areas. The periodicity of carcass removal will be refined based on the design and results of the monitoring and evaluation plan.

The Oyu Tolgoi project will:

- Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals.

6.7.16 Rehabilitate and restore vegetation, specifically including Mongolian Chesney, Riverine Elm Trees and Tall Saxaul Forest

Rehabilitation and restoration are largely considered to be a standard best practice and, as such, not detailed here. However the mitigation actions for impacts on the vegetative priority biodiversity features (Mongolian Chesney, Riverine Elm Trees and Tall Saxaul Forest) include explicit rehabilitation and restoration of these species and habitats. There are opportunities for enabling regeneration of Tall Saxaul Forests as young regenerating Saxaul is currently widespread in Khanbogd *soum* including in Gunii Hooloi around the borefield (Schmidt *et al.* 2011). It is noted that propagation could be undertaken at the recently established Khanbogd nursery, and also that three Elm Trees have already been transplanted, the long-term outcome of which is being monitored.

The Monitoring and Evaluation programme for biodiversity, as outlined in 6.11.3, will require the development of rehabilitation monitoring, including invasive weed monitoring, to identify where further rehabilitation is required or where invasive weeds are to be removed.

The Oyu Tolgoi project will:

- Rehabilitate and restore at least equal areas or numbers of features impacted (in line with Oyu Tolgoi Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice), including the existing Temporary Airstrip.

6.7.17 Replace the Bor Ovoo spring and ensure replacement spring recreates ecological functions of Bor Ovoo spring

The Oyu Tolgoi project proposes to establish an artificial spring at the point where the proposed Undai groundwater diversion pipe terminates, to replace the Bor Ovoo spring which will be covered by the WRD. The spring will mimic the characteristics of the Bor Ovoo spring as closely as practicable - taking into consideration the extent of inundation and catchment size, establishing vegetation and rocky outcrop habitats. It should be noted however, that the location of the spring will limit its use as it will be located within the zone of avoidance for ungulates.

The Oyu Tolgoi project will:

- Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of Bor Ovoo spring.

The Bor Ovoo Spring replacement has been designed[6] to ensure it provides a functional water source similar to that provided by the original spring. The location of the replacement spring, approximately 500 m south of the southern fence, has been selected on advice from biodiversity specialists and from local community consultation. The location is sufficiently separated from the influence of the mine waste structures. The key features of the replacement spring include:

- Providing a simplified pipe network that enables flows to the spring to occur naturally and be diverted under sub zero temperatures without the need for human intervention (i.e. exclude the use of mechanical / moving parts). This design will ensure that flows in the replacement spring have a similar regime to the existing Bor Ovoo Spring;
- Including a “drinker” arrangement for large animal access to water for drinking. This requires animals to walk down the non-skid surface to access the water at the base of the “drinker” which will have dimensions suitable for larger animals;
- For smaller animals, including mammals, birds and reptiles, shallower water would be more appropriate and would avoid accidental drowning. Overseas research has indicated that placement of rocks within the “drinker” enable smaller animals to access the water safely; and
- The existing Bor Ovoo Spring occupies an area of approximately 40 m^2 although only a small percentage of this contains surface water for drinking – much of this area is space of animals to position themselves whilst drinking. The area occupied by each “drinker” unit is

[6] River Diversion Detailed Engineering; Detailed Design Report-Final; SMEC, Prestige,5 September 2011

approximately 13 m^2. As such, 3 artificial "drinker" units would give approximately the same area as the existing Bor Ovoo Spring.

6.7.18 Monitoring to account for hydrological uncertainties

Section 6.6 above describes hydrological and hydrogeological uncertainties associated with the Oyu Tolgoi project. While it is assumed on the basis of existing data that the project will have a negligible impact on surface hydrology and shallow groundwater resources of the Project AoI (including the Undai River), ongoing monitoring is required to validate this assumption. This assumption does not include the impact to the Bor Ovoo spring which is a significant direct impact from mine disturbance. The risk ranking associated with hydrological impacts is considered medium/low and is dependent upon the likelihood of impacts occurring which is subject to some uncertainty. Monitoring to account for hydrological uncertainly is considered important in verifying the risks to biodiversity and will allow these risks to be amended should the likelihood of impacts increase. Monitoring is generally not considered a mitigation action per se but in this case is considered critical to determine future potential mitigation actions should the project be found to have a negative impact on surface water and shallow groundwater. For this reason, Oyu Tolgoi has committed to undertaking the following specific monitoring:

- In consultation with experts, establish a groundwater monitoring programme sufficient to detect project-related impacts of mine dewatering on surficial and alluvial aquifers (temporal and spatial analyses required to assess rate and extent);
- In consultation with experts, establish a groundwater monitoring programme sufficient to enable the detection of project-related impacts on groundwater levels and surface hydrology in the Undai downstream of the mine;
- In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the Gunii Hooloi deep cretaceous aquifer;
- In consultation with experts, establish a groundwater monitoring programme sufficient to detect any change in groundwater level of the deep Galbyn Gobi aquifer arising from abstraction from the Gunii Hooloi deep cretaceous aquifer; and
- In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the deep Durulj Mount Southern aquifer.

6.8 IMPACTS ON PRIORITY ECOSYSTEM SERVICES

Ecosystem services is a concept that cuts across conventional approaches of looking at issues from a subject-specific basis and enables the interactions between the biophysical and human environments to be identified. Most, if not all, of these issues, impacts and associated mitigation actions are either addressed within the Biodiversity mitigations or within other chapters of the ESIA. Appropriate cross-references have been made to set out where mitigations are described within this ESIA. These include the following impact assessment chapters (and associated Management Plans):

- ***Provisioning services:***
  - Impacts on pasture for livestock – addressed in *Chapter C10: Land Use and Displacement Impact Assessment* and this *Chapter C6: Biodiversity*;
  - Impacts on wild plants and animals – addressed in this *Chapter C6: Biodiversity*;
  - Impacts on clean air – addressed in *Chapter C2: Climate and Air Quality Impact Assessment*;
  - Impacts on drinking water – addressed in *Chapter C5: Water Resources Impact Assessment* and *Chapter C8: Population and Influx Impact Assessment*; and
  - Impacts on wood for fuels – addressed in this *Chapter C6: Biodiversity*.

- ***Regulating services:***
  - Impacts on water quality regulation – addressed in – addressed in *Chapter C5: Water Resources Impact Assessment;*
  - Impacts on water quantity regulation – addressed in *Chapter C5: Water Resources Impact Assessment*; and
  - Impacts on soil and erosion regulation addressed in *Chapter C4: Topography, Geology & Soils Impact Assessment* and *Chapter C5: Water Resources Impact Assessment*.
- ***Supporting services:***
  - Impacts on primary production – addressed *in Chapter C10: Land Use and Displacement Impact Assessment* and this *Chapter C6: Biodiversity*; and
  - Impacts on habitat for wildlife – addressed this *Chapter C6: Biodiversity*.
- ***Cultural services:***
  - Impacts on cultural and/or spiritual sites – addressed in *Chapter C11: Cultural Heritage Impact Assessment*; and
  - Impacts on (herder) camp sites – addressed in *Chapter C10: Land Use and Displacement Impact Assessment*.

The construction and operational impacts on each priority ecosystem services are identified for the life of the Project, (construction through mine operation, and where possible through the mine closure). Potential project impacts on ecosystem services have been mapped (*Figures 6.5 through 6.8*) for the four most prominent Project infrastructure components:

- The Mine Licence Area;
- the Gunii Hooloi borefield (and associated infrastructure);
- the Oyu Tolgoi to Gashuun Sukhait Road; and
- infrastructure corridor (220kV Transmission Line).

Each of the three categories of ecosystem services presented in the baseline chapter (biological, physical, and human) have been colour-coded on the figures; biological features depicted in green, physical in blue, and human in purple. This is intended to focus attention upon the location and function ecosystem services rather than the specific elements depicted (e.g. biological resources as a whole versus individual species) and emphasises the spatial distribution of the impacts.

The project's potential direct and indirect impacts on priority ecosystem services are summarised in

Table **6.8**; priority ecosystem services affected by the Project and associated mitigation actions are presented in *Table 6.9*. Proposed mitigation actions for priority services that are also determined to be critical in the Critical habitat Assessment and that trigger critical habitat – livestock, biomass fuel, freshwater, and water regulation - are consistent with Paragraph 10 of the IFC Critical Habitat Requirements (2009). Compliance with these requirements will be determined over time through a rigorous monitoring program and adaptive management strategies which will allow the project to establish effective mitigation actions.

Figure 6.5: **Areas of ecosystem services overlap**

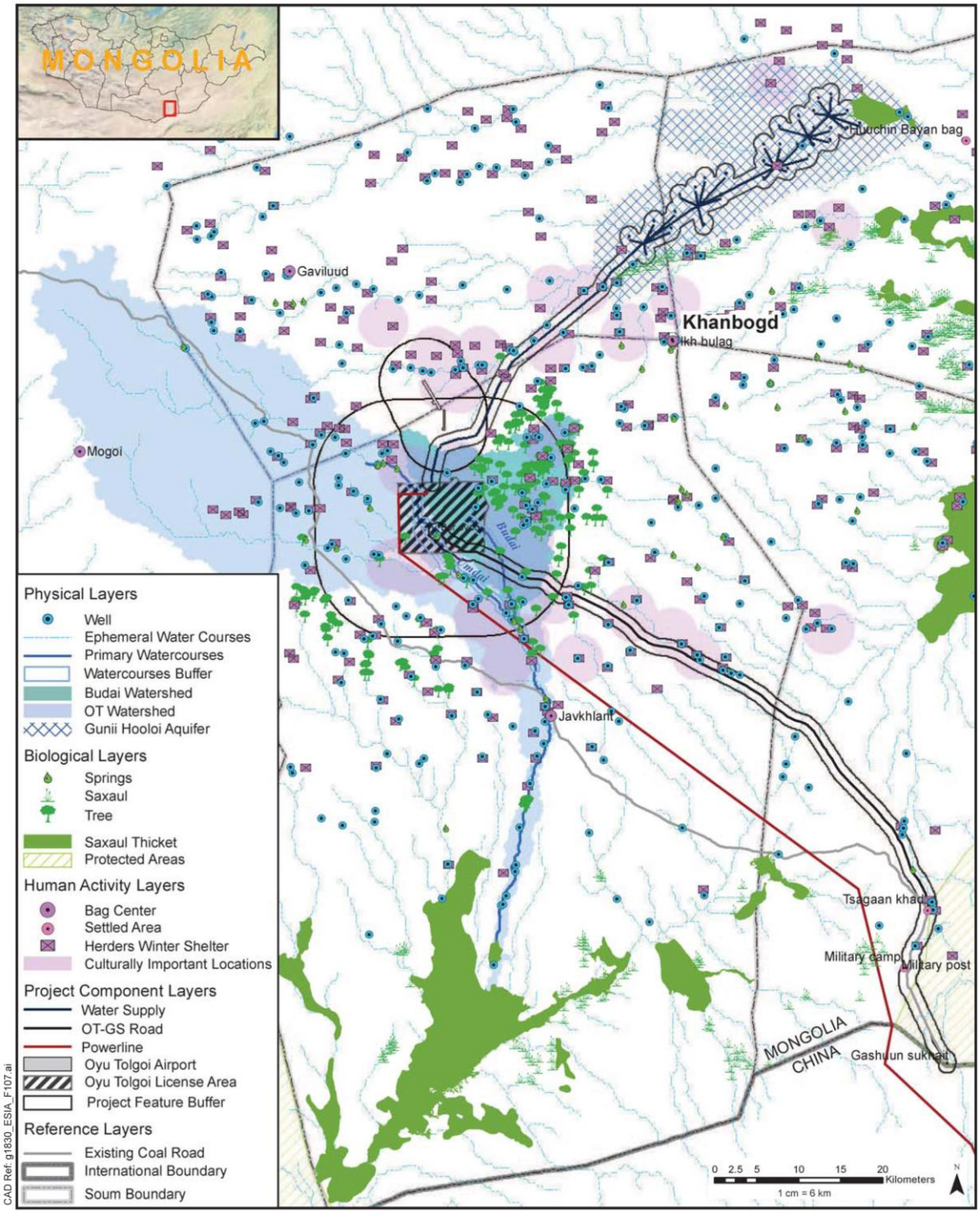


Figure 6.6: Mine Licence Area and downstream potential ecosystem services impacts

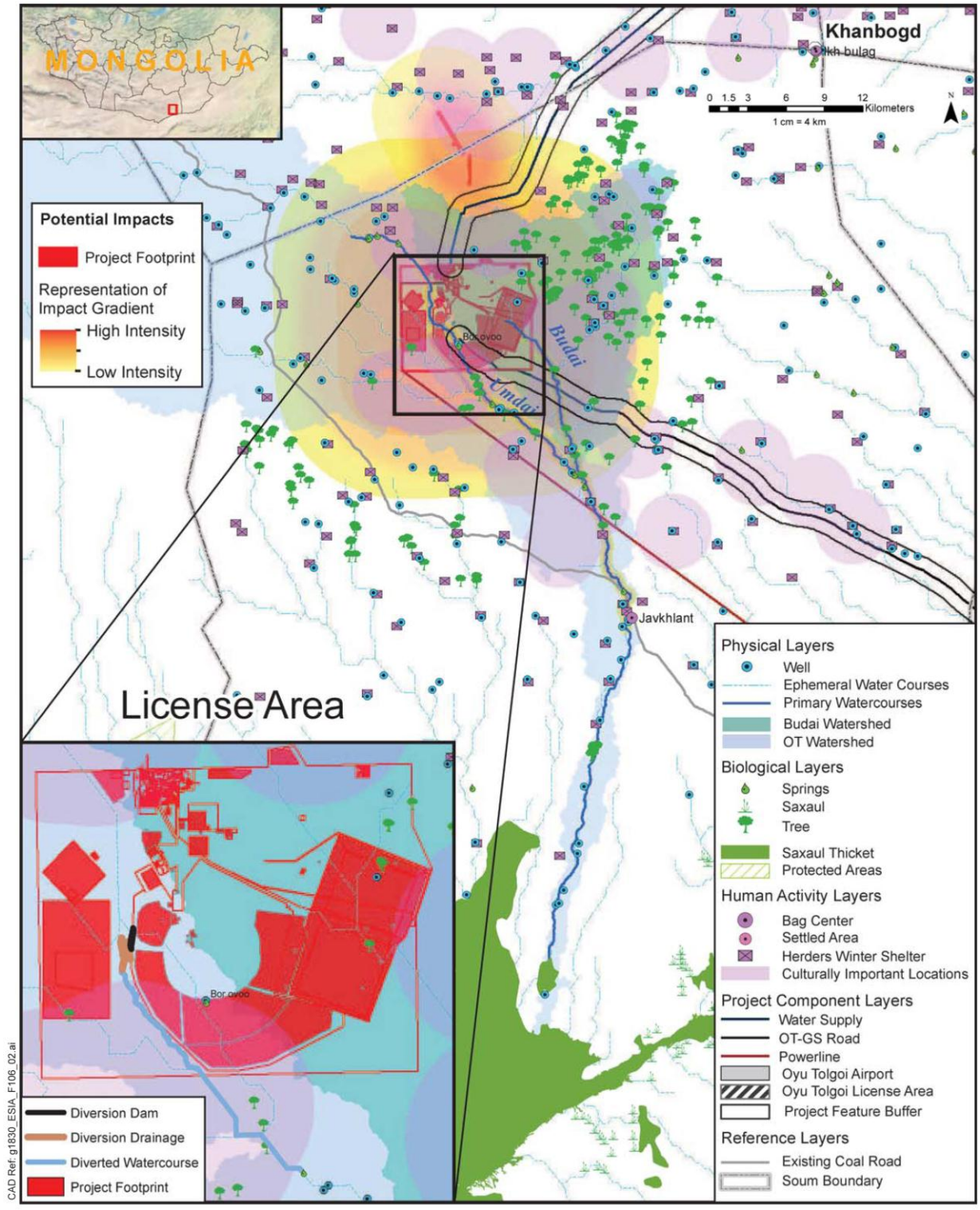


***Figure 6.7*: Gunii Hooloi pipeline & borefield potential ecosystem services impacts**

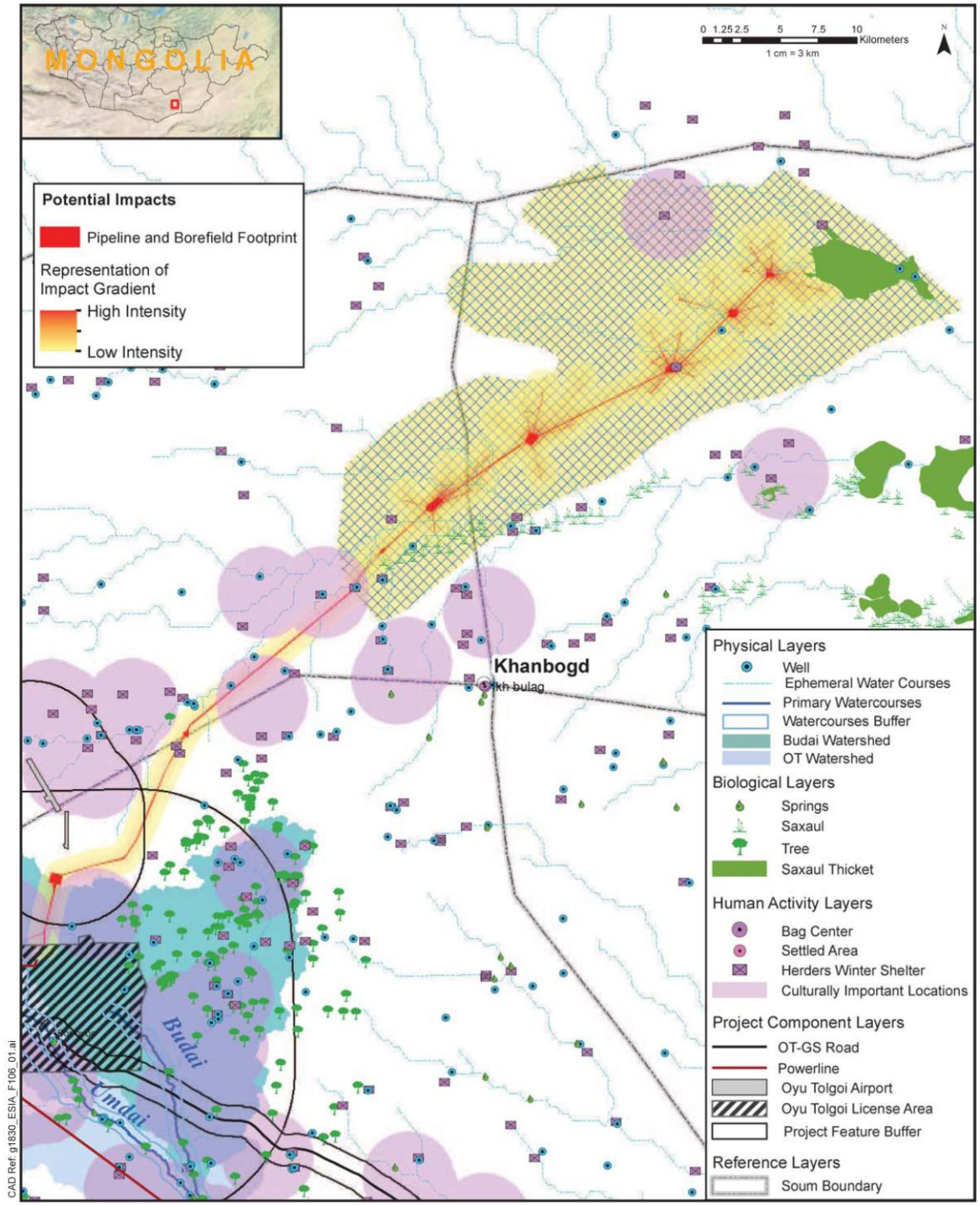


Figure 6.8: Infrastructure corridor potential ecosystem services impacts

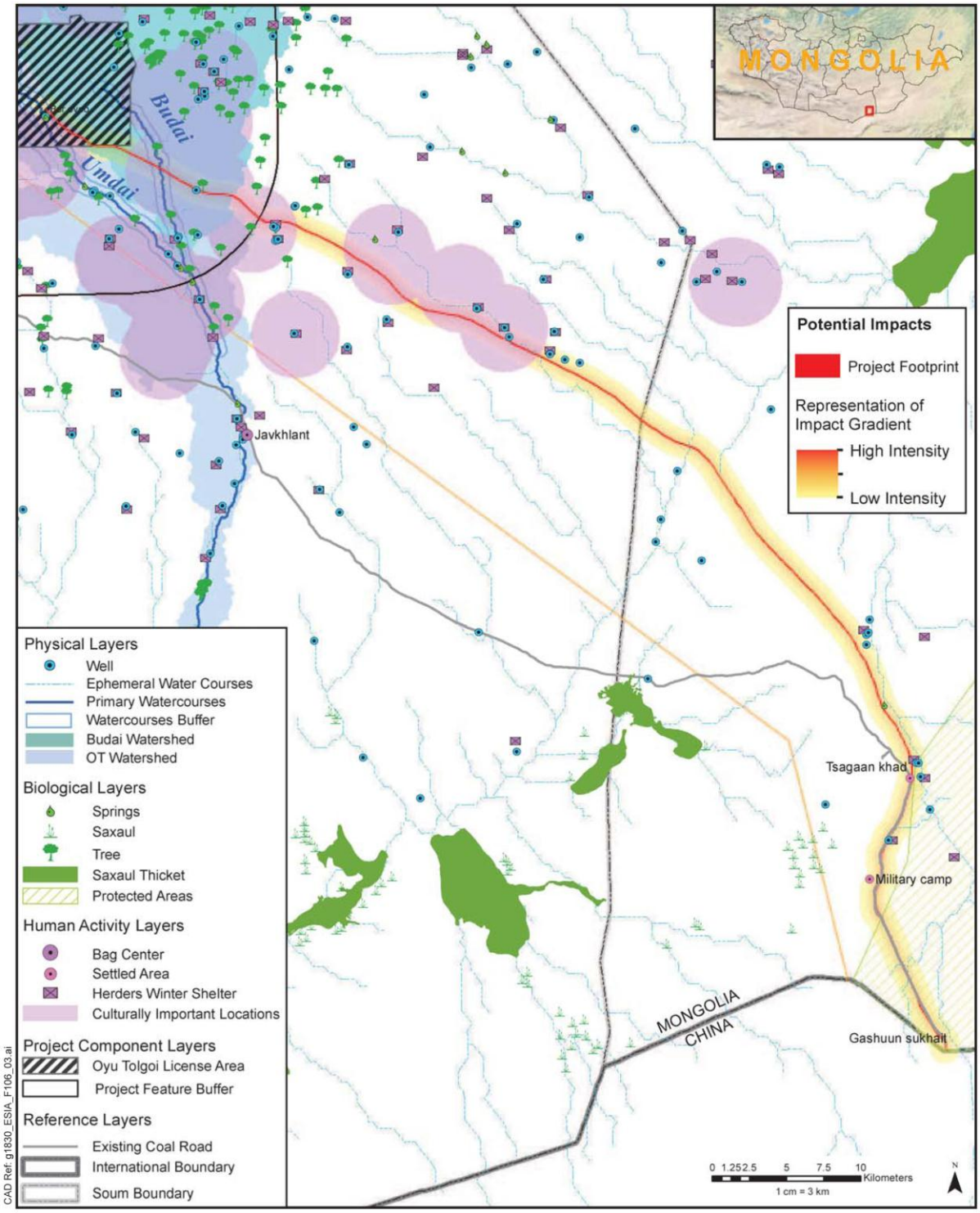


Table 6.8: **Summary of direct impacts, indirect impacts and replaceability for ecosystem services**

Ecosystem Service	Priority Type	Direct Impacts	Indirect Impacts	Replaceability
Provisioning				
Livestock	I	Direct loss of desert steppe vegetation to mine and infrastructure development.	Potential over-grazing if livestock levels increase.	Few alternatives
		Loss of access to pasture due to fencing of the Mine Licence Area.	Potential hydrological impacts from aquifer drawdown due to mine dewatering.	
		Loss of access to pasture during construction phase of borefield pipeline, Oyu Tolgoi to Gashuun Sukhait Road.		
		Loss of access to the spring at Bor Ovoo and the two wells located within the Mine Licence Area.		
		Reduction in pasture quality due to increased dust deposition.		
Wild plants and animals	I	Direct loss of desert steppe vegetation to mine and infrastructure development, overgrazing.	Potential hydrological impacts from aquifer drawdown due to mine dewatering.	Many alternatives
		Reduction in forage quality from changes pastoral management.	Increased hunting/over-collecting due to population influx.	
		Reduction in forage quality due to increased dust deposition.	Disruption of cultural tradition.	
		Collision with vehicles and infrastructure.	Potential over-grazing if livestock levels increase.	
		Fragmentation of wildlife habitat.		
Fresh water	II	Loss of groundwater from temporary abstraction from surface and shallow aquifers.	Loss of herder mobility and more limited campsite suitability.	Few alternatives
		Potential loss of groundwater from long-term abstraction from deep aquifers if hydraulically connected.	Potential increased water usage if livestock levels increase.	

Ecosystem Service	Priority Type	Direct Impacts	Indirect Impacts	Replaceability
		Potential loss of shallow groundwater from mine dewatering and the Undai River diversion.		
		Potential pollution of shallow groundwater aquifer from spills or leaks of pollutants.		
		Development of project infrastructure over the Undai River channel.		
Biomass fuel	I	Habitat degradation due to use of vehicles within habitats. Potentially reduced access to groundwater or periodic surface water.	Over-collecting due to better access to habitats. Over-collecting due to increased population.	Few alternatives
Regulating				
Water regulation	II	Pollution of shallow groundwater aquifer from spills or leaks of pollutants.	Health impacts to herders and livestock	Few alternatives
		Loss of groundwater from temporary abstraction from surface and shallow aquifers	Potential increased pollution by animals if livestock levels increase	
		Abstraction of groundwater from deep aquifers may impact shallow alluvial aquifers if hydraulic connection exists.	Loss of water for associated plant communities, livestock, and wildlife	
Erosion regulation	I	Direct removal of soil-stabilizing vegetation and biological crusts	Increased off-road vehicle activity due to population influx.	Many alternatives
		Creation of steep, erosive landforms (e.g. borrow pits)		
			Loss or reduction in cover of vegetation due to altered pastoral practices.	
Cultural				
Cultural or spiritual sites	I	Direct removal of sacred or cultural sites	Loss of spiritual and cultural connection to the land	Few alternatives

Ecosystem Service	Priority Type	Direct Impacts	Indirect Impacts	Replaceability
		Loss of access to sacred or cultural sites due to project infrastructure.		
		Reduction in condition of sites due to dust deposition.		
Campsites	I	Loss of use from construction noise and dust	Loss of nearby pasture quality due to overgrazing	Many alternatives

Table 6.9: Priority and critical ecosystem services affected by the Project and associated mitigation actions

Mitigation Action	Provisioning				Regulation		Cultural	
	Livestock[1]	Wild plants and animals	Fresh water	Biomass fuels	Water regulation	Erosion regulation	Cultural and spiritual sites	Campsites
Rehabilitate disturbed areas according to Oyu Tolgoi interim Rehabilitation Management Plan and Procedures.	x	x		x	x	x		x
Where appropriate, use culturally useful/significant plant species as part of rehabilitation.		x						x
Divert the Undai River channel to maintain surface and subsurface water flows within the Undai River downstream of the Mine Licence Area. (see *Section 6.7.19* and *Chapter C5: Water Resources*).	x				x	x	x	x
Ensure replacement spring mimics the ecological functions of Bor Ovoo spring (see *Section 6.7.20* and *Chapter C5: Water Resources*).			x		x			
Rehabilitate and restore disturbed vegetation, specifically including Mongolian Chesney, Riverine Elm Trees and Tall Saxaul Forest (see *Section 6.7.18*).	x			x				
Unless specifically authorised, prohibit Oyu Tolgoi Project vehicles (i.e. including contractors) from driving 'off-road (i.e. off existing defined tracks and roads) (see *Chapter D11: Transport Management Plan*).	x	x				x		x
Enforce low speed limits of Oyu Tolgoi vehicles. Engage with key stakeholders to support the adoption and enforcement of suitable speed limits on all public users of the Oyu Tolgoi to Gashuun Sukhait Road (see *Section 6.74* and *Chapter D11: Transport Management Plan*).	x	x				x		
Development of *Chapter D12: Hazardous Materials Management Plan* and *Chapter D8: Waste Management Plan*.			x		x			x
Road culverts to permit the flow of flood waters (see *Chapter D7: Water Resources Management Plan*).	x	x		x	x			x

Mitigation Action	Provisioning				Regulation		Cultural	
	Livestock[1]	Wild plants and animals	Fresh water	Biomass fuels	Water regulation	Erosion regulation	Cultural and spiritual sites	Campsites
If water quantity or quality issue identified, Oyu Tolgoi will work with local potentially affected herders to develop, implement and monitor a mutually acceptable solution (such as provision of an alternative water supply). (Refer to *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Management Plan*).			x		x			
Minimise groundwater abstraction through water conservation initiatives across the site. (refer to *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Management Plan*).					x			x
WRD and TSF to be designed so as to prevent any seepage of contaminants into surface water or groundwater of the Undai and Budaa River systems (refer to *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Management Plan*).			x		x			
Regularly monitor water levels of production bores for groundwater drainage from upper aquifer zones in order to prevent surficial groundwater drawdown. (refer to *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Management Plan*).	x		x		x			
Implement a topsoil management plan through harvesting, storage and restoration. (refer to *Chapter D4: Topsoil Management Plan*).	x	x				x		x
Develop and implement an Air Quality Management Plan to manage gaseous emissions and dust. (refer to *Chapter C2: Climate and Air Quality Impact Assessment and D2 Atmospheric Emissions Management Plan*)	x	x				x		x
Operate all equipment according to operational specifications. (refer to *Chapter C2: Climate and Air Quality Impact Assessment and D2 Atmospheric Emissions Management Plan*)								
Regularly maintain all machinery to prevent unnecessary emissions. (refer to *Chapter C2: Climate and Air Quality Impact Assessment and D2 Atmospheric Emissions Management Plan*)								
Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd & Oyu Tolgoi to airport roads. (refer to *Chapter C6: Biodiversity and Ecosystem Services Impact Assessment*)		x						x
Develop a Noise Management Plan with actions to minimise construction and operational phase noise impacts. (refer to *Chapter C3: Noise and Vibration Impact Assessment*)		x						x
Develop and implement a Waste Management Plan. (refer to *Chapter D8: Waste Management Plan*)	x				X			
Develop and implement a Mine Closure and Reclamation Plan. (refer to *Chapter D21: Mine Closure and Rehabilitation Framework*).	x	x				x		

Mitigation Action	Provisioning				Regulation		Cultural	
	Livestock[1]	Wild plants and animals	Fresh water	Biomass fuels	Water regulation	Erosion regulation	Cultural and spiritual sites	Campsites
Monitor and evaluate the performance of the Undai diversion so that downstream users are not impacted. (refer to *Chapter C5: Water Resources Impact Assessment*)					x			
Monitor and protect important landscapes, natural features such as mountains, springs, etc. and sacred places, that have spiritual value to local residents, as well as cairns, ovoos, and cemeteries. (refer to *Chapter C11: Cultural Heritage Impact Assessment*)							X	X
Fence hazardous areas to prevent wildlife and livestock access. (refer to *Chapter C12: Community Health, Safety & Security Management Plan*)		x						
Prior to disturbance, proposed disturbance areas will be demarcated and inspected by Oyu Tolgoi Environmental Officers for aspects which may require environmental protection (threatened flora and fauna, priority fauna habitat, significant ecological communities etc.).. (refer to *Chapter C6: Biodiversity and Ecosystem Services Impact Assessment*)	x	x			x	x		
Areas containing an item or items of environmental or cultural significance (including biodiversity) which is determined cannot be disturbed will be physically barricaded and sign posted. (refer to *Chapter C11: Cultural Heritage Impact Assessment*)							x	
Develop a site Code of Conduct and Chance Finds procedure (refer to *Chapter C11: Cultural Heritage Impact Assessment*)							x	
Continue the Herder Relocation Program and implement the Resettlement Action Plan. (refer to *Chapter C10: Land Use and Displacement Impact Assessment* and *Chapter D15: Resettlement Action Plan*)	x							x
Develop and implement a Herder Livelihood Improvement Programme. (refer to *Chapter C10: Land Use and Displacement Impact Assessment* and *Chapter D15: Resettlement Action Plan*)	x							x
Install livestock crossing points along the Oyu Tolgoi to Gashuun Sukhait Road. (refer to *Chapter C6: Biodiversity and Ecosystem Services*)	x							x
Provide all project operations staff and contractors fuel for fires to prevent collection of local timber (i.e. Saxaul).(refer to *Chapter C6: Biodiversity and Ecosystem Services*)				x				
Prohibit collection of firewood by Oyu Tolgoi project personnel (refer to *Chapter C6: Biodiversity and Ecosystem Services*)				x				
Engage with local and regional stakeholders to control hunting (and collecting) in the Oyu Tolgoi AoI (refer to *Chapter C6: Biodiversity and Ecosystem Services*)				x				

1. Ecosystems services that trigger Critical Habitat are in boldface.

6.9 IMPACT AVOIDANCE AND MINIMISATION ACTIONS NOT ADOPTED BY OYU TOLGOI

All mitigation actions identified by the Rapid Biodiversity Assessment Team (TBC/FFI) were properly considered for implementation by Oyu Tolgoi through a process of internal consultation and direct discussions with the Rapid Biodiversity Assessment Team. While the majority of mitigation actions proposed by TBC/FFI to minimise and restore impacts have been adopted, a number of actions to avoid impacts were not deemed feasible due largely to the advanced state of the project and to design limitations imposed by the Government of Mongolia. These actions, listed in **Box 5**, have not been adopted by Oyu Tolgoi. There are opportunities to incorporate some of these options in future ground disturbing works, e.g. the project is commissioning best-practice rare plant and Houbara Bustard surveys before deciding the route of a possible additional roads and power lines that are not included in the current construction programme.

Box 5: Mitigation actions not taken

Export ore via railway.

Bury lengths if road in tunnels.

Combine roads from Tavan Tolgoi and Oyu Tolgoi to Gashuun Sukhait.

Survey infrastructure routes and sites for immoveable priority biodiversity values.

Bury high-voltage power transmission lines.

Bury medium-voltage power distribution lines.

Use pylons with horizontal rather than vertical line alignment.

Use pylons with lighting arrestors at transmission towers.

Use bird-friendly (low electrocution risk) poles for the medium-voltage power line.

Design the current temporary airport so that it could be developed and extended into a permanent airport..

Daily closures of the road upgrade to Gashuun Sukhait, to facilitate direct crossings and use of wildlife crossings by wild animals.

A brief summary of the rationale behind each of the RBA Team's recommended actions listed in Box 5 is provided below. This is followed by a discussion of why each of the actions could not be implemented by Oyu Tolgoi.

1. Export ore via railway

Rationale

The export of concentrate via a planned east-west railway from Tavan Tolgoi to the trans-Mongolian railway would negate the need for upgrade of the existing unsealed Oyu Tolgoi to Gashuun Sukhait road. Export via an (as yet un-built) railway would thereby avoid impacts, most significantly habitat fragmentation, on priority biodiversity features south of the Mine Licence Area.

Oyu Tolgoi Response

There is no rail head in China or Mongolia close to the Project. While plans exist to link coal and other mineral deposits in the southern Gobi region with the Chinese and Russian borders via rail, currently, no clear date for construction of such infrastructure has been established. Given the Government of Mongolia's reluctance to permit a rail spur into Mongolia from China with a Chinese gauge railway, the construction of a railway to the Project is not considered feasible in the short-term.

The Oyu Tolgoi to Gashuun Sukhait road route has been agreed with the Government of Mongolia and will be adopted by the Government of Mongolia as the National Road to the border once it is constructed by Oyu Tolgoi. The Oyu Tolgoi to Gashuun Sukhait road will therefore be constructed regardless of the availability of any future rail export options.

Oyu Tolgoi is committed to implementing a range of mitigation actions (e.g. construction of underpasses, deterrence of vehicles leaving the road, enforced speed limits, driver awareness training, warning signs

etc – see *Section 6.7*) which will reduce the risk of habitat fragmentation posed by the Oyu Tolgoi to Gashuun Sukhait road.

2. Bury lengths of road in tunnels

Rationale

Burying lengths of the Oyu Tolgoi to Gashuun Sukhait road in tunnels would maintain large sections of undisturbed habitat along the planned Oyu Tolgoi to Gashuun Sukhait road route and thereby potentially avoid fragmenting habitat of priority biodiversity features, most notably, the Asiatic Wild Ass.

Oyu Tolgoi Response

The Oyu Tolgoi to Gashuun Sukhait road route has been agreed with the Government of Mongolia and will be adopted by the Government of Mongolia as the National Road to the border once it is constructed by Oyu Tolgoi. Burying the road would possibly require significant realignment of the road in order to ensure construction within a suitable landscape setting. The re-design and re-routing required to bury the road would result in significant delays to the project construction schedule and considering the already advanced state of construction, such delays are not considered feasible by Oyu Tolgoi.

It is the opinion of Oyu Tolgoi that the community, biodiversity and water impacts associated with the construction of such a large scale and lengthy excavation and construction effort would be extremely complicated and difficult to adequately mitigate. Additional issue areas include tunnel safety in a remote location and Government of Mongolia acceptance to take over maintenance of such a heavily engineered structure.

Oyu Tolgoi is committed to implementing a range of mitigation actions (e.g. construction of underpasses, deterrence of vehicles leaving the road, enforced speed limits, driver awareness training, warning signs etc – see *Section 6.7*) which will reduce the risk of habitat fragmentation and indirect habitat loss posed by the Oyu Tolgoi to Gashuun Sukhait road.

3. Combine roads from Tavan Tolgoi and Oyu Tolgoi to Gashuun Sukhait

Rationale

Combining the existing Tavan Tolgoi to Gashuun Sukhait road and the Oyu Tolgoi to Gashuun Sukhait road into a single transport corridor would consolidate existing mine transport infrastructure in the southern Gobi region and thereby avoid impacts associated with the construction and operation of another mine export road (the most significant of these being increased fragmentation of large herbivore habitat).

Oyu Tolgoi Response

Consultation with the Government of Mongolia has indicated that the government will not accept the Oyu Tolgoi to Gashuun Sukhait road to be combined with the Tavan Tolvoi coal road (according to L. Gansukh, Minister for Environment and Tourism; meeting minutes of 12 March 2010).

The Oyu Tolgoi to Gashuun Sukhait road route, as well as being the export route for Oyu Tolgoi, is the designated national road within Mongolia to the Gashuun Sukhait border point and utilises a previously-existing desert road through the Small Gobi Specially Protected Area (SGSPA) within the lowest level protection area. Use of this alignment minimises impacts to the SGSPA as it uses an existing road alignment (rather than creating a new road) and meets the requirements of the Government of Mongolia for the road approach to the Chinese border, crossing both through the SGSPA and a military border security zone along the border.

Oyu Tolgoi is committed to implementing a range of mitigation actions (e.g. construction of underpasses, deterrence of vehicles leaving the road, enforced speed limits, driver awareness training, warning signs etc – see *Section 6.7*) which will reduce the risk of habitat fragmentation and indirect habitat loss posed by the Oyu Tolgoi to Gashuun Sukhait road.

As discussed in *Chapter A5: Analysis of Alternatives*, the road route to Gashuun Sukhait was selected as the most direct route to the border crossing utilising existing roads, with local access to water and construction materials and avoiding sensitive playa areas and other watercourses. The transmission line, in common with all transmission lines, was constructed to provide the shortest straight-line distance from Oyu Tolgoi to the Chinese border whilst avoiding the SGSPA. To co-locate the road and transmission line would have increased risks of vehicle collisions into power pylons and would have led to either an

increased length of the transmission line across the IBA and including a crossing of the SGSPA (if the power line had followed the road) or would have resulted in a road alignment that would have been entirely new and would have proven very difficult and expensive to construct and maintain (if the road had followed the power line).

4. Survey infrastructure routes and sites for immoveable priority biodiversity values

Rationale

Biological survey of infrastructure routes and sites prior to construction would provide an opportunity for infrastructure to be relocated so as to avoid impacts on immoveable priority biodiversity features.

Oyu Tolgoi Response

Route alignment and site locations for all project infrastructure has been set and, in all cases, approved by the Government of Mongolia. All elements of project infrastructure are currently in advanced stages of construction and as such, surveys for priority biodiversity features and subsequent realignment of some or all project infrastructure components would result in significant delays to the current project construction schedule.

Oyu Tolgoi is aware that some construction activities associated with transmission line stringing may impact on the Houbara Bustard lekking season through the Galbyn Gobi Important Bird Area. It is proposed to restrict these activities during the construction phase such that these impacts can be minimised through the scheduling of construction activities, undertaking lekking site surveys prior to and during construction in identified priority areas and avoiding disturbance where lekking activity is observed. *Chapter D6: Flora and Fauna Construction Management Plan* provides further detail of these measures.

5. Bury high-voltage power transmission lines

Rationale

Burying the high voltage power lines would avoid the risk of direct mortality to priority biodiversity features associated through collision and electrocution. This action would also significantly reduce impacts associated with increases natural predator populations and indirect habitat loss due to avoidance of the power line easement by priority biodiversity features.

Oyu Tolgoi Response

The 220 kV power line pylons were constructed in 2011 and as such construction of this network is well advanced. The power line pylons were designed and purchased early in 2011 and completed in November 2011. The design of the power line has been agreed to by the Government of Mongolia and at some stage during the life of the project, control and responsibility for the 220 kV network (within Mongolia) may be transferred to the government.

Due to the advanced state of design and construction, burying the 220 kV power line would result in significant delays to the project construction schedule and was therefore not considered feasible by Oyu Tolgoi. It was also noted that schemes to alert people of the presence of energised underground infrastructure (before digging) are under-developed in Mongolia and largely absent from the southern Gobi region. A buried high voltage power line, if technically feasible, would therefore introduce a significant safety risk to the area.

Oyu Tolgoi has committed to fitting bird flight diverters to the optical ground wires (highest, least visible line) of the power line network; a mitigation measure which will significantly reduce bird collisions with 220 kV power lines. Furthermore, Oyu Tolgoi has reviewed the design of the 220 kV hardware and determined that it does not present a significant electrocution risk to birds. Routine inspections and removal of bird nests from pylons will ensure that natural avian predator population are not artificially increased as a consequence of power line infrastructure.

6. Bury medium-voltage power distribution lines

Rationale

Burying the medium-voltage power line network would avoid the risk of direct mortality to priority biodiversity features associated through collision and electrocution. This action would also reduce impacts associated with increases natural predator populations and indirect habitat loss due to avoidance of the power line easement by priority biodiversity features.

Oyu Tolgoi response

The medium-voltage (35 kV) power line construction is well advanced with hardware (pylons etc) for the network has been installed in 2011 Re-design of the network to allow burial of the power lines would necessitate lengthy delays to the project construction schedule and was therefore not considered feasible by Oyu Tolgoi.

Oyu Tolgoi has committed to fitting bird flight diverters to the optical ground wires (highest, least visible line) of the power line network; a mitigation measure which will significantly reduce bird collisions with medium-voltage power lines. Furthermore, Oyu Tolgoi has reviewed the design of the 35 kV hardware and has committed to insulating components which present an electrocution risk to birds. Routine inspections and removal of bird nests from pylons will ensure that natural avian predator population are not artificially increased as a consequence of power line infrastructure.

7. Use pylons with horizontal rather than vertical line alignment

Rationale

The use of pylons for the power line network with a horizontal, rather than vertical arrangement of conductors would minimise the risk of collisions by priority bird species (most notably Houbara Bustard).

Oyu Tolgoi Response

Both the 220 kV and 35 kV power line networks were substantially constructed in 2011 and due for completion in mid 2012 and as such construction is well advanced. All power line pylons were designed and purchased early in 2011 with the basic pylon design chosen from a limited set of pre-approved pylon designs supplied to Oyu Tolgoi by the Government of Mongolian. The pylon design is now fixed, procurement is complete and the pylons are currently being installed along the defined network routes. The use of pylons with horizontally-arranged conductors would require additional approvals from the Government of Mongolia. It is understood that this process would take considerable time and ultimately may not be successful. The time required obtain approvals, re-design the network and manufacture and ship new pylons, would significantly delay project construction. For these reasons, change of pylon design to horizontal, rather than vertical conductor arrangement was not considered feasible by Oyu Tolgoi.

Oyu Tolgoi has committed to fitting bird flight diverters to the optical ground wires (highest, least visible line of the network) of the power line network; a mitigation measure which will significantly reduce bird collisions with both medium and high-voltage power lines.

8. Use pylons with lighting arrestors at transmission towers rather than (thin and low visibility) earth lines

Rationale

The use of pylons which do not require (thin and low visibility) earth lines would reduce the collision risk posed by the medium and high-voltage power line networks to birds.

Oyu Tolgoi Response

Both the medium and high-voltage power line networks were substantially constructed in 2011 with line stringing work expected to be complete by mid 2012 and as such construction of these networks is well advanced. The power line pylons/poles were designed and purchased early in 2011 with the basic pylon/pole design chosen from a limited set of pre-approved pylon designs supplied to Oyu Tolgoi by the Government of Mongolian. The pylon/pole designs are now fixed, procurement is complete and the pylons/poles are currently being installed along the medium and high-voltage power line routes.

Both the high and medium-voltage power line networks include, as their highest line, an optical ground wire 15mm in diameter (the 220 kV network has 2 OPGWs running in parallel). This line contains an optical fibre communications cable at its core which is essential for operation of the power line networks. This line cannot therefore be replaced by lightning arrestors. Given the aforementioned restrictions on pylon and pole design imposed by the Government of Mongolia, it is not feasible to minimise the collision risk to birds by mounting this line elsewhere on any pole or pylon.

Oyu Tolgoi has committed to fitting bird flight diverters to the optical ground wires (highest, least visible line) of the power line network; a mitigation measure which will significantly reduce bird collisions with medium and high-voltage power lines.

9. Use bird-friendly (low electrocution risk) poles for the medium-voltage power line

Rationale

The use of 'bird-friendly' poles and pylons for the medium voltage power line network would avoid the electrocution risk posed by some pylon and pole designs.

Oyu Tolgoi Response

The medium-voltage power line network was commenced in 2011 and as such construction of this network is well advanced. The power line pylons were designed and purchased early in 2011 with the basic pylon design chosen from a limited set of pre-approved pylon designs supplied to Oyu Tolgoi by the Government of Mongolia. The pylon design is now fixed, procurement is complete and the pylons are currently being installed along the agreed medium-voltage power line route.

The medium-voltage power line network includes a variety of different pylon and pole designs, some of which (e.g. tension pylons) are 'bird-friendly' as they present a very low electrocution risk to perching birds. Some pole designs within the network present a risk of electrocution (although none of the pole/pylon types are designed with jump leads that travel over the top of pole cross-arms which present a very high electrocution risk to birds). Due to the advanced stage of construction of the medium-voltage network, it is not possible to re-design the poles which present some electrocution risk.

Oyu Tolgoi has committed to retro-fitting all poles/pylons within the medium voltage network that present an electrocution risk to birds with appropriate insulators so as to minimise electrocution risks.

10. Design the current temporary airport so that it could be developed and extended into a permanent airport

Rationale

Design of the temporary airport so that it could be developed and extended into the planned permanent airport would avoid direct impacts to priority biodiversity features associated with habitat loss.

Oyu Tolgoi Response

The temporary airport was constructed in 2010 and has been in operation since then. Given that the temporary airport is already in place, it is not feasible to design this airport so that it can be upgraded. The permanent airport design is based on specifications derived from the International Civil Aviation Organisations (ICAO). Due to various design criteria, it is not possible to upgrade the temporary airport so that it can function as the permanent airport.

All infrastructure will be removed from the temporary airport site upon closure and the airport footprint will be fully rehabilitated using best practice rehabilitation techniques.

11. Daily closures of the road upgrade to Gashuun Sukhait Road, to facilitate direct crossings and use of wildlife crossings by wild animals

Rationale

Daily closures of the upgraded road to Gashuun Sukhait to Oyu Tolgoi project traffic is likely to facilitate increased use of wildlife crossings and direct crossing of the road by wild animals (notably Asiatic Wild Ass), which may otherwise stay too far away from the road.

Oyu Tolgoi Response

Oyu Tolgoi is still at a preliminary stage of logistics planning as it relates to concentrate movement (the main source of Oyu Tolgoi vehicle movements) up and down the Oyu Tolgoi to Gashuun Sukhait Road and it is therefore considered too early to impose a definitive restriction on vehicle movements. A range of different strategies are currently being evaluated for vehicle scheduling by the Oyu Tolgoi Logistics team, some of which may reduce fragmentation impacts on ungulates and other wildlife.

Oyu Tolgoi will ensure that biodiversity impact mitigation is considered during logistics planning and will implement monitoring of ungulate movements which will inform any potential future restrictions on traffic movements. Oyu Tolgoi is committed to implementing a range of mitigation actions (e.g. construction of underpasses, deterrence of vehicles leaving the road, enforced speed limits, driver awareness training, warning signs etc – see *Section 6.7*) which will reduce the risk of habitat fragmentation posed by the Oyu Tolgoi to Gashuun Sukhait Road.

6.10 OFFSET STRATEGY

The Oyu Tolgoi project has committed to a goal of Net Positive Impact (NPI) on biodiversity (see annexed *Oyu Tolgoi Biodiversity Strategy* (Annex A) and *Net Positive Impact forecast for the Oyu Tolgoi Project (*Annex D)) and as such residual impacts on priority biodiversity features will be offset to achieve a Net Positive Impact. The Oyu Tolgoi RBA programme implemented in 2011 included the preparation of a Biodiversity Offsets Strategy for the Oyu Tolgoi Project (see Annex C) which outlines what needs to be achieved for the Oyu Tolgoi project to have a NPI on biodiversity. This strategy is based on wide technical consultation and aims to demonstrate the 'Technical Feasibility' of achieving NPI.

The Oyu Tolgoi project will have unavoidable residual impacts on biodiversity. Residual impacts are predicted for priority biodiversity features, ecosystems and priority habitats known or likely to occur in the area of influence of the Oyu Tolgoi project. These residual impacts are described in *Section 6.4* above but include direct habitat loss, indirect habitat loss, and increased mortality from increased hunting, increased collecting, collisions with vehicles and power lines, and increased numbers of natural predators. The conservation of Asiatic Wild Ass is recognised as the highest priority for the Oyu Tolgoi project given the international importance of the southern Gobi region to this rapidly declining globally endangered species and the likely residual impacts of the Oyu Tolgoi project on the species.

Biodiversity offsets are recognised as fundamental to the Rio Tinto environmental toolkit and as such the company has produced a draft Biodiversity Offset Guidance Note (Rio Tinto, 2010) to assist business units in developing a technically, socially and politically feasible and robust offset plan. This guidance identifies four major sequential stages in the design of offsets:

1. **Offset Scoping:** in which goals are identified and a long list of potential sites in the region or country are broadly considered as possibilities for offsets.

2. **Offset Screening:** in which the potential offset sites are screened against biological, political, economic and social criteria. This section involves brief consideration of possible types of conservation intervention and additionally criteria: firstly, what actions could be undertaken and would these make a real difference on the ground; secondly, extensive stakeholder consultation, including government, expert organisations and local communities.

3. **Net Positive Impact (NPI) Accounting:** in which estimates of possible biodiversity gains are made using the Rio Tinto NPI Accounting Tool. The accounting data is used to define an offset project or projects which are most likely to achieve NPI for the operation.

4. **Final Approval and Selection:** in which the Biodiversity Offsets Strategy is communicated to the regulator or group of key stakeholders for final consultation and approval. Following any adjustments post-approval, the final output of the design process is a Biodiversity Offsets Plan.

6.10.1 Offset design

- The proposed Offset Strategy developed for the Project is designed to meet the Rio Tinto Guidance and represents Stage 3 in the Rio Tinto process described above. In addition, the Strategy fulfils the requirements of the Project's lenders, notably the International Finance Corporation's Performance Standard 6 (IFC PS6) and the European Bank for Reconstruction and Development's Performance Requirement 6 (EBRD PR6). The Oyu Tolgoi Project is committed to be a pilot for the IUCN / Rio Tinto Net Positive Impact Protocol & Review Panel Team (NPIP&RPT). This team is developing, testing and implementing an independent process for verification of Rio Tinto's commitment to its NPI objective. Through this initiative, Oyu Tolgoi is committed to: Where appropriate, facilitate and contribute to the development and testing of NPIP&RPT tools for NPI verification.
- Participate in regular, independent application of these tools (once fully developed) throughout the Oyu Tolgoi project life in order to track the adequacy of Oyu Tolgoi's progress towards NPI and ultimately to verify that Oyu Tolgoi has achieved its NPI goal.

Potential offset actions were developed to effect gains in priority biodiversity features compared with background rates of loss (e.g. hunting) and potential rates of restoration (e.g. rangeland management). These estimates were all based on expert consultation. The residual impacts and other impacts (including those caused by factors external to the Oyu Tolgoi project) were analysed to assess the ultimate and proximate factors causing negative impacts on the priority biodiversity features. Conservation

interventions already implemented elsewhere in Mongolia (e.g. by WWF) were analysed to assess which actions could address the Project's impacts and which were most effective, lowest risk, most practical and socio-politically feasible. The interventions that appeared to be most suitable were then aggregated into generic potential offset actions.

The process for identifying potential offsets sites and the Offsets Landscape is discussed below. Oyu Tolgoi recognises that offsets for the project must contribute to the long-term survival of the Asiatic Wild Ass subpopulation in the south-eastern Gobi. The area needed for the survival of this subpopulation is unknown but Asiatic Wild Ass utilise very large areas to find patchy food resources in this climatically irregular and drought-prone environment. A viable subpopulation of Asiatic Wild Ass will probably require an area much larger than 70,000 km^2 for long-term survival (based on range estimates of individual Asiatic Wild Ass in Kaczensky *et al.* 2011). The choice of offsets must therefore consider the landscape-scale needs of Asiatic Wild Ass and other ecologically-similar species such as Goitered and Mongolian Gazelles, whereas other priority biodiversity features may be better conserved at a site-scale (typically <1,000 km^2).

6.10.2 Offset site selection

Offset site selection within the Rio Tinto Offset Design Process leads to a larger 'Potential Offsets Sites' list based on biological criteria alone; then a smaller 'Candidate Offset Sites' list based on screening against requirements for offset interventions (spatial scale, gains required versus offset interventions), and social, political and economic constraints and opportunities. In the case of the Oyu Tolgoi Project, Potential Offset Sites are severely constrained by the global and national distribution of Asiatic Wild Ass, the largest and highest priority residual impact requiring offsetting. There are three major populations in the southern Gobi region, so only three 'Potential Offset Sites' or landscapes exist. Its largest global population occurs within and to the east of the Project area, making this area the most suitable and likely offset site. This population, located across several *soums*, is relatively small and conservation actions are required across the core area of c.50,000 km^2 to bring about the required conservation gains. There are a number of political, economic and social constraints which therefore have to be faced within this chosen offset site, which is effectively an offset landscape given the broad spatial scale over which actions are required to reduce hunting and improve rangeland management.

The scale of Offsets Landscape is dictated by the scale of the residual impacts and the 'offsets ratio'. In this case, no generic offsets ratio was applied; instead an area was calculated for each priority biodiversity feature based on a precautionary estimate of the gains likely to be achieved by offset actions over the defined time period of 25 years until 2036.

Most of the priority biodiversity features with residual impacts occur across extensive areas of contiguous habitat. At a broad level (disregarding micro-habitat variation), these ecosystems vary little over distances of hundreds of kilometers, and there are few clear boundaries delineating candidate offset areas. Potential boundaries within which offset action may be undertaken have been based on the base-case development scenarios outlined in the World Bank regional environmental assessment (Walton 2010) and recommendations for safeguarding important habitat alongside economic development (BirdLife Asia 2009).

Intact fences are barriers to Asiatic Wild Ass and gazelle movement (Kaczensky et al. 2010; Olson et al. 2009) and main roads are likely to act as impermeable barriers to Asiatic Wild Ass if they support more than a threshold number of vehicle per day (see *Section 6.4.3*). Current and proposed fences, railways and busy roads in the southern Gobi region that could act as barriers include:

- Ulaanbaatar to Beijing railway (north-south);
- Mongolia to China border fence (west-east);
- Proposed Tavan Tolgoi to Sainshand railway (west-east);
- Tavan Tolgoi to Gashuun Sukhait road (north-south);
- Proposed Tavan Tolgoi to Gashuun Sukhait railway (north-south);
- Oyu Tolgoi to Gashuun Sukhait road (north-south); and
- Khanbogd to Oyu Tolgoi road (west-east).

The Offsets Strategy proposes that the Offsets Landscape could potentially be the *soums* overlapping with the core population of Asiatic Wild Ass, harbour the majority (or all) of the priority biodiversity values suffering residual impacts, and be closest to the Oyu Tolgoi project. The areas of several of these *soums* were combined to just exceed the area estimated to be needed to achieve sufficient biodiversity gains for NPI, based on the NPI accounting. Excluding Khanbogd *soum* as the area for mitigation activities and the Small Gobi SPA (A&B) as an area for specific mandated compensation, the potential Offsets Landscape is therefore Bayan-Ovoo, Khatanbulag and Khuvsgul *soums* as shown in Annex C. This can only be confirmed through thorough stakeholder consultation. A further technical consideration is the risk that rangeland habitat quality gains cannot be achieved in the 'non-equilibrium' drier habitats, and these offset actions need to be extended to wetter habitats to the east.

The Oyu Tolgoi approach to biodiversity offsets will be adaptive; responding where appropriate, to new or updated ecological information and to changes in stakeholder expectations. The Nature Conservancy have recently initiated a Gobi Region Development by Design Landscape Assessment program, and this program in particular, is likely to provide new insights and opportunities for the application of biodiversity offsets in the southern Gobi region. Among other outcomes, TNC's Development By Design program is expected to provide opportunities to revise and focus the offset areas outlined above. Working closely with TNC, Oyu Tolgoi will ensure that the results of the Development by Design program are captured and incorporated into Oyu Tolgoi's ongoing approach to biodiversity offsets.

6.10.3 Proposed offset actions

The aim of Oyu Tolgoi's biodiversity offsets strategy is:

> *'to achieve Net Positive Impact on biodiversity through the generation of gains in priority biodiversity features to offset residual project losses'*

It is proposed to achieve this aim through a series of six objectives to offset the residual impact of the Project. *Table 6.10* provides the relationship between each recommended offset action and the residual impact to priority biodiversity features:

- Reduced illegal hunting and collecting;
- Improved rangeland management;
- Reduced impacts of non-project powerlines (elsewhere in the southern Gobi region);
- Strengthen protected areas;
- Raised bar in regional development;
- Strong enabling mechanisms established;
- Monitoring and evaluation informs adaptive management; and
- Oyu Tolgoi capacity built.

These objectives and their supporting activities have undergone a process of expert consultation to determine that they are the best available options. Given the poor state of knowledge of ecological baselines and the limited number of analogous previous conservation initiatives, no-one can be absolutely certain as to whether these activities will actually generate the required offset gains. However, the RBA team advise that these activities are indeed the most appropriate actions, and will generate gains as proposed (and indeed there is the potential for greater gains as estimates are precautionary). Given the appropriate actions and the proposed contingencies in scale and resourcing, it is the RBA team's opinion that the offsets strategy demonstrates the 'technical feasibility' of achieving the required gains.

Following 'technical feasibility', the practical and political feasibility of these activities and outcomes can only be demonstrated through a stakeholder engagement process and adaptive management during implementation.

The recommended offset actions identified and discussed in detail in the RBA team's Offset Strategy are summarised below:

Reduced illegal hunting and collecting

Recommended Activities:

- Implement 5 Mobile Anti-Poaching Units – 3 in the Offsets Landscape and 2 in the Buffer Zone;
- Build capacity, resources and networking of government institutions to increase prevention, detection and conviction rates of wildlife crime; and
- Reduce hunting of Houbara Bustards migrating outside Mongolia (i.e requires offset effort beyond Mongolia's borders).

Outcomes:

- Reduction in illegal hunting of protected animals;
- Reduction in consumption, trafficking and collection of protected animals;
- Reduction in over-harvesting of Saxaul and other fuelwood sources; and
- Increased populations of priority biodiversity features.

Assumptions:

- Can achieve reduced demand, as well as supply;
- Can recruit staff with charisma and power to enforce law; and
- Can overcome economic, political and community vested interests.

Improved rangeland management

Recommended Activities:

- Support herders to transition to more ecologically sustainable stocking ratios;
- Implement conservation incentive scheme to compensate herders for opportunity costs;
- Develop an alternative livelihoods programme to assist herders' transition to a more biodiversity-friendly system; and
- Revitalise *soum*-level grazing planning to enable strategic decisions about herder entitlements and ecologically appropriate stocking levels, in line with national government policy.

Outcomes:

- Reduced degradation of rangeland by livestock leading to improved habitat quality;
- Increased population of most priority biodiversity features;
- Reduced disturbance to wild ungulates; and
- Increased wild ungulate populations.

Assumptions:

- Oyu Tolgoi able to establish trust and facilitate transparent conflict resolution around probable tensions between livelihood and conservation objectives;
- Oyu Tolgoi able to reduce these conflicts through its social livelihood programmes; and
- Capacity can be built in *soum* administrations.

Reduced impacts of non-project powerlines (elsewhere in the southern Gobi region)

Recommended Activities:

- Install best-practice bird flight diverters on non-Oyu Tolgoi project powerlines.

Outcomes:

- Reduced bird collisions with powerlines; and

- Fewer impacts on Bustard populations.

Assumptions:

- Oyu Tolgoi able to negotiate installation on non-Oyu Tolgoi infrastructure.

Strengthened Protected Areas

Recommended Activities:

- Implement protected area strengthening for Small Gobi SPA (A & B);
- Review management of Ergeliin Zoo NR and Important Bird Areas, and implement the recommendations as appropriate; and
- Work with government to review and revise protected area extent and zoning.

Outcomes:

- Improved management in existing protected areas; and
- Improved sustainability of offset actions.

Assumptions:

- Protected area agencies willing to work with Oyu Tolgoi; and
- Stakeholders support strengthened Protected Areas.

Raised bar in regional development helps sustain gains

Recommended Activities:

- Champion the need for, and benefits of, sustainable and biodiversity-friendly regional development; and
- Facilitate collaborative regional planning e.g. via the Southern Gobi Regional Development Council.

Outcomes:

- Agreement to cooperate;
- Adoption of common standards and actions for biodiversity conservation across the region; and
- Reduced impacts on population connectivity of wild ungulates and Bustards.

Assumptions:

- Regional stakeholders support regional planning; and
- Oyu Tolgoi able to facilitate effective collaborations.

Strong enabling mechanisms established

Recommended Activities:

- Establish long-term financing mechanism; and
- Implement a Stakeholder Engagement Plan.

Outcomes:

- Funding to resource ongoing management of the Offsets Landscape in perpetuity; and
- Stakeholders aware of Oyu Tolgoi's biodiversity offset objectives and actions.

Assumptions:

- Stakeholders agree on financing mechanism.

Monitoring and evaluation informs adaptive management

Recommended Activities:

- Design and implement M&E system to quantify losses and gains and feed into adaptive management.

Outcomes:

- Dynamic, results-driven management system improving over time; and
- Demonstration of compliance with NPI requirements.

Assumptions:

- Capture of adequate data is technically feasible.

Oyu Tolgoi capacity built

Recommended Activities:

- Build Oyu Tolgoi's internal capacity for promoting, managing and implementing the Offsets Strategy.

Outcomes:

- Oyu Tolgoi technically able to manage most offsets actions in 10-20 years time.

Assumptions:

- Oyu Tolgoi effectively establishes and invests in its team.

6.10.4 Integration of offset actions and livelihood programs

Key actions for rangeland management are likely to involve both changes in livestock composition and localised reductions in total livestock numbers. Oyu Tolgoi recognises that these changes may lead to livelihood impacts and thus will undertake an extensive program of consultation, through implementation of the Offset Strategy Stakeholder Engagement Plan, to assess what restrictions on livestock herders are happy to accept, and for what compensation. Oyu Tolgoi expects this to be a fully negotiated and mutually agreed 'deal' with herders, and to additionally provide support to alternative livelihoods to assist transition to a more biodiversity-friendly system.

Given the competition between livestock and wild ungulates for food and water, it is accepted that there is likely to be some potential for conflict between the objectives of rangeland management for biodiversity conservation and traditional livelihoods. A number of steps will be taken to minimise and mitigate this potential conflict. First, all actions will be subject to herder stakeholder review and mutual agreement based on extensive consultation with herders. Second, herders will be given an opportunity to opt out of, or into, these actions. Third, actions will be aligned where possible with applicable ongoing national and international programmes and initiatives. These include the World Bank's Sustainable Livelihoods Project, The Nature Conservancy's Development by Design project in Omnogovi and the national government's Mongol Mal which aims to prevent over-grazing. Fourth, actions will be focused on win-win scenarios such as revitalising *soum*-level grazing planning. Fifth, there will be a system of incentives to compensate for losses made available to any herders incurring opportunity losses through offset actions. Finally, the transition to more biodiversity-friendly livelihoods will be assisted through an alternative livelihoods programme. (Annex C, Section 4.3 'Improved Rangeland Management'):

Given the potential for conflicts between conservation actions, such as improving rangeland management and control of illegal hunting, and the interests and livelihoods of local stakeholders, the Oyu Tolgoi project will work closely with all stakeholders to ensure that the communication and implementation of these activities are undertaken in a culturally appropriate manner.

6.10.5 Biodiversity Offsets Stakeholder Engagement

The Offsets Strategy proposed in Annex C, recommends full engagement with stakeholders, and to revise the strategy based on their inputs into an Offsets Management Plan. It is anticipated that this engagement will run throughout 2012 and 2013 to align with the current Oyu Tolgoi Stakeholder Engagement Plan (SEP). Some engagement will need to be continued beyond finalisation of the Offsets Management Plan. In addition, the socio-economic/social development aspects some of the components of the proposed offset actions, particularly 'improved rangeland management' and 'control of illegal hunting' requires the involvement of social specialists in their design and implementation.

The recommended stakeholder engagement roadmap provided in Annex C is proposed to be fully integrated with the Project Stakeholder Engagement Plan. This will include a Communications Strategy to ensure that the key messages reach the right audiences at the right time. This is proposed to generate a broad media outreach and to continue beyond the finalisation of the Offsets Strategy.

Table 6.10: Residual impacts and key actions required for each priority biodiversity feature

Priority biodiversity feature	Key residual impacts	Possible offset actions
Eastern Gobi desert-steppe	Habitat loss	Improved rangeland management
Alashan Plateau semi-desert	Habitat loss	Improved rangeland management
Mongolian Chesney	Habitat loss	Improved rangeland management
Asiatic Wild Ass	Increased mortality from hunting; habitat loss	Reduced illegal hunting and collecting; infrastructure mitigation; Improved rangeland management
Argali	Increased mortality from hunting; habitat loss	Reduced illegal hunting and collecting; Improved rangeland management
Goitered Gazelle	Increased mortality from hunting; fragmentation; habitat loss	Reduced illegal hunting and collecting; infrastructure mitigation; Improved rangeland management
Mongolian Gazelle	Increased mortality from hunting; fragmentation; habitat loss	Reduced illegal hunting and collecting; infrastructure mitigation; Improved rangeland management
Swan Goose	Increased mortality from collisions	Infrastructure mitigation
Ferruginous Duck	Increased mortality from collisions	Infrastructure mitigation
Short-toed Snake-eagle	Habitat loss; increased mortality from electrocutions	Improved rangeland management; infrastructure mitigation
Saker Falcon	Increased mortality from collecting and electrocutions; habitat loss	Reduced illegal hunting and collecting; infrastructure mitigation; Improved rangeland management
Egyptian Vulture	Habitat loss	Improved rangeland management; infrastructure mitigation
Great Bustard	Increased mortality from hunting and collisions; habitat loss	Reduced illegal hunting and collecting; infrastructure mitigation; Improved rangeland management
Houbara Bustard	Habitat loss; increased mortality from hunting and collisions	Improved rangeland management; Reduced illegal hunting and collecting; infrastructure mitigation
Relict Gull	Increased mortality from collisions	Infrastructure mitigation
Pallas' Sandgrouse	Habitat loss; increased mortality from collisions	Infrastructure mitigation
Mongolian Ground-Jay	Habitat loss	Improved rangeland management
Yellow-breasted Bunting	Habitat loss	Improved rangeland management
Granite Outcrop Flora Communities	None	n/a
Riverine Elm Trees	Habitat loss	Improved rangeland management
Tall Saxaul Forest	Habitat loss; increased collecting	Improved rangeland management; Reduced illegal hunting and collecting

6.10.6 Offset cost estimate and financing

An indicative budget has been prepared in the Offset Strategy (Annex C), but many costs are extremely approximate and dependent on the results of stakeholder engagement, contractors' budgets to undertake the monitoring and evaluation work, and the ongoing adaptive management feedback from monitoring and evaluation. Therefore, no detailed budget is presented here. However, ongoing costs are estimated to be approximately US$3 million / year (approximately equal costs for reduced illegal hunting, improved

rangeland management, M&E, and management and other costs combined), and start-up and short/medium-term costs totalling an additional approximately US$8 million. This indicates that the total budget for the Biodiversity Offsets Strategy over the life of the programme would be in the order of US$70 million.

Rio Tinto and Oyu Tolgoi have provided firm corporate level commitments to achieving a net positive impact on biodiversity. Oyu Tolgoi has established budget processes within which its environmental objectives are funded to meet its policies and commitments. The provision of offset financial requirements will continue to be integrated within its overall project environmental budget

Rio Tinto and Oyu Tolgoi are committed to various external and internal review and verification processes that include external reporting of its progress in implementing its offsets programme and achieving its policy objective. The verification and review process will identify if financial or human resource allocations for biodiversity need adjustment to achieve net positive impact objectives and, as part of normal process, Oyu Tolgoi would adjust resources and budget plans in response to any such findings.

6.10.7 NPI Forecast

This section summarises the forecast for the theoretical and technical feasibility of the Oyu Tolgoi project achieving a NPI or No Net Loss (NNL) on biodiversity. Residual losses, which are the losses remaining after the mitigation hierarchy of avoid, minimise and restore has been followed, were estimated for each priority biodiversity value. Biodiversity gains at offset sites were estimated for each priority biodiversity value based on a proposed set of possible offset areas and activities as outlined in Annex C. This does not imply that these offset areas and activities will be undertaken, but does show the approximate area and type of offsets needed to achieve NPI/NNL. Losses and gains were estimated using a metric of Quality Hectares (QH). These methods derive a scientifically defensible offsets ratio based on the gains and losses per hectare, *for each biodiversity value*, a more rigorous and tailored approach than the subjective selection of an overall offset ratio taken by some regulators and companies.

Direct habitat loss was quantified by overlaying infrastructure maps with habitat maps. Indirect habitat loss was based on estimated 'avoidance distances' for species which were predicted to avoid roads and other infrastructure (for example due to disturbance and hunting pressure). These were converted into QH by multiplying the area (ha) by a vegetation quality percentage of 90%. The baseline quality for hunted species was taken as 50% quality and the indirect impacts of illegal hunting was estimated reduce that to 25% quality within 100 km of the mine site (31,000 km^2). It was estimated that mitigation actions might reduce that by 50%, leading to an overall quality of 62.5%, and a loss of 62.5-50% x 31,000 km^2 or 392,000 QH. It is noted that these quality coefficients are estimates based on expert opinion itself based on extremely limited empirical evidence, and therefore require significant refinement as monitoring data becomes available.

Mortality losses due to powerlines and potential gains to offset these impacts were calculated separately: the residual impact for direct mortality from powerline collisions and electrocution was not estimated directly but as a relative value per km (y birds / km). This was used to calculate a length of offset powerlines (outside the Project area) over which best-practice mitigation is needed to offset the residual loss (0.6y birds 'gained' / km based on assumption that mitigation prevents 60% of collisions, where 60% is the lower estimates of applicable published studies summarised in Jenkins *et al*. 2010).

Gains were estimated for each priority biodiversity value in 2036 (25 years from now), in QH for the main offset actions of improved rangeland management and control of illegal hunting. Biodiversity gains from rangeland management will be difficult to achieve for social, political, ecological and economic reasons. Therefore calculations were highly conservative for this offset activity in terms of the both the area over which herders are fully supportive and the potential gains per unit area. Hence it was conservatively estimated that rangeland habitat degradation could perhaps be reduced by half of the increase in plant biomass achieved by the GIZ (Deutsche Gesellschaft für Internationale Zusammenabeit) project (15%; Hess *et al.* 2010), equating to a 7.5% improvement in habitat quality. A conservative estimate is that this might be achieved across a tenth of the total surface area of the landscape. This is equivalent to an overall quality percentage improvement of just 0.75% across the whole offsets landscape. It was estimated that illegal hunting could perhaps be reduced across the proposed Principal Offsets Landscape (28,245 km^2) by a similar level to that achieved by the WWF 'MAPU' project (which experts suggested as 50% reduction in hunting across 75% of landscape). This is equivalent to an overall quality percentage improvement of 18.75% (50%x50%x75%) or 530 QH across the Principal Offsets Landscape.

It is noted that the predicted gains from improved rangeland management are much less than from reduced illegal hunting. There are however essential to generate gains for species and other features which are not hunted.

These are very approximate estimates based on inadequate baseline and lack of comparable data, and should only be used for enabling an order-of-magnitude estimate of NPI feasibility. It is recommended that the Oyu Tolgoi Project completes further research to refine these figures, then measures these losses and gains in its ongoing monitoring work, and is precautionary in initiating offset actions across much larger areas than these calculations suggest.

The estimated gain of 0.75% in the habitat quality percentage would equate to an 'offset ratio' of 120x (baseline habitat quality of 0.9/0.0075). The estimated gain of 18.75% in illegal hunting quality percentage would equate to an 'offset ratio' of 2.7x (baseline illegal hunting level of 0.5/0.1875). Another approach would be to compare the area of habitat lost (90 km^2 direct loss and up to 1550 km^2 direct and indirect loss) to the area of the Principal Offset Landscape 28,245 km^2), which gives 'offset ratios' of about 300x and 20x. These could be compared to typical 'offset ratios' in wetter environments (where greater gains per unit area are ecologically feasible) of <10x.

The net positions (gains minus losses) suggest that it is theoretically possible, based on the proposed offset sites and activities, to achieve NPI for the majority of priority biodiversity features (*Table 6.11*). The exceptions are the two Bustard species, Great Bustard and Houbara Bustard. Consequently additional Bustard offsets may be required, such as elsewhere in Mongolia or even on the migratory route outside Mongolia, where they are threatened by hunting. However, as noted in the 'Conclusions and Recommendations' section of Annex C, there is considerable uncertainty around these figures; until refined through targeted monitoring, they will be treated with caution. Given this uncertainty, the Oyu Tolgoi Project will incorporate significant contingency into its offset design.

6.10.8 Risks to achieving Net Positive Impact

There are large uncertainties in the estimates underpinning the NPI forecast, notably in the baseline estimates of key biodiversity features and their pressures, and the lack of models enabling accurate estimation of the gains predicted from the chosen offset actions. Thus, the Oyu Tolgoi Project aims to exceed the likely minimum requirements by a large margin to be confident of achieving NPI. The socio-political and technical uncertainties are detailed in Section 7 of Annex C[7], Biodiversity offsets strategy for the Oyu Tolgoi Project, and are summarised below:

- Lack of suitable human resources and/or financial commitment within Oyu Tolgoi to effectively implement the offset programme;
- A number of hydrogeological uncertainties are highlighted in Annex B . If monitoring shows hydrological connectivity between various aquifers, then additional impacts are likely and additional offsets would be needed;
- The offset activities risk being negated by poor standards of development elsewhere in the Offsets Landscape and even elsewhere in the southern Gobi region;
- The threat to long-term sustainability of the offsets gains by inadequate long-term security of land tenure;
- The potential for conflict between traditional herder attitudes and biodiversity-friendly rangeland management;
- The Oyu Tolgoi project's ability to champion and lead raised standards of regional development would be compromised by any significant delays in implementation of best-practice mitigation to its own infrastructure;
- Herders' likely wish for greater provision of water (e.g. boreholes) would risk increase degradation of rangeland and disturbance in areas currently able to support lower livestock densities;

[7] TBC and FFI (2011) Biodiversity Offsets Strategy for the Oyu Tolgoi project. Unpublished draft report of The Biodiversity Consultancy Ltd and Fauna & Flora International, December 2011.

- Additional uncontrolled herder in-migration to the offset landscape;
- Changes in demand for products from illegal hunting;
- Habitats within the offset landscape may be unresponsive to improved rangeland management; and
- Extreme weather events may reverse offset gains.

The Oyu Tolgoi Project offset strategy considers the following proposed measures to address these risks.

- Implement the Stakeholder Engagement Plan and convert the Offsets Strategy into an Offsets Plan; and
- Aim to exceed the likely minimum requirements by a large margin to be confident of achieving NPI (if extra offsets outcomes are verifiably achieved, these could even be traded as 'biodiversity credits'.) This is best achieved by a combination of precautionary measures including:
    - Research legal and other opportunities for ensuring long-term security of offset gains;
    - Investigate opportunities for liaison and partnership with other projects developing infrastructure and considering offsets in the southern Gobi region (e.g. The Nature Conservancy's Development by Design project);
    - Ensure collaboration between environmental and social teams so that the objectives and actions for mitigation actions for local communities are consistent with the objectives and actions for biodiversity mitigation and offsets; and
    - Ensure adequate staffing and resourcing at lower levels for delivering the overall outcome of Net Positive Impact (and hence compliance with PS6 / PR6).

Table 6.11: **Projected net position (gains minus losses) in 2036 for priority biodiversity features (Quality Hectares)**

Name	Direct & indirect habitat loss (1000 ha)	Quality of habitat lost(0-10)	Loss from increas-ed hunting (1000 QH)	Resid-ual loss (1000 QH)	Gain from hunting control (1000 QH)	Gain from rangeland manage-ment (1000 QH)	Predicted overall offset gain (1000 QH)	Net position (1000 QH)	NPI / NNL ?
Mongolian Chesney	9	0.9		8	0	21	21	13	Yes
Asiatic Wild Ass	155	0.5	392	470	530	21	551	59	Yes
Argali	30	0.5	392	407	530	21	551	122	Yes
Goitered Gazelle	130	0.5	392	458	530	21	551	72	Yes
Mongolian Gazelle	76	0.5	392	431	530	21	551	99	Yes
Swan Goose	0			0	0	0	0		Yes[2]
Ferruginous Duck	0			0	0	0	0		Yes[2]
Short-toed Snake-eagle	9	0.9		8	0	21	21	13	Yes[2]
Saker Falcon	9	0.9		8	0	21	21	13	Yes[2]
Egyptian Vulture	9	0.9		8	0	21	21	13	Yes[2]
Great Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Houbara Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Relict Gull	0			0	0	0	0		Yes[2]
Pallas' Sandgrouse	9	0.9		8	0	21	21	13	Yes[2]
Yellow-breasted Bunting	9	0.9		8	0	21	21	13	Yes
Mongolian Ground-Jay	9	0.9		8	0	21	21	13	Yes
Granite Outcrop Floral Communities[4]	0			0	0	0	0	0	Yes
Riverine Elm Trees	0			0	0	+	+	+	Yes[5]
Ephemeral Lakes & Pools	0			0	0	+	+	+	Yes

Name	Direct & indirect habitat loss (1000 ha)	Quality of habitat lost(0-10)	Loss from increas-ed hunting (1000 QH)	Resid-ual loss (1000 QH)	Gain from hunting control (1000 QH)	Gain from rangeland manage-ment (1000 QH)	Predicted overall offset gain (1000 QH)	Net position (1000 QH)	NPI / NNL ?
Tall Saxaul Forest	+	?	-	+	+	+	+	+	Yes[6]
Eastern Gobi desert-steppe	5.5	0.9		5	0	9	9	4	Yes
Alashan Plateau semi-desert	3.5	0.9		3	0	12	12	9	Yes

[1] *Assumed here to represent all 18 'very rare' plants known or predicted from the project area*

[2] *Assuming mitigation is put in place on all Oyu Tolgoi powerlines plus an additional >64km of non-Oyu Tolgoi powerlines*

[3] *Yes if there is an appropriate additional offset*

[4] *Even though these are not predicted to be impacted, they are included here since they are a Critical Habitat –qualifying biodiversity value in the area*

[5] *Yes if the three translocated trees survive; offset gains depend on specific offset site*

[6] *Yes assuming adequate control of illegal collecting (not quantified)*

6.11 OYU TOLGOI APPROACH TO ONGOING BIODIVERSITY MANAGEMENT – THE WAY FORWARD

The Oyu Tolgoi project approach to biodiversity management is set out in the *Oyu Tolgoi Biodiversity Strategy* (Annex A). This strategy outlines Oyu Tolgoi's approach to achieving operational excellence with regards to biodiversity management. An approach that includes: the prioritization of biodiversity features, application of the mitigation hierarchy, design and implementation of effective offsets, design and implementation of effective biodiversity monitoring and evaluation and enthusiastic contribution to research and environmental education. The Oyu Tolgoi Biodiversity Strategy also addresses Oyu Tolgoi's approach to minimising the identified risks to biodiversity management in the southern Gobi region.

The following sections outline the process for progressing key aspects of the ESIA biodiversity baseline and impact assessment chapters towards operational biodiversity management for the Oyu Tolgoi project.

6.11.1 Implementation of Mitigation Actions and the Biodiversity Action Planning process

This chapter and *Chapter B7a: Biodiversity Baseline* together define the priority biodiversity features of the Oyu Tolgoi Project, the high and critical risk impacts to those priority biodiversity features and the proposed ways in which Oyu Tolgoi plans to avoid, minimise and rehabilitate those impacts in order to reduce the overall residual impacts of the project to biodiversity. Moreover this chapter outlines possible approaches to biodiversity offsets which are likely to enable Oyu Tolgoi to reach its goal of NPI on biodiversity of the southern Gobi region.

The mitigation actions (including avoidance, minimisation, mitigation and offsets) have been designed for each biodiversity feature to meet requirements of Paragraph 10 of IFC PS6/Paragraph 14 of EBRD PR6. The actions identified by Oyu Tolgoi to avoid, minimise and rehabilitate impacts to biodiversity include those which:

- Have been applied during the design phase of the project (e.g. Undai River diversion and Replacement of Bor Ovoo Spring);
- Are currently being implemented by Oyu Tolgoi (e.g. enforcement of no unauthorised waste disposal/littering, provision of fuel to project personnel for heating) or will be implemented during the construction phase of the project (e.g addition of bird flight diverters to all project power lines). Construction phase mitigation actions are also captured in *Chapter D6: Flora and Fauna Construction Management Plan*; and
- Will be implemented during the operations phase of the project (e.g. construction of underpasses, placement of boulders/posts/ditches along roads to prevent vehicles leaving the road).

For some Project features, it has not been possible to avoid some priority biodiversity features. For example, the border crossing at Gashuun Sukhait was located by the Government of Mongolia and as a

result there was no way that the Project could avoid crossing through a small portion of the SGSPA to reach the border crossing. Similarly, the alignment of the high voltage transmission line from the Chinese border was revised to avoid crossing through the SGSPA but it was not practical for line to be extended to avoid crossing through the IBA. The transmission line follows a straight alignment to minimise its overall distance.

Potential impacts to biodiversity related to the development of the Oyu Tolgoi worker housing area, light industrial estate related to the development of Khanbogd (including a power line to Khanbogd) will form part of the scope of Supplemental ESIA documentation to be prepared by Oyu Tolgoi as part of the final site selection process for worker housing. In addition, potential cumulative impacts related to land, air quality, soil, water resources, flora, fauna, cultural heritage and ecosystem services issues will be considered as part of the Power Plant ESIA (refer to *Chapter C13: Cumulative Impacts*).

Mitigation actions that are not able to be implemented as part of the Project design and / or actual construction will be implemented during the operation phase of the Project. These actions are captured in the Oyu Tolgoi Biodiversity Action Plan (BAP), see *Table 6.12.*

The BAP sets out the key actions for biodiversity management, mitigation and offsets and provides specific completion indicators and timeframes. These actions include construction and operational phase items. The Oyu Tolgoi BAP will be implemented through the Oyu Tolgoi construction phase and the operations-phase HSE Management System which will include the Operations Phase Environmental and Social Management Plans to be developed 60 days prior to commencement of post-commissioning operations and implemented prior to post-commissioning operations. The construction phase actions will be implemented through *Chapter D6: Flora and Fauna Construction Management Plan*. The management plans will include the operations phase Biodiversity Management Plan which will provide details of the implementation of the operational biodiversity actions. There may be overlap between these construction and operational phase management plans where clear delineation is not practicable e.g. on-going road construction and maintenance activities. As part of the HSE Management system, performance against each BAP action and the management plans will be regularly tracked and reported to site management. Actions will be assigned responsibilities to a specific individual or department and other human and financial resources will be allocated as appropriate. Oyu Tolgoi's BAP includes specific actions to ensure the provision of sufficient resources to achieve its biodiversity management objectives during all phases of the Project.

Although there has been limited baseline surveying, and some priority species may remain undetected, the Critical Habitat analysis was based on maps of predicted distribution which have been developed or are under development for most taxa. National and international expert opinion was also solicited to ascertain inclusion of all plausible priority species based on a precautionary approach. The monitoring and evaluation protocols to be developed in 2012 will also address the need for improved baseline data and the application of a precautionary approach that includes adaptive management of biodiversity risks and impacts.

Table 6.13 primarily provides a summary of the proposed mitigation actions for identified critical and high risk impacts to priority biodiversity species. The road wildlife underpasses are included in *Table 6.13,* even though the loss of connectivity was assessed as a "medium" risk, due to concerns about indirect habitat loss prior to mitigation measures taking affect. *Table 6.13* includes an indication of when in the project cycle each mitigation action will be implemented and whether the action will be captured in *Chapter D6: Flora and Fauna Construction Management Plan* or in the operations phase Biodiversity Management Plan which will be developed at least 60 days prior to the commencement of post – commissioning operations. In some instances, the action will be captured in both Management Plans since the impacts themselves will persist beyond the construction phase of the Project.

Table 6.12: Oyu Tolgoi Biodiversity Action Plan

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
Implementation of Onsite Mitigation Measures				
1	Bird Flight Diverters	Oyu Tolgoi will : (i) complete installation of flight diverters on high-voltage power transmission line from the Chinese border to the Oyu Tolgoi site; (ii) complete installation of flight diverters on medium-voltage power transmission lines from the Oyu Tolgoi site to the Gunii Hooloi borefield; and (iii) complete installation of flight diverters on medium-voltage power transmission lines from the Oyu Tolgoi site to Khanbogd *soum* centre. (flight diverters include "Bird Mark – Model BM-AG (After Glow)"; and the "Swan " spiral flight diverter).	(ia) Begin installation of flight diverters on high-voltage power transmission line (ib) Complete installation of flight diverters on high-voltage power transmission line (iia) Begin installation of flight diverters on medium-voltage power transmission lines (iib) Complete installation of flight diverters on medium-voltage power transmission line (iii) Complete installation of flight diverters on medium-voltage power transmission line to Khanbogd *soum* centre	(ia) Q1 2012 (ib) Q2 2012 (iia) Q3 2012 (iib) Q2 2013 (iii) Q4 2012
2	Transmission line stringing	Oyu Tolgoi will undertake best efforts to complete line stringing in the Galbyn Gobi Important Bird Area (IBA) by the end of April 2012, to minimise disturbance during the lekking season of the Houbara bustard (15 April - 30 June). With best efforts exercised, Oyu Tolgoi will also limit line stringing work to discrete line pulling points that will be checked for nearby bustard activity prior to being established; ensure that a Houbara bustard surveyor is active during the stringing work to identify any specific Bustard lekking site; where any individual lekking sites are identified, Oyu Tolgoi will consult with a Bustard specialist in order to determine the most appropriate action to avoid disturbance.	(i) Line stringing commenced (ii) Commence work with two line stringing teams within the IBA with an aim to complete works within the IBA as soon as possible (iii) Stringing complete (iv) Applicable management plan updated (v) Report to Lenders on contractors' performance	(i) March 2012 (ii) Oyu Tolgoi will apply best efforts to complete the work in the IBA by the end of April 2012 (iii) end of May 2012 (iv) March 2012 (v) April 2012

[8] The timeframes in this column may be revised by Oyu Tolgoi from time to time, subject to mutual agreement with the Lenders. Oyu Tolgoi will promptly circulate an updated BAP to reflect any such revisions.

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
3	Future construction and maintenance activities in the Galbyn Gobi Important Bird Area (IBA)	Oyu Tolgoi will avoid construction and scheduled maintenance activities in the Galbyn Gobi IBA during the lekking season of the Houbara bustard (15 April - 30 June), with the exception of emergency and other time-sensitive maintenance activities and taking into consideration any identified sensitive areas.	(i) Operations Phase Biodiversity Management Plan includes this avoidance measure (ii) Ongoing compliance verified as part of on-site mitigation monitoring	(i) Q3 2012 (ii) From 2013 onwards
4	Medium voltage powerline	Oyu Tolgoi will insulate electrical conductors on medium voltage powerline poles, dead-ends, sub-stations and pylons.	(i) medium/low voltage insulation risk assessment to be commenced by specialist consultant (ii) medium/low voltage insulation risk assessment to be complete by specialist consultant (iii) related procurement / installation works commenced in accordance with risk assessment recommendations (iv) related procurement / installation works to be complete in accordance with risk assessment recommendations	(i) Q1 2012 (ii) Q2 2012 (iii) Q3 2012 (iv) Q1 2013.
5	Underpasses	Oyu Tolgoi will: (i) develop and submit for Lenders' review a workplan for the installation of underpasses, which will include activities/timelines for stakeholder consultation, design, locations, engineering, environmental assessment; and (ii) complete underpass construction.	(ia) Draft workplan submitted to Lenders (ib) Final workplan submitted to Lenders (iia) Start of construction (iib) Completion of works	(ia) Q3 2012 (ib) Q4 2012 (iia) Q2 2013 (iib) Q3 2014 or before handover of the road to the government of Mongolia (whichever is sooner)
6	Off road traffic	Oyu Tolgoi will: (i) write a workplan for the installation of structures or barriers at sensitive areas such to prevent vehicles from leaving the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi airport roads; and (ii) install the structures. This workplan will provide for a testing and monitoring phase to determine	(i) Final workplan submitted to Lenders (iia) Installation of structures for testing and monitoring phase (iib) Start of installation of final solution (iic) Installation of final solution complete	(i) end-Q3 2012 (iia) Q4 2012 (iib) Q4 2013 (iic) Q4 2014

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
		the most effective structures to be used, and to plan for installation of the final solution to be completed as early as possible for the solution selected. The areas of the before mentioned roads where these structures will be placed will be determined through consultation with key stakeholders. Structures will serve as an effective deterrent while at the same time facilitate wildlife crossing (or not present a barrier to wildlife crossings) and not create a risk to traffic safety.		
7	Livestock crossings	Based on stakeholder consultation, Oyu Tolgoi will: (i) write a work plan for the installation of livestock crossing points along the Oyu Tolgoi to Gashuun Sukhait road using signage, traffic calming techniques and other engineering features to facilitate livestock animal crossings; and (ii) complete the installation of the livestock crossings.	(i) Final workplan submitted to Lenders (iia) Start of installation (iib) Installation complete	(i) end-Q3 2012 (iia) Q2 2013 (iib) Q3 2013
8	Road signage	Oyu Tolgoi will complete road signage installation for the Oyu Tolgoi to Gashuun Sukhait Rd, Oyu Tolgoi to Khanbogd Rd and the Borefield Rd) to warn drivers of risk of collision with animals.	Signs installed	Q2 2013
9	Biodiversity training module	Oyu Tolgoi will: (i) develop a training module for construction / operations personnel (operator and contractors) on a suite of biodiversity related topics (including driver awareness and rules, waste disposal and litter, hunting policy); and (ii) (ii) mainstream biodiversity-related topics as part of toolbox talks; (iii) review their current induction program to ensure that any updated commitments are included, as appropriate / applicable.	(i) Training module submitted to Lenders (ii) and (iii) Activities implemented	(i) end-Q3 2012 (ii) and (iii) by Q4 2012
Assessment				
10	Riverine Elm & Tall Saxaul habitats	Oyu Tolgoi will assess the adequacy of current measures to mitigate the impacts on these priority features and achieve no net loss where feasible (natural habitat) and incorporate any identified additional measures in the Biodiversity Management Plan for operations and/or the Offsets Management Plan.	(i) Findings of Oyu Tolgoi's assessment submitted to Lenders (ii) Biodiversity Management Plan and/or Offsets Management Plan includes any additional measures proposed on the basis of the	(i) Q3 2012 (ii) Q4 2012 and/or completion of Offsets Management Plan

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
			assessment by Oyu Tolgoi.	
Biodiversity Offsets				
11	Long term engagement of independent organisation(s)	Oyu Tolgoi will enter into engagement with reputable, qualified and internationally recognised independent organisation(s) to design and where appropriate implement Oyu Tolgoi's biodiversity management programmes, for as long as considered necessary by both Oyu Tolgoi and Lenders to fulfil the following tasks: ▪ Long term biodiversity monitoring and evaluation; ▪ Design, implementation and where appropriate management of the Biodiversity Offsets Strategy and Management Program; and ▪ Support in the development and implementation of Operations Phase Biodiversity Management Plans. The terms of engagement will include processes that allow lenders to have independent access to the expert organisation upon notification to Oyu Tolgoi that this advice and opinion is being sought.	(i) Draft Terms of Engagement developed (ii) Final Terms of Engagement agreed with lenders and initiated (iii) Dialogue with Lenders on proposals received) (iv) Engagement in place	(i) Q3 2012 (ii) Q3 2012 (iii) Q4 2012 (iv) Q1 2013
12	NPI accounting & verification	Oyu Tolgoi will (i) update its NPI accounting and report to the Lenders on the results of the update and (ii) participate in the IUCN convened Net Positive Impact Protocol and Review Panel Team (NPIP&RPT) who will develop, test and implement an independent process for verification of Rio Tinto's and Oyu Tolgoi's commitment to the NPI objective.	(i) NPI accounting updated and results reported to the Lenders (iia)Project-specific scope of work developed and shared with lenders (iib) NPI&RPT verification pilot program commenced for OT	(i) Q4 2012 and as necessary thereafter (iia) Q2 2013 (iib) Q4 2013
13	Offsets Management Plan	Oyu Tolgoi will develop and implement an Offsets Management Plan (or Plans) that identifies options for sustainable financing, including conservation trust funds, which will ensure long-term compliance with paragraph 10 of IFC's Performance Standard 6 and EBRD's Performance Requirement 6 over the life of the mine.	(i) Identification and evaluation of existing programs for offset pilots and update provided to Lenders. (ii) Biodiversity offset funding strategy developed and shared with the Lenders (iii) Draft Offset Management Plan(s) submitted for Lender review, with preferred offsets financing option identified (iv) Offset Management Plans are finalized	(i) Q4 2012 (ii) December 2013 (iii) Q2 2014 (iv) Q3 2014

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
Biodiversity Monitoring				
14	Monitoring and Evaluation Program	Oyu Tolgoi will develop a Biodiversity Monitoring and Evaluation Program (BMEP) for critical habitat species sufficient to determine project compliance, over the long-term, with respect to para. 10 of Performance Standard 6 and para. 8 of Performance Requirement 6. The BMEP will reflect Oyu Tolgoi's stakeholder engagement and will include other identified priority biodiversity species in the BMEP in a manner that is sufficient to determine project compliance with para. 9 of Performance Standard 6 and para. 8 of Performance Requirement 6. For critical habitat species, and non-critical priority biodiversity values, the monitoring program will include relevant metrics and threshold values adequate to determine compliance over the long-term and its design will be statistically relevant.	(i) Oyu Tolgoi and Lenders agrees on goals and objectives of the BMEP (ii) TOR for BMEP finalised (iii) Implementing organisation selected (iv) Draft design for BMEP submitted for Lender review (v) Final BMEP submitted (vi) BMEP implemented	(i) Q3 2012 (ii) Q3 2012 (iii) Q4 2012 (iv) Q1 2013 (v) end Q1 2013 (vi) Q2 2013
15	2012 Baseline field program – Houbara bustard	Oyu Tolgoi will commence in-field biodiversity baseline for the Houbara bustard as part of its monitoring program. The baseline will be consistent with the goals and objectives of the Biodiversity Monitoring and Evaluation Program.	(i) TOR sent to IFC for review (ii) Teams are mobilized	(i) March 2012 (ii) Mid-April 2012
16	2012 Baseline field program – large ungulates	Oyu Tolgoi will commence in-field biodiversity baseline for large ungulates as part of its monitoring program. The baseline will be consistent with the goals and objectives of the Biodiversity Monitoring and Evaluation Program.	(i) TOR for ground based large ungulate surveys sent to IFC for review (ii)Teams mobilised for ground-based surveys	(i) Q3 2012 (ii) Q3 2012
17	Water impact monitoring	Oyu Tolgoi will develop and implement a multi-disciplinary Monitoring and Evaluation Program for water impacts on vegetation, pasture quality and critical ecosystem services. This plan will build upon and integrate components of the ongoing water monitoring program and include, where applicable, the monitoring of critical ecosystem services. It will be designed in a collaborative manner with environmental and social specialists and be integrated with social monitoring. The Monitoring and Evaluation Program will include relevant metrics and threshold values adequate to determine compliance over the long-term, integrating adaptive management strategies. Its design will be statistically relevant.	(i) Gap analysis completed of existing mitigation strategy for vegetation, pasture quality and ecosystem services (ii) Draft design for Monitoring and Evaluation Program submitted to Lenders for review (iii) Monitoring and Evaluation Plan are finalised and implementation has begun	(i) Q3 2012 (ii) end-Q3 2012 (iii) Q2 2013
Management Plans				
18	Operations Phase Biodiversity	Oyu Tolgoi will develop an Operations Phase Biodiversity Management Plan in line with international best industry practices and subject to Lender review that includes all identified on-site biodiversity mitigation	(i) Submission of draft plan for Lender review (ii) Submission of final plan to Lenders	(i) by end Q3 2012 (ii) delivered in Q4 2012

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
	Management Plan	measures, including specific roles and responsibilities for Oyu Tolgoi staff and contractors / subcontractors. The Operations Phase Biodiversity Management Plan will include commitments and actions related to construction that will occur during the operations phase. As applicable, biodiversity-related commitments will also be mainstreamed into other applicable Management Plans, such as the Transport Management Plan, Water Resources Management Plan, Waste Management Plan and Influx Management Plan.		(Consistent with D1 operational management plan commitment schedule)
Management and Resources				
19	Provision of adequate resources	Oyu Tolgoi will ensure that over the long-term its biodiversity management program including on-site mitigation, offset management and biodiversity monitoring is adequately resourced and financed to meet IFC's Performance Standard 6, EBRD's Performance Requirement 6 and ESIA commitments.	On-going review	On-going review
20	Specialist capacity	Oyu Tolgoi will engage a full time senior level specialist (likely to be on secondment from Rio Tinto HSEC), based in Mongolia, with demonstrated experience in international best practices to provide support, capability and leadership to Oyu Tolgoi's biodiversity team in the implementation of biodiversity commitments. The position will be in place for the period necessary to achieve sufficient capacity within Oyu Tolgoi's national biodiversity team to implement and manage the project's biodiversity commitments. The progress of capacity development will be subject to an annual review process which will include advice from the Project's international biodiversity organisation (as established in item 11) and in consultation with the Lenders.	(i) CV of senior level specialist (ii) Senior level specialist established in Mongolia	(i) Q3 2012 (ii) Q3 2012
21	Organisational structure	Oyu Tolgoi will develop an organisational structure for the operations phase that will facilitate the integration of both environmental and social specialists to ensure the effective delivery of socio-ecological commitments, especially those relating to offset management.	Complete organisational structure and provide organisational chart to Lenders	Q3 2012
22	Compliance management	OT will incorporate BAP, Flora & Fauna Management Plan and biodiversity-related ESIA obligations into its HSE management and assurance processes.	Biodiversity-related commitments incorporated into the HSE management and assurance processes.	Q4 2012
Stakeholder Engagement				

ID	Topic/ Aspect	Action Description	Completion Indicator	Timeframe[8]
23	Stakeholder engagement plan	Oyu Tolgoi will revise the existing Stakeholder Engagement Plan to incorporate the stakeholder engagement/consultation needed as part of (i) implementation of on-site biodiversity mitigation; and (ii) development of Offsets Management Plan(s).	Stakeholder Engagement Plan updated	Q1 2013 (*fully updated)*
24	Stakeholder engagement on offset program	Oyu Tolgoi will carry out a substantial stakeholder engagement and consultation exercise to ensure that its biodiversity offset program is consistent with national conservation priorities and stakeholders' interests and that it is both technically and politically/administratively feasible over the long-term.	Start consultation end of Q1 2013. Dates and minutes of meetings submitted to Lenders	Q1 2013
25	Engagement with regional bodies	As part of the development of the offset program, Oyu Tolgoi will undertake formal engagement with regional bodies and institutions involved with regional-scale sustainable development, such as the Regional Development Council, on the implementation of certain on-site and offset mitigation measures that may have relevance to regional-scale sustainable development. As a component of Oyu Tolgoi's wider regional engagement, it will consult with companies and other users of regional infrastructure, including the coal road, in order to develop an options paper evaluating different schedules for vehicle movements and restrictions on vehicle movement.	(i) Stakeholder Engagement Plan updated (ii) Options plan submitted to Lenders (iii) Oyu Tolgoi's on-going engagement and participation documented in reports communicated to Lenders (e.g., such as annual monitoring reports, independent environmental and social monitoring reports, etc.).	(i) Q3 2012 (ii) Q4 2012 (iii) With submission of regular reporting

Table 6.13: Oyu Tolgoi mitigation actions, the project phase in which they will be implemented and the Management Plan in which they will be captured

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
Powerline Infrastructure	Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m).	Minimise	Houbara Bustard, Great Bustard	Construction	-		
	Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary.	Minimise	Saker Falcon, Egyptian Vulture, Short-toed Snake-eagle (other bird species)	Construction and Operation	-	-	
	Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals.	Restore	Saker Falcon, Egyptian Vulture, Short-toed Snake-eagle, Houbara Bustard, Great Bustard	Construction and Operation	-	-	
	Remove nests of birds which predate Bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure	Minimise	Houbara Bustard, Great Bustard, Saker Falcon	Operation		-	
Oyu Tolgoi Roads	Even though the Project is in already fragmented landscape, Oyu Tolgoi is taking a forward looking approach to mitigating and reducing existing effects of the coal road by means of the underpasses and other management actions. Oyu Tolgoi will construct appropriate and sufficient underpasses (at ecologically suitable locations such as river beds, approximately every 6 km along the Oyu Tolgoi to Gashuun Sukhait road, as long as practically possible but minimum 12 m long, at least 4.5 m high along the whole length, with solid sides at least as high as highest Oyu Tolgoi vehicles, a natural, non-waterlogged substrate with no obstacles, affording a view of	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Mongolian Gazelle	Operation		-	

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
	the horizon from either side, and with earth berm along edge of road either side of underpass to funnel wildlife towards underpasses; to be constructed before hand-over to GoM).						
	Inspect and remove litter and other anthropogenic waste from along the Oyu Tolgoi to Gashuun Sukhait road, Oyu Tolgoi to Khanbogd Road and Oyu Tolgoi Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces)	Restore	All (esp. Egyptian Vulture, Short-toed Snake-eagle)	Construction and Operation	-	-	-
	Provide driver awareness and training for all Oyu Tolgoi staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds).	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	-
	Enforce no unauthorised waste disposal/littering from Oyu Tolgoi vehicles or around work place	Minimise	All	Construction and Operation	-	-	-
	Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert).	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	-
	Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait Road.	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	
	Deter vehicles leaving the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi to airport roads (by some combination of using immoveable boulders, side ditches, and/or posts to prevent vehicles leaving either side of the road	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
	except for at agreed herder crossings, to be determined by further research), whilst facilitating wildlife crossing.						
	Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue.	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	
	Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue.	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	
	Erect signage on roads to warn drivers of risk of collision with wild animals	Minimise	All (esp. Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard)	Construction and Operation	-	-	
Hunting and Collecting	Provide all project operations staff and contractors fuel for fires to prevent collection of local timber (i.e. Saxaul).	Minimise	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Construction and Operation	-	-	-
	Control illegal hunting by Oyu Tolgoi personnel (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties)	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard, Great Bustard, Saker Falcon	Construction and Operation	-	-	-
	Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels).	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard, Great Bustard, Saker Falcon	Construction and Operation	-	-	

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
	Inspect an adequate proportion of all aircraft under Oyu Tolgoi control for illegal wild animal products. (Publicise and apply suitable penalties to offenders under Oyu Tolgoi control found trafficking illegal wild animal products.)	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	
	Inspect all vehicles entering the Oyu Tolgoi site for illegal wild animal products. (Publicise and apply suitable penalties to offenders under Oyu Tolgoi control found trafficking illegal wild animal products.)	Minimise	Asiatic Wild Ass, Goitered Gazelle, Argali, Houbara Bustard	Construction and Operation	-	-	
Regional Strategy	Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd *soum* (It is noted that more detailed commitments may be developed in association with the Oyu Tolgoi project social team). Secondary impacts of the increased number of non-Oyu Tolgoi project employees in Khanbogd *soum* can be mitigated by enabling balanced and sustainable regional planning, including infrastructure development, within Khanbogd *soum*. Currently Khanbogd does not have the infrastructure or administrative capacity to manage such large transformations without significant support from both the Government of Mongolia and the major project developers in the region. The Oyu Tolgoi project is establishing a Local Regional Planning and Infrastructure (LRPI) unit to coordinate with the Southern Gobi Regional Development Council (SGRDC) that is being established by the Government of Mongolia.	Minimise	ALL	Construction and Operation	-	-	

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
	Moreover, a regional, landscape level approach is required to address the cumulative fragmentation effects of infrastructure development in the southern Gobi region. This is best achieved through close cooperation between key regional stakeholders on regional planning issues. The recently agreed MoU on biodiversity management and monitoring between Oyu Tolgoi and Energy Resources LLC provides an excellent example of opportunities for collaboration between key stakeholders in the southern Gobi region						
Restoration and Rehab	Rehabilitate and restore at least equal areas or numbers of features impacted (in line with the Oyu Tolgoi Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice), including the existing Temporary Airstrip	Restore	All (esp. Very rare flora, Tall Saxaul Forest & Riverine Elm)	Construction and Operation	-	-	-
	Divert the Undai River channel to maintain surface and subsurface water flows within the Undai River downstream of the Mine Licence Area	Restore	Asiatic Wild Ass, Goitered Gazelle, Saker Falcon, Riverine Elm Trees, Saxaul	Project Design and Construction	-		
	Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of the Bor Ovoo spring in terms of maintaining similar surface and subsurface flow patterns and seasonal variations throughout the year.	Restore	Asiatic Wild Ass, Goitered Gazelle, Saker Falcon, Riverine Elm Trees, Saxaul	Project design and Construction	-		
Monitoring of Uncertainties	In consultation with experts, establish a groundwater monitoring programme sufficient to detect project-related impacts of mine dewatering on surficial and alluvial aquifers (temporal and spatial analyses required to assess rate and extent)	Other	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Operation		-	

Infrastructure Component or Impact Type	Mitigation Action	Type of Mitigation	Priority Biodiversity Feature	Project Phase of Implementation	Construction Flora and Fauna Management Plan	Biodiversity Action Plan	Action already (partially) implemented
	In consultation with experts, establish a groundwater monitoring programme sufficient to enable the detection of project-related impacts on groundwater levels and surface hydrology in the Undai downstream of the mine.	Other	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Operation		-	
	In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the Gunii Hooloi deep cretaceous aquifer.	Other	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Operation		-	
	In consultation with experts, establish a groundwater monitoring programme sufficient to detect any change in groundwater level of the deep Galbyn Gobi aquifer arising from abstraction from the Gunii Hooloi deep cretaceous aquifer.	Other	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Operation		-	
	In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the deep Durulj Mount Southern aquifer.	Other	Asiatic Wild Ass, Goitered Gazelle, Short-toed Snake-eagle, Saker Falcon, Houbara Bustard, Riverine Elm Trees	Operation		-	

6.11.2 Ongoing development of offsets

Oyu Tolgoi's approach to biodiversity offsets is outlined in *Section 6.10* together with an overview of the proposed scale, possible offset areas and possible offset actions which, if adopted and successfully implemented, are likely to allow Oyu Tolgoi to achieve its stated goal of NPI on biodiversity.

While Oyu Tolgoi has taken important and significant steps towards the development of offsets to compensate for residual impacts, there is considerably more work to do on this important aspect of biodiversity management.

Oyu Tolgoi is currently engaged with key subject matter experts as part of the stakeholder consultation process for Oyu Tolgoi's offsets approach and following this, will undertake comprehensive stakeholder engagement which will canvass the identified possible offsets to local communities, Mongolian government ministries, *soum* and *aimag* administrators, NGOs and other identified stakeholders. Following the outcomes of the stakeholder engagement process, Oyu Tolgoi will produce a strategic plan for the delivery of biodiversity offsets in the southern Gobi region. This plan will articulate specific, costed conservation actions designed to fully address the residual impacts of the Oyu Tolgoi project to priority biodiversity features.

Because of their scale and the level of stakeholder engagement required, it is necessary to develop biodiversity offsets through a separate but complimentary process to the BAP. However, conservation actions identified through the offsets planning process will be fully integrated into the BAP.

6.11.3 Monitoring and Evaluation

A well-designed, cost-effective monitoring and evaluation program is essential to inform Oyu Tolgoi's adaptive approach to biodiversity management. Furthermore, it will fundamentally underpin Oyu Tolgoi's ability to demonstrate its progress towards the goal of NPI to both internal and external stakeholders.

Oyu Tolgoi will draw on guidance from recent Rio Tinto technical publications, from IFC PS6 and internal and external experts (academic, government and non-government institutions) to develop an effective monitoring and evaluation program. Oyu Tolgoi will select appropriate methods for measuring and evaluating:

- Projected-related residual impacts on biodiversity;
- The adequacy and effectiveness of mitigation actions; and
- The adequacy and effectiveness of offset actions.

Oyu Tolgoi's understanding of the southern Gobi region biodiversity setting and the potential impacts of Project operations on biodiversity has grown significantly due, in large part, to the completion of a rapid biodiversity assessment program. As well as broadening the understanding of biodiversity, this program has identified a number of knowledge gaps which will be addressed so as to fully understand project impacts, potential mitigation options, and conservation opportunities / offsets available in the region. These knowledge gaps, presented below, will become priorities for monitoring and evaluation in line with Rio Tinto's Guiding Principles regarding biodiversity.

Biodiversity knowledge gaps which have been identified as monitoring and evaluation priorities for Oyu Tolgoi include:

- Movements of Asiatic Wild Ass and other nomadic ungulates;
- Behaviour of Asiatic Wild Ass with respect to transport corridors;
- Barrier effect of roads and other infrastructure, such as electricity transmission lines for Houbara Bustard;
- Impacts of levels of grazing on priority biodiversity features;
- Impacts of aquifer drawdown on pastureland and biodiversity; and
- Sustainable harvesting levels of Saxaul.

Where appropriate, Oyu Tolgoi will seek out opportunities to coordinate and collaborate with other southern Gobi regional biodiversity stakeholders so as to maximise the spatio-temporal breadth and cost-efficiency of its Monitoring and Evaluation Program.

The RBA team has, on behalf of Oyu Tolgoi, has developed a preliminary "Terms of Reference for Monitoring and Evaluation of biodiversity to meet Critical Habitat requirements of IFC Performance Standard 6 / EBRD Performance Requirement 6 for the Oyu Tolgoi project". The preliminary terms of reference provides guidance for Oyu Tolgoi and suitably experienced organisations on what monitoring is required to meet the Project's biodiversity objectives. The document does not describe how the monitoring is to be completed. Oyu Tolgoi is committed to completing a full Biodiversity Monitoring and Evaluation Plan in line with its Biodiversity Action Plan.

A separate Ecosystems Services Monitoring and Evaluation Plan will also be developed for those identified potential impacts to ecosystem services that trigger critical habitat: livestock, biomass for fuel, water regulation, and freshwater. The Ecosystems Services Monitoring and Evaluation Plan will consolidate, within a single document, monitoring and evaluation actions that will already be included in the water, biodiversity and social monitoring and evaluation plans.

6.12 SUMMARY TABLE

Table 6.14 below summarises potential impacts to biodiversity, including proposed design and mitigation measures, the respective management plan (see Part D of this ESIA), and the level of residual impacts.

Table 6.14: Summary of Impacts: Biodiversity

Impact	Receptor	Phase	Likelihood	Consequence	Risk	Design and Mitigation actions
Loss of Bor Ovoo Spring	Asiatic Wild Ass, Goitered Gazelle, Saker Falcon	C, O	Likely	Medium	High	Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of the Bor Ovoo spring in terms of maintaining similar surface and subsurface flow patterns and seasonal variations throughout the year.
Indirect habitat loss due to avoidance of infrastructure	Asiatic Wild Ass, Goitered Gazelle	C, O	Likely	Serious	Critical	Control illegal hunting by Oyu Tolgoi personnel when at work (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties). Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels). Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert). Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait Road. Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue. Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi to airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings).
	Argali, Houbara Bustard	C, O	Likely	Medium	High	
	All other fauna	C, O	Possible / Likely	Minor	Low / Moderate	
Mortality from hunting and collecting facilitated by increased access	Asiatic Wild Ass	C, O	Possible	Major	Critical	Control illegal hunting by Oyu Tolgoi personnel when at work (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties) Engage with local and regional stakeholders to control hunting in the Oyu Tolgoi AoI and more broadly within Khanbogd *soum* (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce
	Argali, Goitered Gazelle, Saker Falcon, Houbara Bustard, Tall Saxaul Forest	C, O	Possible	Serious	High	

Impact	Receptor	Phase	Likelihood	Consequence	Risk	Design and Mitigation actions
	Species with traditional use or commercial value	C, O	Likely	Minor	Moderate	the level and impact of illegal hunting and collecting to baseline levels) Provide all project operations staff and contractors fuel for fires to remove the need for collection of local timber (i.e. Saxaul) Inspect an adequate proportion of all aircraft under Oyu Tolgoi control for illegal wild animal products Inspect all vehicles entering the Oyu Tolgoi site for illegal wild animal products
	Species without traditional use or commercial value	C, O	Unlikely	Minor	Low	
Direct mortality from collision with vehicles	All terrestrial fauna	C, O			Low	Provide driver awareness and training for all Oyu Tolgoi staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds). Enforce low speed limits of Oyu Tolgoi vehicles on sealed and unsealed roads on and off-lease (speed limits for Oyu Tolgoi vehicles will be reviewed in consultation with a wildlife expert). Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with Oyu Tolgoi vehicle speed limits) on all public users of the Oyu Tolgoi to Gashuun Sukhait Road. Erect signage on roads to warn drivers of risk of collision with wild animals.
Direct mortality from collision with and electrocution by power transmission lines	Great Bustard, Houbara Bustard, Saker Falcon	C, O	Almost Certain / Likely	Medium	High	Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m) Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary
	All other species of birds	C, O	Almost Certain / Likely / Possible	Minor	Moderate / Low	
Direct mortality from collision with communications towers	All species of birds	C, O	Possible	Minor	Low	None required.
Direct habitat loss under infrastructure	Mongolian Chesney, Asiatic Wild Ass, Goitered Gazelle, Houbara Bustard, Mongolian Ground-Jay	C, O	Almost Certain	Medium	High	Rehabilitate and restore at least equal areas or numbers of priority biodiversity features impacted (in line with Oyu Tolgoi interim Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice) Replace the Bor Ovoo spring and ensure replacement spring mimics the ecological functions of the Bor Ovoo spring.
	All other species of		Likely	Minor	Moderate	

Impact	Receptor	Phase	Likelihood	Consequence	Risk	Design and Mitigation actions
	plants and animals					
Mortality from increased predation rates	Houbara Bustard, Mongolian Ground-Jay	C, O	Likely	Medium	High	Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals. Inspect and remove litter and other anthropogenic waste from along the Oyu Tolgoi to Gashuun Sukhait Road, Oyu Tolgoi to Khanbogd Road and Oyu Tolgoi Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces). Remove nests of birds which predate Bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure.
	All other species of fauna	C, O	Possible / Likely		Low / Moderate	
Decreased plant productivity and sexual reproduction due to dustfall upon vegetation	All species of flora	C, O	Possible / Likely	Low / Medium	Low / Moderate	NA. Dust controls will be implemented as a general management measure. Road sealing is part of Project design.
Decreased animal health and reproduction due to dust exposure	All species of fauna	C, O	Unlikely	Low / Medium	Low	NA. Dust controls will be implemented as a general management measure. Road sealing is part of Project design.

Annex A: RBA Appendix 1: Oyu Tolgoi Biodiversity Strategy

ESIA Appendix 1

Oyu Tolgoi LLC Biodiversity Strategy

The Strategy at a glance

Oyu Tolgoi LLC Biodiversity goal

Oyu Tolgoi seeks to ensure that the biodiversity of the southern Gobi region ultimately benefits from the project's presence in the region. In keeping with the Rio Tinto corporate Biodiversity Strategy, Oyu Tolgoi's goal is to have a net positive impact on biodiversity of the southern Gobi region. Oyu Tolgoi aims to reach this goal by mine closure but will seek opportunities to achieve net positive impact as early as practicable in the project life.

The business case for a biodiversity strategy at Oyu Tolgoi and the associated commitment to Net Positive Impact includes the following considerations:

- ***Rio Tinto Biodiversity Strategy*** The Oyu Tolgoi approach to biodiversity is a southern Gobi region- and project-specific adaptation of the global Rio Tinto biodiversity strategy which has at its core a commitment to Net Positive Impact.
- ***Finance***. A significant proportion of the Oyu Tolgoi project finance comes from three development banks, all of which are applying rigorous performance standards concerning biodiversity.
- ***Access to land and mineral resources*** Leading practice biodiversity management offers an opportunity to differentiate Rio Tinto/Oyu Tolgoi from its competitors and is an important component of Oyu Tolgoi's social 'licence to operate'.
- ***Mongolian Government Biodiversity Policy*** Mongolian government policy and legislation reflects the need to balance economic development through mineral extraction with the need to manage and conserve the nation's natural values.

To achieve its goal of Net Positive Impact on biodiversity Oyu Tolgoi LLC will:

- Identify important biodiversity features (Priority Biodiversity Features) of relevance to the operation and the project-related threats to these biodiversity features.
- Apply the mitigation hierarchy to avoid, minimise and rehabilitate projected-related impacts to biodiversity.
- Develop a Biodiversity Offsets Plan and identify Additional Conservation Actions (ACAs) that will, over time, compensate for the residual impacts of the project on biodiversity of the southern Gobi region.
- Develop a Monitoring and Evaluation program which is capable of tracking Oyu Tolgoi's journey towards NPI by quantifying the residual impacts (pressures) on

biodiversity features, the state of biodiversity features and the adequacy of management responses.

- Facilitate the development, testing and implementation of tools to track and verify the project's journey towards NPI.
- Ensure that mitigation and offset objectives, actions and targets are clearly defined within the operations Biodiversity Action Plan (BAP) and that the BAP is integrated into the Oyu Tolgoi Environment Management System.
- Seek to capitalise on its position as a regional industry leader in order to minimise the cumulative impacts of mining developments on biodiversity of the southern Gobi region region.
- Engage and consult with biodiversity stakeholders at all stages of the project and build cross-sector partnerships with local communities, various levels of Mongolian government, non-government organisations and academic institutions.
- Ensure that the Oyu Tolgoi Biodiversity Strategy is communicated to and aligned with all other Oyu Tolgoi environmental and social/community strategies.

Oyu Tolgoi LLC Biodiversity Strategy

The Strategy in detail

This strategy outlines the approach the Oyu Tolgoi LLC project will take to achieve Net Positive Impact on biodiversity in the southern Gobi region of Mongolia. The core of the strategy comprises approaches to measuring, mitigating, offsetting and evaluating impacts on biodiversity. Furthermore, an approach to biodiversity partnerships and relationships with Government bodies and civil society stakeholders is also outlined.

The strategy outlines Oyu Tolgoi's commitment to biodiversity management and conservation through a Net Positive Impact goal. The strategy also discusses Oyu Tolgoi's aspirations to use the extensive Rio Tinto biodiversity toolkit and expertise to work with key stakeholder to deliver regional sustainable development benefits.

1. Background

1.1. The Rio Tinto Biodiversity Strategy

Rio Tinto announced a leading-edge biodiversity strategy in 2004 at the global IUCN World Conservation Congress, making a corporate commitment to a Net Positive Impact on biodiversity. This policy goal was reaffirmed by the Rio Tinto CEO Tom Albanese in 2008 and 2010.

Rio Tinto regards managing biodiversity risk as critical in maintaining and potentially enhancing access to new land and resources by demonstrating that Rio Tinto operations can be operated in a way that delivers both mineral resource and biodiversity conservation value and benefits. The business case extends to access to capital and insurance; access to markets for products; access to human capital; and obtaining a seat at the rapidly developing global and national policy tables. The Oyu Tolgoi approach to biodiversity management is a southern Gobi- and project-specific adaptation of the globally generic Rio Tinto biodiversity strategy. Therefore the core of this Rio Tinto strategy is quoted here for reference.

Rio Tinto (2004, 2008) made the following position statement on biodiversity

"Rio Tinto recognizes that conservation and responsible management of biodiversity are important business and societal issues. Our goal is to have a net positive impact on biodiversity"

"We are committed to:

- *The identification of biodiversity values impacted by our activities*
- *The prevention, minimization and mitigation of biodiversity risks through the business cycle*
- *Responsible stewardship of the land we manage*
- *The identification and pursuit of biodiversity conservation opportunities*
- *The involvement of communities and other constituencies in our management of biodiversity issues"*

Rio Tinto (2008) elaborated the position statement with a set of principles:

- *Our goal is to have a net positive impact on biodiversity by minimising the negative impacts of our activities and by making appropriate contributions to conservation in the regions in which we operate.*
- *We are committed to the conservation of threatened and endemic species and high priority conservation areas, and support local, national and global conservation initiatives.*
- *We will seek equity and the reconciliation of differing perspectives and ideals in biodiversity decisions and actions.*
- *We will enhance biodiversity outcomes through consultation, constructive relationships, and partnerships with key stakeholders.*
- *We will integrate the identification, evaluation, and management of biodiversity issues into the planning, decision making, and reporting processes throughout the business cycle.*
- *We will apply appropriate expertise and resources to biodiversity issues, building internal and external capacity where necessary.*
- *Subject to appropriate consent, we promote the collection, analysis, and dissemination of biodiversity information and knowledge.*

1.2 Biodiversity within Rio Tinto Standards

Biodiversity is a core component of existing Rio Tinto Standards. Completion of a Biodiversity Action Plan by a business unit is part of the Land Use Stewardship Standard (E9). Rio Tinto has ranked operations globally in terms of their biodiversity value and risk. Those sites ranking High or Very High are mandatorily required to complete a Biodiversity Action Plan by 2015 under the Tier 2 Biodiversity Target. Oyu Tolgoi has not yet been formally ranked, however a cursory assessment (TBC unpubl. data) indicates the operation counts amongst these higher priority Rio Tinto operations for biodiversity.

1.3 Oyu Tolgoi Business Case for a biodiversity strategy

The business case for a biodiversity strategy at Oyu Tolgoi, and the associated commitments to Net Positive Impact, includes the following considerations:

1.3.1 **Finance**. A significant proportion of the Oyu Tolgoi project finance comes from three development banks, all of which are applying the International Finance Corporation's Performance Standard 6[1] or variations thereof. This performance standard is the most rigorous in existence concerning biodiversity and compliance requires and encourages leading edge biodiversity management, including:

- Identification of Modified, Natural and Critical Habitat.

[1] The Oyu Tolgoi project is required to comply with International Finance Corporation (IFC) *Performance Standard 6 - Biodiversity Conservation and Sustainable Natural Resource Management* as published April 30, 2006

- Design and implementation of mitigation and biodiversity offsets for impacts on Natural and Critical Habitat.

- Creation of partnerships with external stakeholder institutions for effective biodiversity management.

- Monitoring and evaluation of biodiversity gains and losses.

Critical Habitat is a concept within the IFC Performance Standard 6 and is defined as areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or which are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic or cultural importance to local communities.

The entire Oyu Tolgoi project area of influence is associated with Critical Habitat for a range of biodiversity values. As such, Performance Standard 6 requires the Oyu Tolgoi project to ensure that:

- There is no measurable adverse impacts on the ability of the critical habitat to support established populations of critical habitat-qualifying species or the functions of the critical habitat

- There is no reduction in the population of any recognized critically endangered or endangered species

- Any lesser impacts are mitigated appropriately and in accordance with Performance Standard 6..

1.3.2 **Access to land and mineral resources**: Mongolia is a mineral rich country in which a large number of mining companies are increasingly active. First, to the degree to which Government is concerned about biodiversity issues, access to land and resources in the future will be influenced by past environmental performance. Leading practice biodiversity management therefore offers an opportunity to differentiate Rio Tinto/Oyu Tolgoi from its competitors. Second, to the degree to which local communities and civil society value or have rights over biodiversity or biodiversity-linked natural resources, current and future local social 'licence to operate' will be partly dependent on the sound stewardship of biodiversity, ecosystems and their human-derived services.

1.3.3 **Mongolian Government Biodiversity Policy**. Mongolia is a signatory of most international environmental conventions and is an established part of the mainstream global environmental and conservation community. The Mongolian Government has an active interest in biodiversity conservation with a significant area of land gazetted under protected areas law (13.4%, WDPA 2011). More recently the Mongolian government has made a legislative commitment to conserve 30% of the country (46.9 million ha) in protected areas by 2030. The government is particularly cognisant of the need to balance economic development through mineral extraction with the need to manage and conserve its

significant natural values. The government is thought to be seeking legislative change to manage these tensions and is in discussions with several organisations concerning biodiversity offsets. Although at early stages, these engagements may well evolve into a national biodiversity offset policy. Rio Tinto has taken a leadership role globally on biodiversity offsets and has already developed world-leading best practice technical guidance on biodiversity offsets. The Oyu Tolgoi biodiversity strategy will provide an important case study resource for the Mongolian government as it explores options to strengthen and revise policies and legislation relating to biodiversity management.

1.4 Oyu Tolgoi biodiversity goal

Oyu Tolgoi has developed its biodiversity policy goal. This goal is presented below and references both the spatial and temporal scale of the projects commitment to biodiversity management:

Oyu Tolgoi Biodiversity goal

Oyu Tolgoi seeks to ensure that the biodiversity of the southern Gobi ultimately benefits from the project's presence in the region. In keeping with the Rio Tinto corporate Biodiversity Strategy, Oyu Tolgoi's goal is to have a net positive impact on biodiversity of the southern Gobi region of Mongolia. Oyu Tolgoi aims to reach this goal by mine closure but will seek opportunities to achieve net positive impact as early as practicable in the project life.

2. The Strategy

2.1. Operational Excellence

Operational excellence in biodiversity management follows a set of processes common to all Rio Business Units. Over the past 10 years Rio Tinto has been actively working in partnership with some of the world's leading conservation scientists, organisations and intergovernmental agencies[2] to develop a set of best practice biodiversity tools and methodologies.

2.1.1. Oyu Tolgoi's approach to prioritising and managing biodiversity features.

Oyu Tolgoi takes a value and risk-based approach to prioritising biodiversity features following the Rio Tinto Biodiversity Action Planning system (Figure 1) to identify the most important biodiversity features of relevance to the operation.

These include:

- **All natural habitats** (unless experts and stakeholders approve removal of the particular habitat from the BAP due to its identified low conservation value).
- **Species of conservation priority** (includes all globally and nationally listed threatened species, restricted range species and priority migratory and congregatory species)
- **Priority ecosystem services and other site values** (including cultural sites and practices [e.g. hunting etc.])
- **Sites of conservation importance** (includes designated sites [e.g. protected areas at IUCN levels I-VI, Ramsar sites, World Heritage Sites, National Nature Reserves, State and Local Nature Reserves] and some undesignated sites [e.g. Key Biodiversity Areas, Important Bird Areas, etc.]

Following the criteria outlined above, priority biodiversity features for the Oyu Tolgoi project will be as diverse as: rare and very rare medicinal plants (important to herder communities around the Oyu Tolgoi mine site and infrastructure); protected areas such as the Small Gobi SPA (high value to the national government); and threatened fauna species such as Asiatic Wild Ass and Houbara Bustard (important to the national, regional and global conservation communities including organisations such as BirdLife International and IUCN).

2.1.2. Oyu Tolgoi's approach to the mitigation hierarchy.

In accordance with the Rio Tinto approach to biodiversity management, Oyu Tolgoi applies the mitigation hierarchy in managing its biodiversity risks and opportunities (Figure 2). This means that opportunities to mitigate impacts on biodiversity are sought through avoidance, minimisation and rehabilitation, in that order. When this hierarchy of mitigation opportunities is exhausted or optimised for biodiversity, the residual impacts are measured and biodiversity offsets and additional conservation actions are sought to bridge the residual gap towards NPI. Oyu Tolgoi defines each of the steps in the mitigation hierarchy, i.e. avoidance, minimisation, rehabilitation, offsets and additional conservation actions as follows:

[2] Rio Tinto biodiversity program has been a collaborative process involving several of the world's leading conservation NGOs including: Fauna & Flora International; Conservation International; Birdlife International; Royal Botanic Gardens Kew; and the IUCN.

Avoidance:
Avoidance actions are those that either change or stop mining and refining actions before they take place, preventing their expected impacts on biodiversity. Avoidance involves a decision to change the expected or normal course of action.

Minimisation:
Minimisation actions are those that reduce the severity of impacts on biodiversity that result from mining and processing actions already under way. These actions reduce the likelihood or magnitude of biodiversity impacts, but cannot completely prevent them. It can sometimes be difficult to demarcate between avoidance and minimisation because some actions have aspects of both.

Rehabilitation:
Rehabilitation actions involve the preparation of safe and stable landforms on sites that have been disturbed by our activities, followed by re-vegetation with the aim of establishing a specific habitat type. Restoration is different to rehabilitation in that the aim, as far as practicable, is to recreate the original pre-disturbance habitat type. Both rehabilitation and restoration must generate measurable biodiversity value in order to qualify in NPI calculations.

Biodiversity Offsets
Biodiversity offsets are conservation actions designed to compensate for the unavoidable residual impacts on biodiversity caused by a project. Offsets should never be employed in the place of appropriate on-site avoidance and minimisation measures but should be used to address residual gaps. Offsets typically take the form of either 'averted disturbance' of habitat (the offset must demonstrate that the disturbance was inevitable without intervention) or ecological restoration of degraded habitat. Offset actions can be applied within discrete 'offset areas', or if appropriate, more regionally through programmes and policy interventions (such as concerning the control of hunting).

Additional Conservation Actions
Additional Conservation Actions are actions intended to benefit biodiversity (e.g. capacity building and environmental education programs) but which are not considered offsets since their effects or outcomes are often difficult to quantify. Such biodiversity outcomes, while qualitative, will form an essential part of Oyu Tolgoi's contribution to biodiversity conservation in the southern Gobi region.

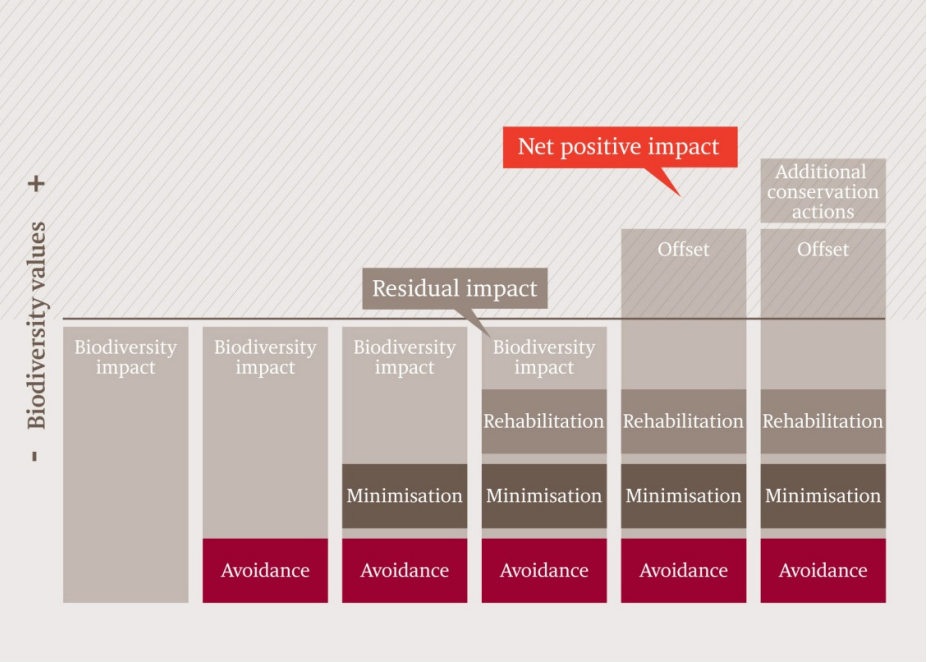


Figure 1: *The mitigation hierarchy and how it will be applied throughout the Oyu Tolgoi project life to achieve a Net Positive Impact on biodiversity values (taken from Rio Tinto 2008)*

Actions to avoid, minimise and rehabilitate high and critical risk impacts on priority biodiversity features have been identified and discussed within the Oyu Tolgoi project Environmental & Social Impact Assessment (ESIA) process. The ESIA documentation includes mitigation actions that have or are currently being applied during the design and construction phases as well as actions which will be implemented during the operation and closure phases of the project. Construction phase mitigation actions are captured in the Construction Flora and Fauna Management Plan included as part of the ESIA document set.

Rehabilitation and restoration efforts across the Oyu Tolgoi project will be managed under a rehabilitation management plan which will form an integral component of the Oyu Tolgoi Environmental Management System (EMS).

Biodiversity mitigation actions to be implemented during the project operations phase will be captured in detail in the Oyu Tolgoi Biodiversity Action Plan (BAP). The biodiversity specific objectives, targets, actions and accountabilities detailed in the BAP will be integrated with the Oyu Tolgoi Environmental Management System.

The Biodiversity Action Planning process focuses on specific biodiversity issues and the identification of discrete management solutions which mitigate impacts on biodiversity. Because of their scale biodiversity offsets will be developed through a separate but complimentary process (see section 2.1.2) with specific offset actions later integrated into the BAP.

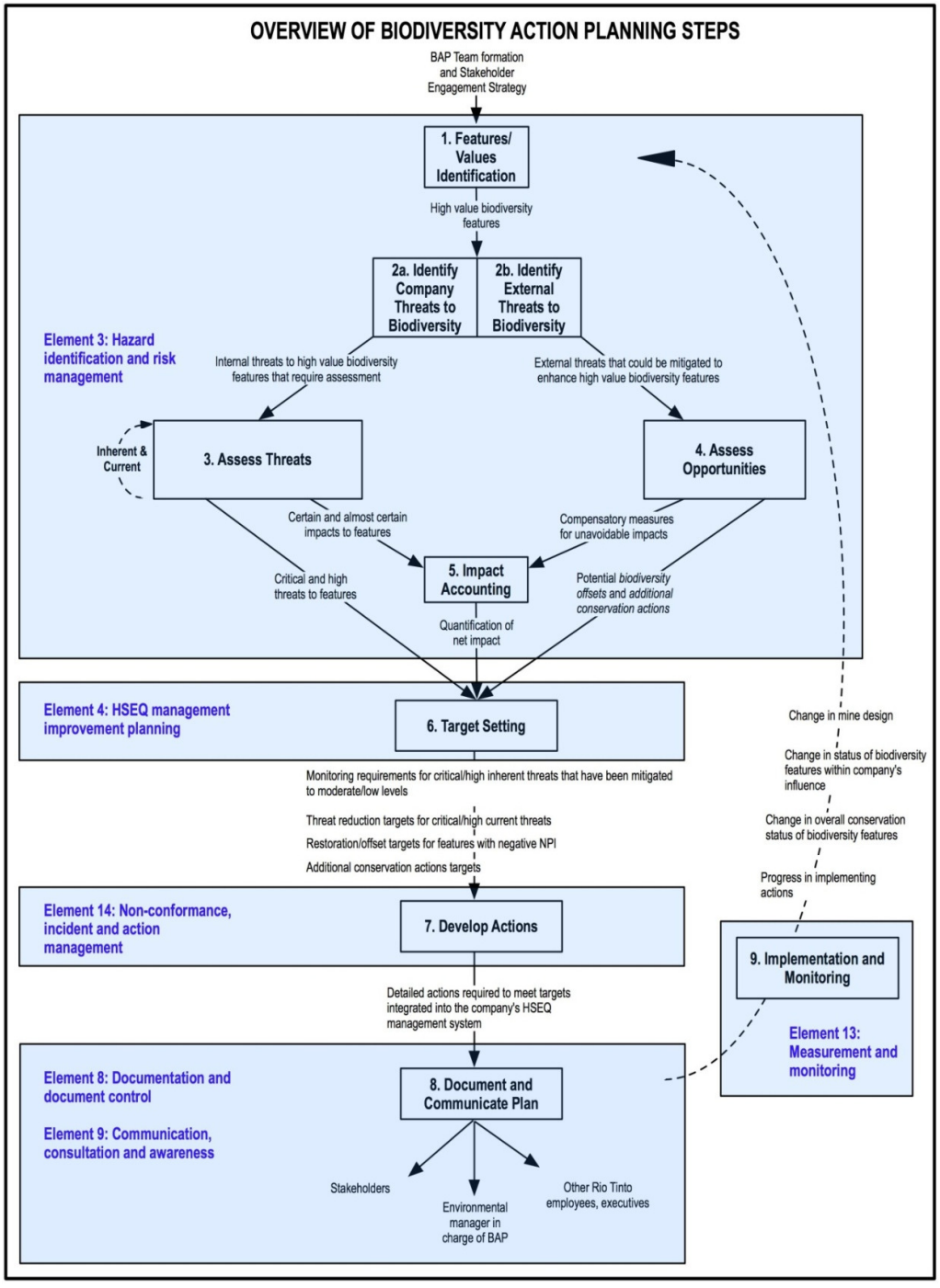


Figure 2: *Step-by-step guidance for development of a Biodiversity Action Plan (BAP), presented in nine sequential stages (taken from Rio Tinto 2010a).*

2.1.3. Oyu Tolgoi's approach to biodiversity offsets.

The Oyu Tolgoi project will have residual impacts on biodiversity. The development of an integrated package of offsets and additional conservation actions, will therefore allow Oyu Tolgoi to compensate for project-related residual impacts and achieve its goal of net positive impact on biodiversity.

Oyu Tolgoi, in conjunction with Rio Tinto's biodiversity partners, regional stakeholders and other biodiversity experts will develop an offsets strategy for the Oyu Tolgoi project. This strategy will, as far as practicable, take a landscape-level approach to biodiversity offsets in the southern Gobi region. The need for a landscape-level approach is due in part to the scale of ecological boundaries within the system, largely because of the inherent ecology of the priority biodiversity features (e.g. nomadic Asiatic Wild Ass).

Oyu Tolgoi will draw on extensive guidance developed by Rio Tinto on the technical issues surrounding the measures of biodiversity losses and gains and the political and stakeholder processes required in setting up biodiversity offsets. This guidance will form the framework for the design and implementation of biodiversity offsets suitable for the Oyu Tolgoi project (see Figure 3).

Concurrently, Rio Tinto is contributing to landscape-scale biodiversity conservation planning in the Gobi region through the provision of financial support to The Nature Conservancy's (TNC) Gobi Region *Development by Design* Landscape Assessment Project. The aim of the project is to help reduce "*conflicts between development and conservation goals, avoid or offset the impacts of development, and support win-win solutions for the Gobi region*". This initiative will develop a portfolio of priority conservation areas throughout the Gobi region based on identification of conflicts between conservation and development and application of the mitigation hierarchy at the landscape level. Oyu Tolgoi LLC will work closely with TNC to ensure biodiversity-related information held by Oyu Tolgoi is fed in to TNC's landscape assessment process and, conversely, that outputs of TNC's project inform the Oyu Tolgoi biodiversity program in a timely manner.

The Oyu Tolgoi approach to biodiversity offsets will be adaptive; responding where appropriate, to new or updated ecological information and to changes in stakeholder expectations. The results of TNC *Development by Design* program, in particular, are likely to provide new insights and opportunities for the application of biodiversity offsets in the southern Gobi region. By working closely with TNC, Oyu Tolgoi will ensure that the results of the *Development by Design* program are captured and incorporated into Oyu Tolgoi's ongoing approach to biodiversity offsets.

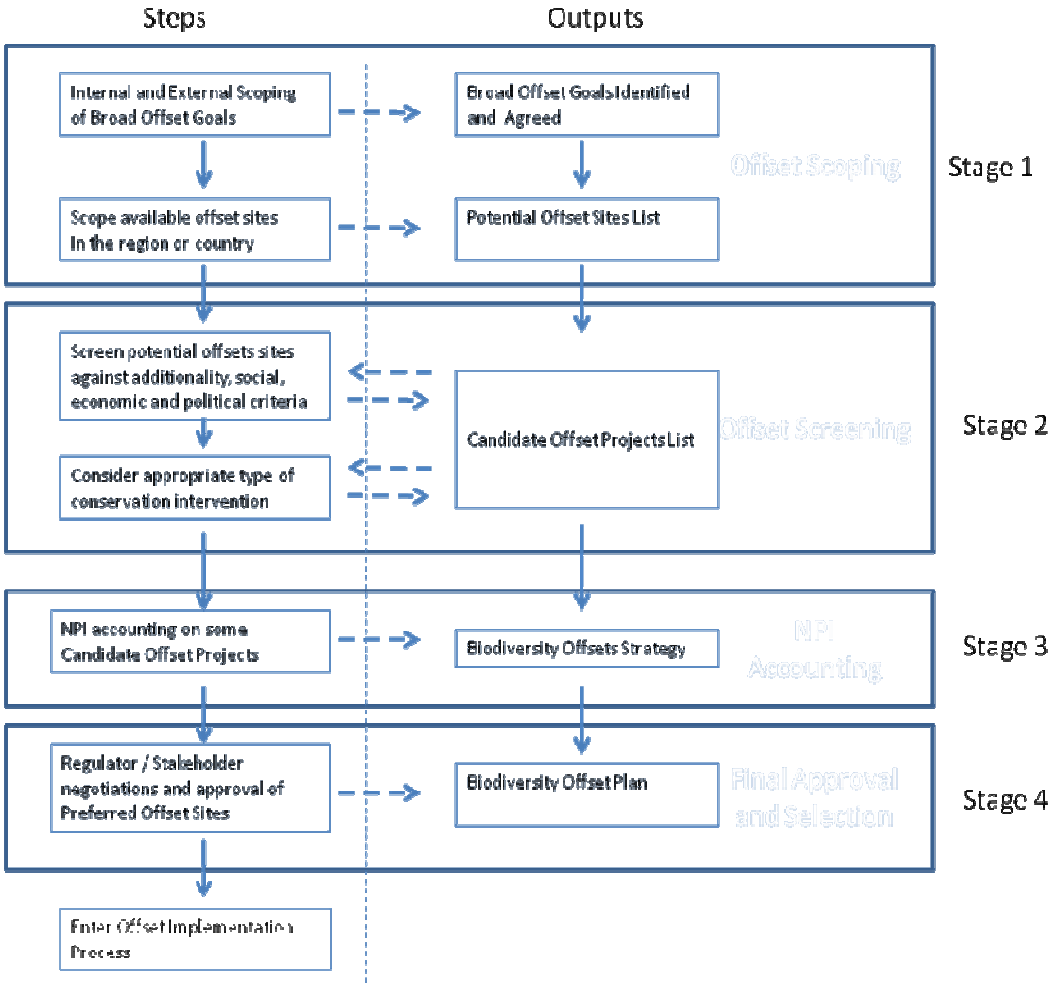


Figure 3. *The Steps and Stages of Biodiversity Offset Design. Stages are shown as blue boxes: Offset Scoping, Offset Screening, NPI Accounting, and Final Approval and Selection (taken from Rio Tinto 2010b).*

2.1.4. Oyu Tolgoi's approach to Monitoring and Evaluation.

A well-designed, cost-effective monitoring and evaluation program is essential to inform Oyu Tolgoi's adaptive approach to biodiversity management. Furthermore, it will fundamentally underpin Oyu Tolgoi's ability to demonstrate its progress towards the goal of Net Positive Impact to both internal and external stakeholders (see Section 2.1.5 below).

Oyu Tolgoi will draw on guidance from recent Rio Tinto technical publications, from the International Finance Corporation Performance Standard 6 and internal and external experts (academic, government and non-government institutions) to develop an effective monitoring and evaluation program. Oyu Tolgoi will select appropriate methods for measuring and evaluating:

- Projected-related residual impacts on biodiversity
- The adequacy and effectiveness of mitigation actions
- The adequacy and effectiveness of offset actions.

Where appropriate, Oyu Tolgoi will seek out opportunities to coordinate and collaborate with other southern Gobi region biodiversity stakeholders so as to maximise the spatio-temporal breadth and cost-efficiency of its monitoring and evaluation program.

2.1.5. Oyu Tolgoi's approach to Net Positive Impact verification

The IUCN, at the request of - and in collaboration with - Rio Tinto, has convened a Net Positive Impact Protocol & Review Panel Team (NPIP&RPT) that will develop, test and implement an independent process for verification of Rio Tinto's commitment to its NPI objective.

As a project committed to having a net positive impact on biodiversity of the southern Gobi region, Oyu Tolgoi will:

- Where appropriate, facilitate and contribute to the development and testing of NPIP&RPT tools for NPI verification.
- Participate in regular, independent application of these tools (once fully developed) throughout the Oyu Tolgoi project life in order to track the adequacy of Oyu Tolgoi's progress towards NPI and ultimately to verify that Oyu Tolgoi has achieved its NPI goal.

2.1.6. Oyu Tolgoi's approach to Research and Environmental Education.

Where appropriate, Oyu Tolgoi will support research that contributes to the overall understanding of biodiversity and environmental management in the southern Gobi region. Oyu Tolgoi will look to establish working relationships with research institutions to facilitate biodiversity research and promote exchange of knowledge between these institutions and its internal Biodiversity Research Team.

Oyu Tolgoi recognises that environmental education of its staff and contractors is an integral part of mitigating project impacts on biodiversity and will implement and frequently update a range of environmental training and educational initiatives on site. Moreover, Oyu Tolgoi aims to enhance awareness of biodiversity conservation issues in the region by providing environmental training and education opportunities to local communities.

2.2. Risks to the achieving NPI

2.2.1. Regional Leadership.

Biodiversity management of the southern Gobi region requires a regional scale approach due, in part, to the broad landscapes and nomadic habits of many conservation significant species which occur in the region. Efforts to appropriately manage biodiversity will therefore be of limited value if other developers in the region do not (voluntarily or legally) match up to Oyu Tolgoi's high standards. In other words, the cumulative impacts of mining development in the southern Gobi region are predicted to be high (Walton 2010) and it is therefore in Oyu Tolgoi's interest to be a sector and regional leader in managing biodiversity.

Oyu Tolgoi is the largest development project in Mongolia and regarded as a key to the country's economic development. This leadership provides Oyu Tolgoi with the opportunity to position itself as a sector leader within the growing mining industry in Mongolia, and a regional leader within the southern Gobi region. Sustainable development is a cornerstone of Rio Tinto's project development policy and industrial growth model. Environmental sustainability is one aspect of this.

Oyu Tolgoi has taken significant steps to position itself as a sector and regional leader in managing biodiversity and in driving sustainable regional development. Oyu Tolgoi has established a Memorandum of Understanding with Energy Resources LLC which will facilitate cooperation in ecological research and monitoring and promote an integrated approach to biodiversity management. Going forward, Oyu Tolgoi will develop and implement local and regional-level planning and infrastructure initiatives. These initiatives will provide training and resources to assist soum and aimag government better manage infrastructure development, land use and protect natural resources, including biodiversity.

In the future, Oyu Tolgoi plans to facilitate the development of a regional infrastructure biodiversity mitigation plan. This could involve facilitating leadership by the government or other third party, of a consortium of stakeholders to collectively design, manage and measure issues around regional scale infrastructure. Examples include export roads, railways, groundwater use and electricity generation and transmission systems. The most critical issue which has arisen to date is the potential long term impact of the Oyu Tolgoi export road/national highway through the global stronghold of Asiatic Wild Ass.

2.2.2. Strategic Alliances.

Biodiversity is a societal issue, therefore the process of involving stakeholders in decision making around biodiversity is as important as the content of a strategy. Cross-sector partnership with government, NGOs, academic institutions and others is considered essential for the effective design and implementation of the Oyu Tolgoi biodiversity programme. Consultation with local, national and global stakeholders is an important step in sustaining support and ownership of company biodiversity programmes.

There is a strong cultural pride in the environment in Mongolia. The southern Gobi region is essentially economically and culturally sustained by the natural environment: this is because the majority of people and income generation is based on a primary relationship with natural resources. Singular amongst these is herding: historically deep and spatially extensive, the Oyu Tolgoi project is essentially overlaid onto this pre-existing land use. Investment into social and ecological research - facilitated by alignment of the Oyu Tolgoi biodiversity and community strategies - is necessary to better understand this system and its interdependencies.

Annex B: RBA Appendix 3: Biodiversity Impacts and Mitigation Actions for the Oyu Tolgoi Project

the biodiversity consultancy

FAUNA & FLORA INTERNATIONAL

ESIA Appendix 3

Biodiversity Impacts and Mitigation Actions for the Oyu Tolgoi Project

April 2012

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This report has been written by:
The Biodiversity Consultancy Ltd and Fauna & Flora International, Cambridge, UK,
with contributions from Oyu Tolgoi LLC and the Wildlife Conservation Society

Contents

1 Summary

This document briefly discusses the major potential impacts on biodiversity from the Oyu Tolgoi project, and details the major mitigation actions that will be undertaken. It is based upon a series of eight Biodiversity Management Plan Options Papers and a summary Biodiversity Management Plan Options Paper produced by the Rapid Biodiversity Assessment team to help the Oyu Tolgoi project meet the requirements of the International Finance Corporation's Performance Standard 6 (IFC PS6), the European Bank for Reconstruction and Development's Performance Requirement 6 (EBRD PR6), and Rio Tinto's Biodiversity Strategy (Rio Tinto 2010). It is complemented by the accompanying five appendices, the Biodiversity Strategy, Critical Habitat Assessment, Offsets Strategy, Net Positive Impact forecast and Monitoring & Evaluation.

This document discusses major potential impacts on priority biodiversity features. These are features for which the area of influence (Khanbogd soum) was found to qualify as:

- Tier 1 Critical Habitat: Asiatic Wild Ass
- Tier 2 Critical Habitat: Mongolian Chesney, Argali, Goitered Gazelle, Short-toed Snake-eagle, granite outcrop floral communities, and four ecosystem services (water regulation, livestock [pasture], biomass fuel and freshwater)
- Additional significant features under Rio Tinto Biodiversity Action Plan guidelines: Mongolian Gazelle, nine bird species and two habitats

Before the application of the mitigation actions, the Oyu Tolgoi project will have six main impacts on these priority biodiversity features:

- Direct habitat loss
- Indirect habitat loss (due to avoidance of infrastructure by animals)
- Fragmentation (reduced connectivity) of animal populations
- Direct mortality (from collision with vehicles and power lines, and electrocution by power lines)
- Indirect mortality from hunting and collecting (from increased numbers of people and increased access)
- Indirect mortality from increased populations of natural predators (from increased food and nesting opportunities)

In addition, some hydrological uncertainties could have significant consequences, and could require mitigation actions. The Oyu Tolgoi project has committed to undertake further research and monitoring to better assess these uncertainties.

The likelihood, consequence and risk of each impact were assessed for each priority biodiversity feature for each infrastructure unit. For all impacts assessed as Critical Risk or High Risk, mitigation options were identified. Actions required to mitigate low and moderate risk

impacts to priority biodiversity features or impacts to biodiversity features not of high conservation concern, are not presented in this document. These mitigation actions will be articulated in biodiversity-specific construction and operational management plans currently in development by the Oyu Tolgoi project.

The Oyu Tolgoi project has committed to adopt the mitigation options proposed for the Critical Risk and High Risk impacts, as summarised in Table 1. The Oyu Tolgoi project did not adopt a number of other options, almost all avoidance options, for various reasons, notably the advanced state of construction.

Implementation of these mitigation actions and offsets will reduce the residual impacts on priority biodiversity features, as quantified in the accompanying document 'Net Positive Impact forecast for the Oyu Tolgoi project'. Moreover, demonstration of best-practice road mitigation is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure.

Table 1: Mitigation actions for all Critical and High Risk impacts agreed and committed to by Oyu Tolgoi

Infrastructure	Step in the mitigation hierarchy	Action
Roads	Minimise	Deter vehicles leaving, but facilitate wildlife crossing, the OT-GS, OT-Khanbogd and OT-airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings)
	Minimise	Provide driver awareness and training for all OT staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds)
	Minimise	Enforce no unauthorised waste disposal/littering from OT vehicles or around work place
	Minimise	Enforce low speed limits of OT vehicles on sealed and unsealed roads on and off-lease (speed limits for OT vehicles will be reviewed in consultation with a wildlife expert).
	Minimise	Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with OT vehicle speed limits) on all public users of the OT-GS Road
	Minimise	Restrict OT vehicles from parking beside roads except in an emergency or to manage fatigue
	Minimise	Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue
	Minimise	Erect signage on roads to warn drivers of risk of collision with wild animals
	Rehabilitate	Inspect and remove litter and other anthropogenic waste from along the OT - GS Road, OT - Khanbogd Road and OT Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces)
Hunting and collecting	Minimise	Control illegal hunting by OT personnel (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties)

	Minimise	Engage with local and regional stakeholders to control hunting in the OT AoI and more broadly within Khanbogd soum (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels)
	Minimise	Provide all project operations staff and contractors fuel for fires to prevent collection of local timber (i.e. saxaul)
	Minimise	Inspect an adequate proportion of all aircraft under OT control for illegal wild animal products
	Minimise	Inspect all vehicles entering the OT site for illegal wild animal products
Regional	Minimise	Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd soum (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team)
Power Lines	Minimise	Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m)
	Minimise	Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary
	Rehabilitate	Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals
	Rehabilitate	Remove nests of birds which predate bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure
Rehabilitation	Rehabilitate	Rehabilitate and restore at least equal areas or numbers of features impacted (in line with Oyu Tolgoi Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice)
	Rehabilitate	Ensure replacement spring mimics the ecological functions of Bor Ovoo spring
Offsets	Offset	Undertake adequate offset actions to achieve a Net Positive Impact at low risk as discussed in the separate offsets discussion paper

2 Purpose of this paper

This document briefly discusses priority biodiversity features of the Oyu Tolgoi project area in southern Mongolia and major potential biodiversity impacts from the Oyu Tolgoi project, before detailing mitigation actions that Oyu Tolgoi LLC will undertake. It is the result of discussion between Oyu Tolgoi LLC and the Rapid Biodiversity Assessment team regarding appropriate mitigation actions for biodiversity impacts. These discussions were based upon a series of eight Biodiversity Management Plan Options Papers and a summary Biodiversity Management Plan Options Paper produced by the rapid biodiversity assessment team to help the Oyu Tolgoi project meet the requirements of the International Finance Corporation's Performance Standard 6 (IFC PS6), the European Bank for Reconstruction and Development's Performance Requirement 6 (EBRD PR6), and Rio Tinto's Biodiversity Strategy (Rio Tinto 2010).

This document is complemented by the accompanying appendices, which together provide a summary explanation of how the Oyu Tolgoi project will comply with Paragraph 10 of IFC PS6/Paragraph 14 of EBRD PR6:

- Appendix 1 Oyu Tolgoi LLC Biodiversity Strategy
- Appendix 2 Critical Habitat Assessment
- Appendix 4 Offsets Strategy
- Appendix 5 Net Positive Impact forecast
- Appendix 6 Monitoring & Evaluation

This document does not discuss the following points which were discussed in each of the eight Biodiversity Management Plan Options Papers:

- Description of each infrastructure component
- Sphere of influence of each infrastructure component

3 Priority biodiversity features within area of influence

Priority biodiversity features for the Oyu Tolgoi project comprise all biodiversity features for which the Oyu Tolgoi project area of influence qualifies as Critical Habitat under Paragraph 9 of IFC PS6 / Paragraph 13 of EBRD PR6 as well as all biodiversity features which are considered significant under Rio Tinto Biodiversity Action Plan guidelines. The Oyu Tolgoi project area of influence is considered here to be the sum of the areas of influence for each of the infrastructure components, which is the whole of Khanbogd soum as impacted by the secondary impact of illegal hunting, as used by the ESIA (Oyu Tolgoi LLC in prep.). However the Critical Habitat Assessment and the Oyu Tolgoi Project Guidance Note on Critical Habitat note that some impacts may extend beyond this area, notably the secondary impact of illegal hunting, but also the possible impacts on habitat and water availability over the deep Gunii Hooloi, Galbyn Gobi and Durulj Mount Southern aquifers. For the purpose of planning mitigation actions, a practical area of influence is needed, and is defined as Khanbogd soum. It is recognised that the secondary impact of illegal hunting may extend further, and it is recommended that offset and additional conservation actions are adequate to address this possible additional area of impact. The impacts on the aquifers are inadequately known and it is recommended that these are subject to further monitoring and research.

Although there has been limited baseline surveying, and some priority species may remain undetected, the Critical Habitat analysis was based on the best available maps of predicted distribution which have been developed or are under development for most taxa. National and international expert opinion was also solicited to ascertain inclusion of all plausible priority species. The monitoring and evaluation protocols to be developed in 2012 will also address the need for improved baseline data.

3.1 Biodiversity features which qualify for Critical Habitat

The rapid biodiversity assessment team's Critical Habitat Assessment (Appendix 2) found that the area of influence (Khanbogd soum) is:

- Tier 1 Critical Habitat for Asiatic Wild Ass;
- Tier 2 Critical Habitat for Mongolian Chesney, Argali, Goitered Gazelle, Short-toed Snake-eagle, granite outcrop floral communities, and four ecosystem services (water regulation, livestock [pasture], biomass fuel and freshwater).

A summary of the biodiversity values identified as qualifying for Critical Habitat is given in Table 2

Table 2: Critical Habitat qualifying biodiversity features

Criterion	Qualifying value	Biodiversity type	Critical Habitat category
1. Critically Endangered or Endangered species	Asiatic Wild Ass	mammal	Tier 1 (globally important concentrations of a globally Endangered species: >10% of the global population in the unit of analysis)
	Mongolian Chesney	plant	Tier 2 (nationally important concentrations of a potentially nationally Endangered species: >10% of the national population in the unit of analysis)
	Argali	mammal	Tier 2 (nationally important concentrations of a nationally Endangered species: >10% of the national population in the unit of analysis)
	Short-toed Snake-eagle	bird	Tier 2 (nationally important concentrations of a nationally Endangered species: >10% of the national population in the unit of analysis)
2. Endemic or restricted-range species	Not triggered		
3. Migratory or congregatory species	Goitered Gazelle	mammal	Tier 2 (nationally important concentrations of a migratory species: >1% of the global population in the unit of analysis)
4. Unique assemblages of species	Granite outcrop floral communities	species assemblage	N/a
5. Key evolutionary processes	Not triggered		
6. Key ecosystem services	Water regulation	ecosystem service	N/a
7. Biodiversity of social, economic or cultural importance to local communities	Livestock (pasture)	ecosystem service	N/a
	Biomass fuel	ecosystem service	N/a
	Freshwater	ecosystem service	N/a

Ecosystem services (Criteria 6 and 7 in Table 2) are considered to be a component of biodiversity but impacts and mitigation actions on ecosystem services are not discussed here because these need socio-economic, rather than biodiversity, assessment.

3.2 Additional biodiversity features considered significant under Rio Tinto Biodiversity Action Plan guidelines

All biodiversity features which qualify for Critical Habitat are considered to be significant under Rio Tinto Biodiversity Action Plan guidelines. In addition, Rio Tinto considers other key stakeholder biodiversity features (which may be primarily of local rather than global concern) within Biodiversity Action Plans (i.e. impacted features for which action may be needed). Within the Oyu Tolgoi project area of influence, these are considered to comprise:

- all globally and nationally threatened species
- all globally restricted-range species (i.e. terrestrial and freshwater fauna with ranges of <

50,000 km^2; expert advice is needed to identify restricted-range flora)
- all habitats of conservation value; following the Critical Habitat report (Appendix 2), these are identified at an ecosystem level
- key habitats (finer-scale than ecosystems) advocated by stakeholders as documented in the Critical Habitat Assessment (Appendix 2)

3.3 Full set of priority biodiversity features

A full list of priority biodiversity features, combining those identified in Sections 3.1 and 3.2, is presented in Table 3. Additional plants, including those listed as Very Rare in the national *Law on Natural Plants,* may occur in the Oyu Tolgoi project sphere of influence (18 such species were identified as known or likely from the area in Appendix 2). There is very limited data on their distribution, status and ecological requirements, and they are considered to be sufficiently represented here by Mongolian Chesney which is the only species triggering Critical Habitat (Appendix 2). This will be updated as further data becomes available, such as in the forthcoming Mongolian Red List for Plants, and additional species may need to be treated separately.

Not all priority biodiversity features listed in Table 3 were included in all previous iterations of Biodiversity Management Plan Options Papers. Knowledge of features' distribution and status has increased over time, causing some features to be excluded and others to be included. Table 3 reflects best current knowledge.

All priority biodiversity features are priorities but the ungulates, notably Asiatic Wild Ass, could be considered as a 'flagship' species for mitigation and conservation actions. Southern Mongolia remains one of three areas in Eurasia that still hold viable communities of nomadic or migratory ungulates (the others being the Tibetan plateau and the Kazakhstan steppes; Harris *et al.* 2009; Mallon and Jiang 2009). Not only are these communities of ungulates now very restricted, but the global and Mongolian distributions of Asiatic Wild Ass and Goitered Gazelle are now extremely reduced. Indeed, since the 19th century the Asiatic Wild Ass has probably lost as much as 70% of its original Mongolian range because of human encroachment (Kaczensky *et al.* 2011). The unit of analysis represents a vital part of these ungulates' remaining global range – perhaps the most important remaining part for Asiatic Wild Ass as it is situated in the middle of their only sizeable remaining population (IUCN 2010; Kaczensky *et al.* 2011). Maps illustrating the species' global and national distribution are given in the Offsets strategy.

The ungulate communities are nomadic in response to pasture and water resources that are naturally patchy in space and time – an area that is important now may not be important next month, but may be important again in five years' time. Such nomadism in an area of sparse resources necessarily occurs over very large areas. Asiatic Wild Ass, for example, move an average of c. 12 km per day (Kaczensky *et al.* 2006). The 'A' and 'B' sections of the Small Gobi Strictly Protected Area are important refuges for these ungulates, but only form a minor part of the range of any individual ass or gazelle.

Table 3: Priority biodiversity features within area of influence

Taxonomic group	Biodiversity feature	Scientific name	Critical Habitat	IUCN Red List status	National Red List status	Status in unit of analysis
Plant (herb)	18 'very rare' plants such as Mongolian Chesney	*Chesneya/Chesniella mongolica*	Tier 2	-	EN?	Patchily distributed throughout – assumed here to represent all 18 'very rare' plants known or predicted from the project area
Mammal (carnivore)	Snow Leopard	*Panthera uncia*	-	EN	EN	Very rare 'resident'
Mammal (ungulate)	Asiatic Wild Ass	*Equus hemionus*	Tier 1	EN	EN	Nomadic 'resident'
Mammal (ungulate)	Argali	*Ovis ammon*	Tier 2	NT	EN	Localised resident
Mammal (ungulate)	Goitered Gazelle	*Gazella subgutturosa*	Tier 2	VU	VU	Migratory 'resident'
Mammal (ungulate)	Mongolian Gazelle	*Procapra gutturosa*	-	LC	EN	Rare visitor from the east
Mammal (rodent)	Long-eared Jerboa	*Euchoreutes naso*	-	LC	VU	Likely very rare in far south Undai
Bird	Swan Goose	*Anser cygnoides*	-	VU	NT	Likely a regular migrant over the area
Bird	Ferruginous Duck	*Aythya nyroca*	-	NT	VU	Likely a regular migrant over the area
Bird	Short-toed Snake-eagle	*Circaetus gallicus*	Tier 2	LC	EN	Breeds
Bird	Saker Falcon	*Falco cherrug*	-	VU	VU	Breeds
Bird	Egyptian Vulture	*Neophron percnopterus*	-	EN	LC	Probably breeds
Bird	Great Bustard	*Otis tarda*	-	VU	VU	Regular migrant (stops over in the area)
Bird	Houbara Bustard	*Chlamydotis undulata*	-	VU	VU	Breeds
Bird	Relict Gull	*Larus relictus*	-	VU	EN	Likely a rare migrant over the area
Bird	Pallas' Sandgrouse	*Syrrhaptes paradoxus*	-	LC	LC	Breeds
Bird	Mongolian Accentor	*Prunella koslowi*	-	LC	LC	Very localised breeder
Bird	Mongolian Ground-jay	*Podoces hendersoni*	-	LC	VU	Breeds
Bird	Yellow-breasted Bunting	*Emberiza aureola*	-	VU	NT	Likely a regular migrant
Species Assemblage	Granite Outcrop Floral Communities	n/a	Tier 2	n/a	n/a	Khanbogd and other massifs
Habitat	Riverine Elm Trees	n/a	-	n/a	n/a	Mostly in Undai riverbed
Habitat	Ephemeral Lakes and Pools	n/a	-	n/a	n/a	Scattered near to hills in south
Habitat	Tall Saxaul Forest	n/a	-	n/a	n/a	Mostly in borefield and depressions
Habitat	Eastern Gobi desert-steppe	n/a	-	n/a	n/a	Major habitat type in the region - widespread

Habitat	Alashan Plateau semi-desert	n/a	-	n/a	n/a	Major habitat type in the region - widespread

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern

As Table 4 illustrates, it is essential to understand what maintains biodiversity features in order to understand how they might be threatened and to set management objectives. Knowing why a biodiversity feature is of value helps prioritise which features need to be managed in order to have the biggest conservation impacts, to minimise negative reputational impacts and to identify opportunities. Values may range from global to local, and from scientific to practical. Table 4 and the rest of this report excludes five biodiversity priority features which are believed to occur in Khanbogd soum but not to be impacted by the Oyu Tolgoi project: Snow Leopard, Long-eared Jerboa, Mongolian Accentor, Granite Outcrops Floral Communities and Ephemeral Lakes and Pools.

Table 4: Summary of priority biodiversity features impacted in the area of influence, and their values and risks (illustrative, so not all priority biodiversity features included)

Priority biodiversity feature	**What maintains the biodiversity feature**	**Value to Oyu Tolgoi or others**	**Risks to Oyu Tolgoi if not managed**
Mongolian Chesney[1]	Poorly-known	Very rare medicinal plant	Lenders' and national regulations, Rio Tinto policies
Asiatic Wild Ass	Pasture, drinking water, extensive contiguous habitat, limited hunting pressure	Iconic species of extensive steppe and desert	Lenders' regulations, reputation, Rio Tinto policies
Argali	Pasture, drinking water, limited hunting pressure	Iconic species of rocky hills and mountains	Lenders' regulations, reputation, Rio Tinto policies
Goitered Gazelle	Pasture, drinking water, extensive contiguous habitat, limited hunting pressure	Iconic species of extensive steppe and desert	Lenders' regulations, reputation, Rio Tinto policies
Mongolian Gazelle	Pasture, drinking water, extensive contiguous habitat, limited hunting pressure	Iconic species of extensive steppe and desert	Lenders' regulations, reputation, Rio Tinto policies
Swan Goose	Safe migration route, open water habitat	Iconic international migrant	Lenders' regulations, reputation, Rio Tinto policies
Ferruginous Duck	Safe migration route, open water habitat	International migrant	Reputation, Rio Tinto policies
Short-toed Snake-eagle	Elm trees for nesting	International migrant	Lenders' regulations, Rio Tinto policies
Saker Falcon	Prey availability, nesting trees	Iconic predator of extensive steppe	Lenders' regulations, reputation, Rio Tinto policies
Egyptian Vulture	Carrion, nesting cliffs	Large bird, scavenging	Lenders' regulations, Rio Tinto

[1] assumed here to represent all 18 'very rare' plants known or predicted from the project area.

		services	policies
Great Bustard	Safe migration route, open grassy/scrubby habitat	Iconic international migrant	Lenders' regulations, reputation, Rio Tinto policies
Houbara Bustard	Safe migration route, open stony habitat, limited hunting pressure	Iconic international migrant and inhabitant of extensive steppe and desert	Lenders' and national regulations, reputation, Rio Tinto policies
Relict Gull	Safe migration route, open water habitat	International migrant	Lenders' and national regulations, Rio Tinto policies
Pallas' Sandgrouse	Semi-desert habitat, drinking water	Conspicuous resident susceptible to collisions with overhead wires	Reputation, Rio Tinto policies
Mongolian Ground-Jay	Scrubby habitat	Declining resident	Reputation, Rio Tinto policies
Yellow-breasted Bunting	Vegetation along migration route, especially near water	International migrant	Lenders' regulations, Rio Tinto policies
Riverine Elm Trees	Surficial (primary alluvial) aquifers, limited grazing pressure to allow regeneration	Shelter for animals from heat, sun, wind and predation; nesting for birds	Reputation, Rio Tinto policies
Tall Saxaul Forest	Surficial aquifers / soil moistures, limited grazing pressure to allow regeneration	Shelter for animals from heat, sun, wind and predation; nesting for birds	Reputation, Rio Tinto policies

4 Major potential impacts on biodiversity

Before the application of the mitigation hierarchy, the Oyu Tolgoi project will have six main impacts on priority biodiversity features, for which more details are given in Appendix II:

- Direct habitat loss
- Indirect habitat loss (due to avoidance of infrastructure by animals)
- Fragmentation (reduced connectivity) of animal populations
- Direct mortality (from collisions with and electrocution by vehicles and power lines)
- Indirect mortality from increased hunting and collecting
- Indirect mortality from increased populations of natural predators

In addition, the hydrological uncertainties in Box 1 could have significant implications for risk assessments and mitigation actions (further details in Appendix I). The Oyu Tolgoi project has committed to undertake further research and monitoring to better assess these uncertainties:

Box 1: Hydrological uncertainties, requiring further research and monitoring

Dewatering of the mine area

The Oyu Tolgoi project will:

In consultation with experts, establish a groundwater monitoring programme sufficient to detect project-related impacts of mine dewatering on surficial and alluvial aquifers (temporal and spatial analyses required to assess rate and extent)

Maintained groundwater flow in the Undai river

The Oyu Tolgoi project will:

In consultation with experts, establish a groundwater monitoring programme sufficient to enable the detection of project-related impacts on groundwater levels and surface hydrology in the Undai downstream of the mine.

Connectivity between the Gunii Hooloi deep and shallow aquifers

The Oyu Tolgoi project will:

In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the Gunii Hooloi deep cretaceous aquifer.

Connectivity between the Gunii Hooloi and Galbyn Gobi aquifers

The Oyu Tolgoi project will:

In consultation with experts, establish a groundwater monitoring programme sufficient to detect any change in groundwater level of the deep Galbyn Gobi aquifer arising from abstraction from the Gunii Hooloi deep cretaceous aquifer.

Water abstraction from Durulj Mount Southern aquifer

The Oyu Tolgoi project will:

In consultation with experts, establish a groundwater monitoring programme sufficient to detect impacts on surficial and alluvial groundwater levels related to abstraction from the deep Durulj Mount Southern aquifer.

5 Priority biodiversity features to manage

The likelihood, consequence and risk of each impact were assessed for each priority biodiversity feature for each infrastructure unit, following Rio Tinto guidance note (Rio Tinto 2011). Methods and example risk assessment tables are in Appendix III. Risk assessment matrices for each priority biodiversity feature and each significant impact are presented in the constituent Biodiversity Management Options Papers (which have been made available to the lenders). Mitigation options were identified for all Critical and High Risks, as listed in Table 5:

Table 5: Priority biodiversity features at Critical and High Risk (in approximate order of significance)

Feature	Impact	Likelihood	Consequence	Risk
Asiatic Wild Ass, Goitered Gazelle	Indirect habitat loss due to avoidance of infrastructure	Likely	Serious	Critical
Asiatic Wild Ass	Indirect mortality from hunting facilitated by increased access	Possible	Major	Critical
Argali, Goitered Gazelle, Saker Falcon, Houbara Bustard, Tall Saxaul Forest	Indirect mortality from hunting and collecting facilitated by increased access	Possible	Serious	High
Argali, Houbara Bustard	Indirect habitat loss due to avoidance of infrastructure	Likely	Medium	High
Great Bustard, Houbara Bustard, Saker Falcon	Direct mortality from collision with and electrocution by power transmission lines	Almost Certain / Likely	Medium	High
Mongolian Chesney, Asiatic Wild Ass, Goitered Gazelle, Houbara Bustard, Mongolian Ground-Jay	Direct habitat loss under infrastructure	Almost Certain	Medium	High
Houbara Bustard, Mongolian Ground-Jay	Indirect mortality from increased predation rates	Likely	Medium	High

Mitigation options were not identified in this analysis for Medium and Low Risks. Most mitigation options for these risks will be covered by the options proposed for Critical and High Risks.

6 Mitigation options

Mitigation options were developed for all Critical Risk and High Risk potential impacts in the Options Papers. Throughout this section, the mitigation options committed to by OT are given in bold.

The uncertainties highlighted in Box 1 require ongoing monitoring and evaluation which may indicate the need for additional mitigation actions to ameliorate or restore impacts in priority biodiversity features.

Actions required to mitigate low and moderate risk impacts to priority biodiversity features or impacts to biodiversity features not of high conservation concern, are not presented in this paper. These mitigation actions will be articulated in biodiversity-specific construction and operational management plans currently in development by the Oyu Tolgoi project.

The biodiversity-specific construction and operational management plans will be complemented by a suite of other environmental management plans (e.g. air quality, waste, topsoil, water, transport) each of which will contain mitigation actions that contribute directly and indirectly to Oyu Tolgoi project's management of biodiversity.

From the perspective of biodiversity, the most effective mitigation is almost always avoidance. The Oyu Tolgoi project has stated that a number of optimal avoidance options cannot be adopted for various reasons, notably the advanced state of construction. These include the options in Box 2. There may however be opportunities to incorporate some of these options in future works, e.g. Oyu Tolgoi project is commissioning best-practice rare plant and Houbara Bustard surveys before deciding the route of a spur road between the mine and the Tavan Tolgoi 'coal road'. The Oyu Tolgoi project is committed to implementing all other proposed mitigation options except for those in Box 2:

Box 2: Mitigation options not taken

- Export ore via railway
- Bury lengths of road in tunnels
- Combine roads from Tavan Tolgoi and Oyu Tolgoi to Gashuun Sukhait
- Survey infrastructure routes and sites for immoveable priority biodiversity values
- Bury high-voltage power transmission lines
- Bury medium-voltage power distribution lines
- Use pylons with horizontal rather than vertical line alignment
- Use pylons with lighting arrestors at transmission towers rather than
- Use bird-friendly (low electrocution risk) poles for the medium-voltage power line
- Design the current temporary airport so that it could be developed and extended into a permanent airport
- Daily closures of the road upgrade to Gashuun Sukhait, to facilitate direct crossings and use of wildlife crossings by wild animals

The Oyu Tolgoi project has committed to implementing a number of best practice actions to mitigate the potential impacts of fragmentation by improving the connectivity of ungulate populations. Increased traffic volumes, notably along the road upgrade to Gashuun Sukhait, risk creating functional barriers to some animals, notably ungulates which are hunted (and hence wary of vehicles), as discussed in Appendix II.3. The actual residual impact of the road upgrade to Gashuun Sukhait will be limited given that it runs approximately in parallel to the Tavan Tolgoi to Gashuun Sukhait 'coal road' which lacks any mitigations against fragmenting ungulate populations. However, the Oyu Tolgoi project is committed to demonstrating best practice to mitigate the impacts of fragmentation and indirect habitat loss, and improve connectivity, between these roads, and to play a leading role in facilitating higher regional standards of infrastructure mitigation.

Table 6: Mitigation actions for all Critical and High Risk impacts

Infrastructure	Step in the mitigation hierarchy	Action
Roads	Minimise	Deter vehicles leaving, but facilitate wildlife crossing, the OT-GS, OT-Khanbogd and OT-airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings)
	Minimise	Provide driver awareness and training for all OT staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds)
	Minimise	Enforce no unauthorised waste disposal/littering from OT vehicles or around work place
	Minimise	Enforce low speed limits of OT vehicles on sealed and unsealed roads on and off-lease (speed limits for OT vehicles will be reviewed in consultation with a wildlife expert).
	Minimise	Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with OT vehicle speed limits) on all public users of the OT-GS Road
	Minimise	Restrict OT vehicles from parking beside roads except in an emergency or to manage fatigue
	Minimise	Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue
	Minimise	Erect signage on roads to warn drivers of risk of collision with wild animals
	Rehabilitate	Inspect and remove litter and other anthropogenic waste from along the OT - GS Road, OT - Khanbogd Road and OT Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces)
Hunting and collecting	Minimise	Control illegal hunting by OT personnel (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties)
	Minimise	Engage with local and regional stakeholders to control hunting in the OT AoI and more broadly within Khanbogd soum (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels)
	Minimise	Provide all project operations staff and contractors fuel for fires to prevent collection of local timber (i.e. saxaul)
	Minimise	Inspect an adequate proportion of all aircraft under OT control for illegal wild animal products
	Minimise	Inspect all vehicles entering the OT site for illegal wild animal products
Regional	Minimise	Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd soum (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team)
Power Lines	Minimise	Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m)
	Minimise	Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary

	Rehabilitate	Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals
	Rehabilitate	Remove nests of birds which predate bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure
Rehabilitation	Rehabilitate	Rehabilitate and restore at least equal areas or numbers of features impacted (in line with Oyu Tolgoi Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice)
	Rehabilitate	Ensure replacement spring mimics the ecological functions of Bor Ovoo spring
Offsets	Offset	Undertake adequate offset actions to achieve a Net Positive Impact at low risk as discussed in the separate offsets discussion paper

6.1 Construct appropriate and sufficient underpasses

Indirect habitat loss, fragmentation and reduced connectivity of wildlife populations by roads can be mitigated by construction of appropriate and sufficient 'wildlife crossings' including overpasses (e.g. tunnels and wildlife overpasses) and underpasses (e.g. viaducts and culverts). Based on available evidence from priority species and similar species, and acting on a precautionary basis, such underpasses should be as long (where length is the axis of the road not the axis of animal movement) as possible (minimum 12 m long) and at least 4.5 m high along the entire length. It is estimated that one such underpass would be needed approximately every 6 km along roads to ensure appropriate ecological permeability for Asiatic Wild Ass and gazelles.

Such underpasses may potentially not delay current road construction if temporary diversions could be incorporated into the road until these structures were in place. The maximum grade of the road will be determined during design. A grade of e.g. 2% would mean that wildlife underpasses of 4.5 m height would require lead-in distances of 225 m each side. Thus, diversions of c. 500m would be required parallel to the road. These diversions could be used until suitable underpasses were constructed. It is possible that this strategy would need permission from the government, who may not favour underpasses as government will ultimately become responsible for their maintenance.

Any elevated infrastructure may provide nesting platforms for predators of Houbara Bustard. Any such structures should thus be designed with nest deterrents and/or be regularly monitored and nests removed.

Underpasses designed for wildlife along the road upgrade to Gashuun Sukhait will be most effective and cost-effective when situated over river beds. In such locations, it is likely that culverts will be required at minimum (to avoid flood damage to roads). River beds in the area are likely to also be a focus for wildlife activity, given the higher availability of water (e.g. springs) in such areas. In India, Asiatic Wild Ass more frequently travel along river beds (World Bank 2002).

Wildlife crossings can also be used by domestic livestock as long as monitoring is established to

ensure that livestock use does not prevent use by wildlife. If possible, vehicles should be prohibited from using wildlife crossings. If herder vehicles need to use wildlife crossings, they should be limited to only part of the width of such crossings or their damage to substrate may reduce or prevent use by wildlife. Vehicle routes can be indicated by placement of medium-sized rocks (large rocks and other blockages must be avoided as these will reduce or prevent use by wildlife). The substrate of the underpass must be natural, not waterlogged and have no obstructions or non-natural features such as litter, other anthropogenic waste, or excessive vehicle tracks.

Building solid sides at least as high as the highest Oyu Tolgoi project vehicles will render vehicles on the bridge invisible to wild animals considering crossing, and improve the likelihood of crossings. Building an earth berm along a length of road either side of any underpasses will help to hide traffic (enabling animals to approach roads), funnel animals towards the crossings and reduce incidence of collisions.

This demonstration of best-practice is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure. Further background information to this recommendation is given in Appendix IV.

The Oyu Tolgoi project will:

Construct appropriate and sufficient underpasses (at ecologically suitable locations such as river beds, approximately every 6 km along the OT-GS road, as long as practically possible but minimum 12 m long, at least 4.5 m high along the whole length, with solid sides at least as high as highest OT vehicles, a natural, non-waterlogged substrate with no obstacles, affording a view of the horizon from either side, and with earth berm along edge of road either side of underpass to funnel wildlife towards underpasses; to be constructed before hand-over to GoM, probably in 2013)

6.2 Daily closures of the road upgrade to Gashuun Sukhait

Asiatic Wild Ass in the south-west Gobi region of Mongolia are most mobile at 16:00-20:00 (P. Kaczensky *in litt.* 2011), but these times will vary seasonally (earlier in winter, later in summer) so further study is desirable to identify the peak mobility period during each season. Kiang, Tibetan Antelope and Tibetan Gazelle most frequently used wildlife crossings under the Qinghai-Lhasa railway in the morning when traffic was lightest (Baofa *et al.* 2006; Xia *et al.* 2007), although it is not clear whether the key factor was traffic volumes or peaks of activity in mammals in mornings. In India, Asiatic Wild Ass most often crossed roads in mornings and evenings (World Bank 2002). Daily closures of the upgraded road to Gashuun Sukhait to Oyu Tolgoi project traffic is likely to facilitate direct crossing of the road and use of wildlife crossings by wild animals notably Asiatic Wild Ass, which may otherwise stay too far away from the road. However, it would be counter-productive if closures encouraged any non-Oyu Tolgoi project vehicles to drive off-road to avoid closures.

The Oyu Tolgoi project is investigating opportunities to address this option (December 2011).

6.3 Driver awareness and training

Vehicle drivers who are aware of and trained in safe driving techniques will have fewer collisions with wild animals, other vehicles and livestock, which have additional social and health/safety benefits.

The Oyu Tolgoi project will:

Provide driver awareness and training for all OT staff and contractors with specific information on priority biodiversity features (e.g. ungulates and birds)

6.4 Enforce no waste disposal from vehicles or around work place

Organic waste, especially foodstuffs, attracts and supports predatory and scavenging birds and mammals, which may predate priority biodiversity features.

The Oyu Tolgoi project will:

Enforce no unauthorised waste disposal/littering from OT vehicles or around work place

6.5 Enforce low speed limits

Enforcing low speed limits will reduce collisions with wild animals, other vehicles and livestock, which has additional social and health/safety benefits.

The Oyu Tolgoi project will:

Enforce low speed limits of OT vehicles on sealed and unsealed roads on and off-lease (speed limits for OT vehicles will be reviewed in consultation with a wildlife expert).

Engage with key stakeholders to support the adoption and enforcement of suitable speed limits (in line with OT vehicle speed limits) on all public users of the OT-GS Road

6.6 Prevent vehicles leaving, but facilitate wildlife crossing roads, by use of boulders and/or posts and/or ditches

Vehicles currently readily leave roads in the area when their quality degenerates, resulting in increased habitat loss, wildlife avoidance distances and impacts such as hunting or wildlife collisions. The road upgrade to Gashuun Sukhait should largely alleviate these problems. In order to ensure this, obstacles are necessary to prevent vehicles leaving the road at will (though vehicles will ultimately be able to leave the road at designated herder crossings). These obstacles may comprise immoveable boulders (immoveable boulders could be partially buried to leave the minimum exposure to prevent vehicle passage), or short (above vehicle axle height) but solid posts (e.g. concrete with steel cable core), either obstacle being accompanied by shallow ditches (c.1 m deep and 2 m wide). None of these features are likely to present a significant barrier to wildlife after they have habituated to their presence, though boulders (as

a natural feature) and shallow ditches are likely to present the least barrier to wildlife. Boulders could be sourced from the mine provided that there is a low risk of acid leaching. Ditches may promote vegetation growth (being nearer the water table), thus attracting wildlife and livestock and increasing collision risks, but would increase difficulty of vehicles squeezing between boulders or posts. As long as ditches are designed so that wildlife cannot be trapped in them, their biodiversity benefits are likely to outweigh their costs.

The Oyu Tolgoi project will:

Deter vehicles leaving, but facilitate wildlife crossing, the OT-GS, OT-Khanbogd and OT-airport roads (probably by using immoveable boulders or posts, and optionally also ditches, but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings)

6.7 Prevent vehicles parking beside roads

Parking vehicles beside roads increases the barrier effect of roads to wild animals which are hunted by people in vehicles.

The Oyu Tolgoi project will:

Restrict OT vehicles from parking beside roads except in an emergency or to manage fatigue

Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue

6.8 Erect warning signs

Erection of suitable signs to warn vehicle drivers of the risks of collisions with wild animals and other obstacles will reduce collisions with wild animals (Huijser *et al.* 2009), other vehicles and livestock, which has additional social and health/safety benefits.

The Oyu Tolgoi project will:

Erect signage on roads to warn drivers of risk of collision with wild animals

6.9 Regularly remove litter and collision carcasses

Litter, especially foodstuffs, and collision carcasses, attract and support predatory and scavenging birds and mammals, which may predate priority biodiversity features. Removing all litter and carcasses will rehabilitate the habitat (with respect to populations of predators and scavengers) as well as monitoring the impact of collisions. Other anthropogenic waste can add to the barrier effect of infrastructure towards wild animals, and reduce habitat quality. The periodicity of removal will be refined based on the design and results of the monitoring and evaluation plan; at present (December 2011), the monitoring needs but not methods have been determined (Appendix VI Monitoring and Evaluation).

The Oyu Tolgoi project will:

Inspect and remove litter and other anthropogenic waste from along the OT - GS Road, OT - Khanbogd Road and OT Borefield Access Road 3 times weekly during peak construction period (frequency of inspections to be reviewed on an ongoing basis, and is expected to be reduced as project moves to operational phase and traffic on roads reduces)

6.10 Control illegal hunting in the wider landscape

The primary impact from in-migration of people and money associated with, but not under direct control of, the Oyu Tolgoi project is indirect mortality from illegal hunting and collecting. As well as the increase in direct mortality, hunted species show greater avoidance of infrastructure, which increases the area of indirect habitat loss and the chance of fragmentation of hunted species' populations. A model for control of illegal hunting exists in western Mongolia where WWF has been successfully developing national-level anti-poaching government enforcement teams and informant networks. Actions to control illegal hunting and collecting are complex and are discussed more fully in the offsets discussion paper. It is important to differentiate between mitigation actions, which would maintain the levels of hunting at that of the base-line before any impacts from the Oyu Tolgoi project, and offset actions, which would improve the levels to better than the base-line. To clarify the difference between mitigation and offset, and enable undisputed quantification of offset gains, it could be easier to classify these actions based on location, for example, all actions in Khanbogd soum are mitigation actions, and all actions in neighbouring soums are offset actions.

The Oyu Tolgoi project will:

Control illegal hunting by OT personnel (awareness, publicity and enforcement of strict no-hunting policy, including inspection as required and suitable penalties)

Engage with local and regional stakeholders to control hunting in the OT AoI and more broadly within Khanbogd soum (research the best actions to address illegal hunting and collecting, and undertake actions adequate to reduce the level and impact of illegal hunting and collecting to baseline levels)

6.11 Provide all project operations, staff and contractors with fuel other than firewood

Fuel needs of local people are primarily fed by dried livestock dung and, in winter when heating needs are high, woody plants, notably saxaul (Damdin 2011; Center for Policy Research 2009 in Environ 2011). Tall Saxaul Forest is a priority biodiversity feature and supports other features such as Saker Falcon. Tall Saxaul Forest is currently over-collected in Khanbogd soum, and this is predicted to increase with increasing in-migration of people (Schmidt *et al.* 2011).

The Oyu Tolgoi project will:

Provide all project operations staff and contractors fuel for fires to prevent collection of local

timber (i.e. saxaul)

6.12 Inspect goods being transported by plane (for hunted animals)

Inspection of all aircraft under the control of the Oyu Tolgoi project for illegal wild animal products will help reduce the impact of constructing an airport on the rate of illegal hunting. Inspection could be undertaken on all aircraft or an effective random proportion of aircraft. There must be adequate publicity and enforcement of punishments to act as an effective deterrent.

The Oyu Tolgoi project will:

Inspect an adequate proportion of all aircraft under OT control for illegal wild animal products

Publicise and apply suitable penalties to offenders under OT control found trafficking illegal wild animal products

6.13 Inspect vehicles (for hunted animals) at start and end of roads

Inspection of all vehicles under the control of the Oyu Tolgoi project for illegal wild animal products will help reduce the impact of upgrading roads on the rate of illegal hunting. Inspection could be undertaken on all vehicles or an effective random proportion of vehicles, at the start and end of all roads which may act as conduits for hunters or movement of hunted animal products. The road to Gashuun Sukhait is the highest priority given its length and connection to China which is a major market for wild animal products. There must be adequate publicity and enforcement of punishments to act as an effective deterrent.

The Oyu Tolgoi project will:

Inspect all vehicles entering the OT site for illegal wild animal products.

Publicise and apply suitable penalties to offenders under OT control found trafficking illegal wild animal products.

6.14 Enable balanced and sustainable regional planning

Secondary impacts of the increased number of non-Oyu Tolgoi project employees in Khanbogd soum can be mitigated by enabling balanced and sustainable regional planning, including infrastructure development, within Khanbogd soum. Currently Khanbogd does not have the infrastructure or administrative capacity to manage such large transformations without significant support from both the Government of Mongolia and the major project developers in the region. The Oyu Tolgoi project is establishing a Local Regional Planning and

Infrastructure (LRPI) unit to coordinate with the Southern Gobi Regional Development Council (SGRDC) that is being established by the Government of Mongolia. Moreover, a regional, landscape level approach is required to address the cumulative fragmentation effects of infrastructure development in the southern Gobi region. This is best achieved through close cooperation between key regional stakeholders on regional planning issues. The recently agreed MoU on biodiversity management and monitoring between OT and Energy Resources LLC provides an excellent example of opportunities for collaboration between key stakeholders in the southern Gobi region.

The Oyo Tolgoi project will:

Seek opportunities to engage with key stakeholders and provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions, including those that minimise cumulative fragmentation effects of linear infrastructure, to be integrated into regional planning, including infrastructure development, within Khanbogd soum. (It is noted that more detailed commitments may be developed in association with the Oyo Tolgoi project social team).

6.15 Add bird flight diverters to all power lines

Most collisions are with the highest and thinnest wires, usually the earth wire. Various 'bird flight diverters' can increase visibility and avoidance of these wires. Bird flight diverters can be both visual and auditory markers of power lines. The most common visual markers are large PVC spirals (e.g. "Swan Deflectors" of 1 m length and 30 cm diameter; Figure 1). The most common auditory markers are 'flappers' – these are usually smaller (less visible) but make a noise when they blow in the breeze. PVC spirals alone have been shown to reduce bird collision mortality by up to 81% (Janss & Ferrer 1998), flappers on their own have been shown to reduce bird collision mortality by 60-63% (Brown & Drewien 1995; Yee 2008), and flappers added to spirals have been shown to reduce bird collision mortality by an additional 52% (Anderson 2002). Noise-generating flappers may be particularly important for bustards, which show poor visual detection of power transmission lines (Martin & Shaw 2010). Because bustards migrate during the day and at night, a particularly effective flapper may be the "Bird Mark AG" (Figure 2), which glows in the dark for up to ten hours after dark.

Frequencies of bird flight diverters of every 5-10 m along the earth wire have been shown to reduce collision rates (Jenkins *et al.* 2010; Barrientos *et al.* 2011; J. Shaw pers. comm. 2011). It is assumed that increasing these frequencies further will further reduce the collision rate, e.g. a frequency of every 1.5 m is recommended for high-risk lines for Little Bustard in Portugal (J.-P. Silva pers. comm. 2011). It has been suggested that bird flight diverters be yellow or yellow-green, or alternating contrasting colours (dark and light), to maximise effects within the avian visual spectrum (Crowder & Rhodes 2001) but this has not yet been adequately tested in the field (Jenkins et al. 2010). Nonetheless, alternating contrasting colours inherently have more likelihood of including colours that are visible to birds.

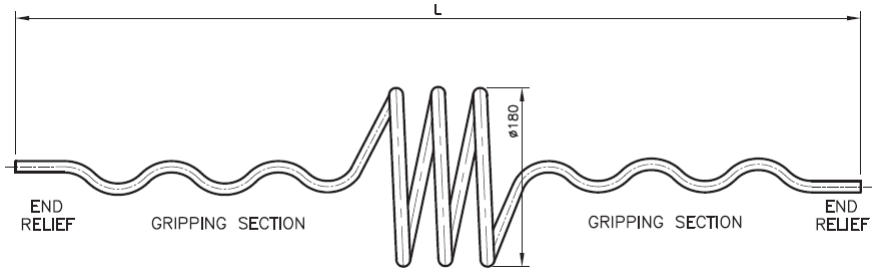

Figure 1: Spiral bird flight diverter

Figure 2: "Bird Mark AG" flapper bird flight diverter in daylight and at night

The Oyu Tolgoi project will:

Add bird flight diverters to all power lines (install alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m i.e. one device every 5 -10 m)

6.16 Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary

Retrofitting customised insulation to problem areas of medium-voltage (<40 kV) distribution powerline infrastructure can reduce the risk of perching birds being electrocuted. Insulation will require regular inspection and will probably need replacing every few years given the harsh weather conditions (A. Dixon pers. comm. 2011). Similarly, any jump wires and sub-station wires identified as presenting a high risk to birds should be insulated or routed under conductor arms. The Oyu Tolgoi project is currently (December 2011) in discussion with bird electrocution experts to determine the exact insulation needs.

The Oyu Tolgoi project will:

Insulate medium-voltage powerline poles, dead-ends and sub-stations, and on pylons where necessary

6.17 Remove nests of birds which predate bustards, where made on infrastructure

Any elevated infrastructure could provide nesting and perching areas for predatory birds. This would increase the local population densities of these predators, and increase the level of predation on Houbara Bustard and other priority biodiversity species. It is considered more cost-effective to remove nests of species that are potential predators of Houbara Bustard nests and young (e.g. buzzards *Buteo* spp., Black Kite *Milvus migrans* and Common Raven *Corvus corax*) as they are built rather than to mitigate this risk through perch-deterrents (such as the spikes commonly seen to deter perching pigeons in American and European cities). It is standard practice for Mongolian companies maintaining electricity infrastructure to remove birds' nests annually, after they have laid eggs in spring (G. Sundev pers. comm. 2011). Although Saker Falcon is commonly used by falconers to hunt Houbara Bustard, wild Saker Falcon appear to very rarely hunt Houbara Bustard in this region (Sundev *et al.* 2001; G. Sundev pers. comm. 2011). Therefore, nests known to be of Saker Falcon, which is a priority biodiversity feature), should not be removed.

The Oyu Tolgoi project will:

Remove nests of birds which predate bustards, except where known to be Saker Falcon nests, where made on project-related infrastructure

6.18 Regularly remove collision carcasses

Collision carcasses under power lines, attract and support predatory and scavenging birds and mammals, which may predate priority biodiversity features. Removing every carcass will rehabilitate the habitat (with respect to populations of predators and scavengers) as well as monitoring the impact of collisions. Standard methods exist for adjusting bird carcass surveys to account for scavenging rates. OT is currently (December 2011) investigating the potential to install Bird Strike Indicators which are electronic devices mounted on power lines to detect actual collisions. These could be used to directly quantify bird collisions in sensitive areas and control areas. They could also be used to compare pre- and post-mitigation collisions in offset areas. The periodicity of carcass removal will be refined based on the design and results of the monitoring and evaluation plan; at present (December 2011), the monitoring needs but not methods have been determined (Appendix VI Monitoring and Evaluation).

The Oyu Tolgoi project will:

Document and remove collision carcasses and nests from medium voltage and high-voltage powerlines during regular inspections. Review periodicity of inspections after 6 months then at annual intervals

6.19 Rehabilitate and restore vegetation, specifically including Mongolian Chesney, Riverine Elm Trees and Tall Saxaul Forest

Rehabilitation and restoration are largely considered to be a standard best practice and, as such, not detailed here. However the mitigation options for impacts on the vegetative priority biodiversity features (Mongolian Chesney, Riverine Elm Trees and Tall Saxaul Forest) include explicit rehabilitation and restoration of these species and habitats. There are opportunities for enabling regeneration of Tall Saxaul Forests as young regenerating saxaul is currently widespread in Khanbogd soum including in Gunii Hooloi around the borefield (Schmidt *et al.* 2011). It is noted that propagation could be undertaken at the recently established Khanbogd nursery, and also that three elm trees have already been transplanted, the long-term outcome of which is being monitored.

The Oyu Tolgoi project will:

Rehabilitate and restore at least equal areas or numbers of features impacted (in line with OT Rehabilitation Management Plan and standard Rio Tinto rehabilitation and restoration practice)

6.20 Ensure replacement spring recreates ecological functions of Bor Ovoo spring

The Oyu Tolgoi project proposes to establish an artificial spring at the point where the proposed Undai groundwater diversion pipe terminates, to replace the Bor Ovoo spring which will be covered by the waste dump rock. The spring should mimic the characteristics of the Bor Ovoo spring as closely as practicable - taking into consideration the extent of inundation and catchment size, establishing vegetation and rocky outcrop habitats. It should be noted however, that the location of the spring will limit its use as it will be located within the zone of avoidance for ungulates.

The Oyu Tolgoi project will:

Ensure replacement spring mimics the ecological functions of Bor Ovoo spring

6.21 Establish conservation actions specific to impacted biodiversity features

Most residual impacts are technically feasible to offset. Offset options include addressing illegal hunting, improving pasture and habitat quality, mitigating other infrastructure in the region and propagation and planting of Riverine Elm trees and Tall Saxaul Forest. Offsets are feasible but expensive and are not an alternative to following the mitigation hierarchy. More details are available in the rapid biodiversity assessment team's draft offsets paper and no further consideration is presented here.

The Oyu Tolgoi project will:

Undertake adequate offset actions to achieve a Net Positive Impact at low risk as discussed in

the separate offsets discussion paper

There are also a range of best-practice mitigation measures such as minimising noise and dust pollution, and preventing establishment of invasive alien species. These standard procedures are dealt with in Environmental Management Plans and are not discussed further here. A number of these mitigation actions will also address health and safety objectives (e.g. reduction of collisions with vehicles) and social objectives (e.g. pasture management).

7 Monitoring

Monitoring and evaluation is addressed in Appendix 6 Monitoring & Evaluation. It is noted that many of these mitigation actions will be inadequate if not supported by suitable monitoring and evaluation. These monitoring actions will be captured in the ongoing process of developing a Biodiversity Action plan workbook for the Oyu Tolgoi project.

It is noted that some monitoring actions are needed to assess the likelihood of low-probability high-consequence impacts which are currently assessed as 'uncertainties' and discussed in Appendix I. These monitoring actions are essential to indicate whether any of these 'uncertainties' are likely realities. The Oyu Tolgoi project has committed to undertake the monitoring actions for these 'uncertainties' as detailed in Box 1.

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Appendix I: Hydrological uncertainties

A number of hydrological uncertainties have been identified which could have significant influence on the risk assessments of priority biodiversity features or on the mitigation of other impacts. The Oyu Tolgoi project has committed to undertake further research and monitoring to better assess these uncertainties, as detailed in Box 1. For each hydrological uncertainty, a summary description is given here, followed by fuller background details.

I.1 Dewatering of the mine area

The impact of dewatering of the mine area on the neighbouring shallow and alluvial aquifers is inadequately known as the connections between these aquifers are uncertain. If there are significant functional hydrological connections, dewatering may cause loss of habitat, springs and waterholes across a large cone of depression.

I.2 Maintained groundwater flow in the Undai river

The ability of the river diversions to maintain the original hydrological connections and flows, particularly given mine dewatering, is uncertain. If the flows are impacted, the sustainability of groundwater flow and springs downstream of the mine may be compromised, and a large area of the lower Undai basin may be impacted.

I.3 Connectivity between the deep Gunii Hooloi aquifer and overlying surficial and alluvial aquifers

The impact of abstracting water from the deep Gunii Hooloi aquifer is inadequately known as the connectivity between this deep aquifer and the overlying alluvial and surficial aquifers is uncertain. If there are significant functional hydrological connections, abstraction may cause loss of habitat, springs and waterholes across the whole Gunii Hooloi borefield.

I.4 Connectivity between the Gunii Hooloi and Galbyn Gobi aquifers

The impact of abstracting water from the deep Gunii Hooloi aquifer is inadequately known as the connectivity between this aquifer and the neighbouring Galbyn Gobi aquifer is uncertain. If there are significant functional hydrological connections, abstraction may cause drawdown in the Galbyn Gobi aquifer. As noted above, if there are significant functional hydrological connections with surficial aquifers, abstraction may cause loss of habitat, springs and waterholes across the whole Galbyn Gobi area.

I.5 Connectivity between the deep Durulj Mount Southern aquifer and overlying surficial aquifers

The impact of abstracting water for Khanbogd camp from the deep Durulj Mount Southern aquifer is inadequately known as the connectivity between this aquifer and overlying shallow surficial aquifers is uncertain. If there are significant functional hydrological connections, abstraction may cause drawdown in the adjacent shallow surficial aquifers which may cause loss of habitat, springs and waterholes in the area of influence of these aquifers.

Dewatering of the mine area

Riverine Elm Trees, Tall Saxaul Forest, Asiatic Wild Ass, Argali and Goitered Gazelle are all dependent on groundwater resources – elms and saxaul tap groundwater through their deep (up to approximately 40 m) root systems and ungulates rely on groundwater fed springs. Saker Falcon is dependent on elm and saxaul trees for nesting but may be able to nest on electricity transmission pylons being erected by the project. At present it is not entirely clear what impact the effects of dewatering will have on groundwater resources outside of the Mine License Area. The impact assessment in this options paper is based on assumptions presented in the ESIA (2011) and the Amendment to the Mine & Processing DEIA (2010), which state that the shallow groundwater system present within the surface materials and weathered bedrock across the Mine License Area has limited hydrological connectivity with the alluvial aquifer beneath the Undai. Until actual flow rates are established and investigation of intersected aquifers takes place (during construction of the underground mine and open pit), the actual impact on groundwater dependent priority biodiversity features remains unclear.

Priority biodiversity features would suffer significant consequences if mine dewatering causes significant draw down of groundwater in the Undai channel. The likelihood of Riverine Elm Trees in the dewatering zone being impacted by mine dewatering is considered possible but the consequence only medium - given the very small number of trees – resulting in a moderate risk. However, the consequence of Riverine Elm Trees downstream of the dewatering zone being impacted by mine dewatering is Serious given that this section of river supports a globally significant population (H. von Wehrden *in litt.* 2011) of Riverine Elm Trees. The likelihood of this second impact is uncertain as discussed in Box 3; if possible or likely, this would imply a high risk. Impacts on Saker Falcon and ungulates are assessed as unlikely or possible, resulting in minor or moderate risk.

If the effects of dewatering are shown to have a significant impact on groundwater resources in the Undai then the likelihood and threat rating for all groundwater dependent biodiversity features will be elevated – the degree of elevation will depend on how far the impacts are felt from the Mine License Area. Box 3 summarises the potential risk from hydraulic connectivity, and primary mitigation and monitoring actions.

Box 3: Potential risk from mine dewatering

Construction of the open pit will dewater sediments around the pit, some of which form surficial aquifers (Amendment to the Mine & Processing DEIA 2010). There is a risk that these surficial aquifers have functional hydrological connectivity with the alluvial aquifer beneath the Undai. Dewatering could then affect the downstream hydrology of the Undai. The relative contribution of the Undai to downstream alluvial aquifers is poorly-known, but mine dewatering could potentially affect a very large area of alluvial aquifers which support a large proportion of the Riverine Elm Trees and the best-quality Tall Saxaul Forest in the unit of analysis. This would have a serious or major impact, and is potentially a critical risk.

Currently and provisionally, the risk of hydrological connectivity is considered low based on the limited evidence from current monitoring. Water abstraction for construction activities has resulted in groundwater levels dropping by up to 8 m (although a limited (<1 m) drop in water level has occurred in some boreholes) since baseline conditions were established in 2003 but water levels away from these active bores has remained relatively constant suggesting low hydrological conductivity. A full risk assessment cannot be completed without better hydrological modelling of the connectivity between these aquifers. If significant induced connectivity is detected, the primary mitigation action would be to amend the design of the river diversion so that water is transferred to a point on the downstream reach of the Undai down-gradient, which will protect downstream springs and users.

As well as modelling and monitoring hydrological flows, the health of Riverine Elm Trees needs to be monitored within the zone of predicted drawdown from dewatering, and in control areas outside this zone.

I.6 Maintained groundwater flow in the Undai river

Under the current mine plan, the Southern Oyu open pit will extend into the Undai flood plain and the Waste Rock Dumps will lie directly across the Undai river channel. Given the size of the Undai and the operational (flooding) risks involved, Oyu Tolgoi has determined that the best solution will be to divert the watercourse, thus allowing both the flood water and subsurface flows to pass safely around the open pit and waste dumps and to re-join the course of the Undai about two kilometres south of the Mine Licence Area.

In the absence of comprehensive investigations into physical attributes of the subsurface, including the existence of paleochannels, the actual impact on groundwater-dependent priority biodiversity features remains unclear (Box 4).

Groundwater flow from the Undai is believed to be responsible for sustaining springs downstream of the Mine Licence Area including Khukh Khad, 5 km downstream of Bor Ovoo Spring, Buural and Maanit , a further 8 km further downstream, and Tavan Ovoo, a further 7 km. Although the Brown Hill river is believed to have a larger catchment area than the Undai, it joins the Undai to the south of these springs. If reinstatement of the groundwater flow is unsuccessful, or the compaction of the soil substrate underneath the TSF depletes or alters groundwater flow, there could be major potential impacts on the availability of water in springs downstream of the Mine License Area with consequent impacts on priority biodiversity features.

Box 4: Uncertain downstream impacts

If the river diversions fail to maintain the original hydrological connectivities and flows, sustainability of groundwater flow and springs downstream of the Mine License Area may be compromised. Further research and monitoring is needed to quantify the potential hydrological changes. The consequence of a significant reduction in flow on Riverine Elm Trees (of which the Undai supports a globally significant population (H. von Wehrden *in litt.* 2011) and Tall Saxaul Forest would be serious. If the likelihood of significant reduction in flows was possible or likely, this would imply a high risk; if almost certain, this would imply a critical risk

I.7 Connectivity between the deep Gunii Hooloi aquifer and overlying surficial and alluvial aquifers and deep Galbyn Gobi aquifers

According to the Oyu Tolgoi ESIA (Water Resources Management Plan, Citrus, 26112010), the baseline data for the main aquifer units in the Project area can be separated into three main hydrogeological units which have varying degrees of hydrological connectivity in the different parts of the Project area: Alluvial, Bedrock and Late Cretaceous aquifers. Full characterisation of the aquifers has not been completed; however, additional monitoring and investigation are underway.

The most significant aquifers (volume) in the Project Area of Influence are the Late Cretaceous aquifers which comprise a thick sequence of clastic sediments deposited into rift basins with a predominant WSW-ENE trend. In the vicinity of the Project area, Oyu Tolgoi identified and subsequently investigated three basins based on the gravity surveys of the area. These basins were Gunii Hooloi to the northeast, Galbyn Gobi to the southeast and Nariin Zag located to the southwest (Figure 3).

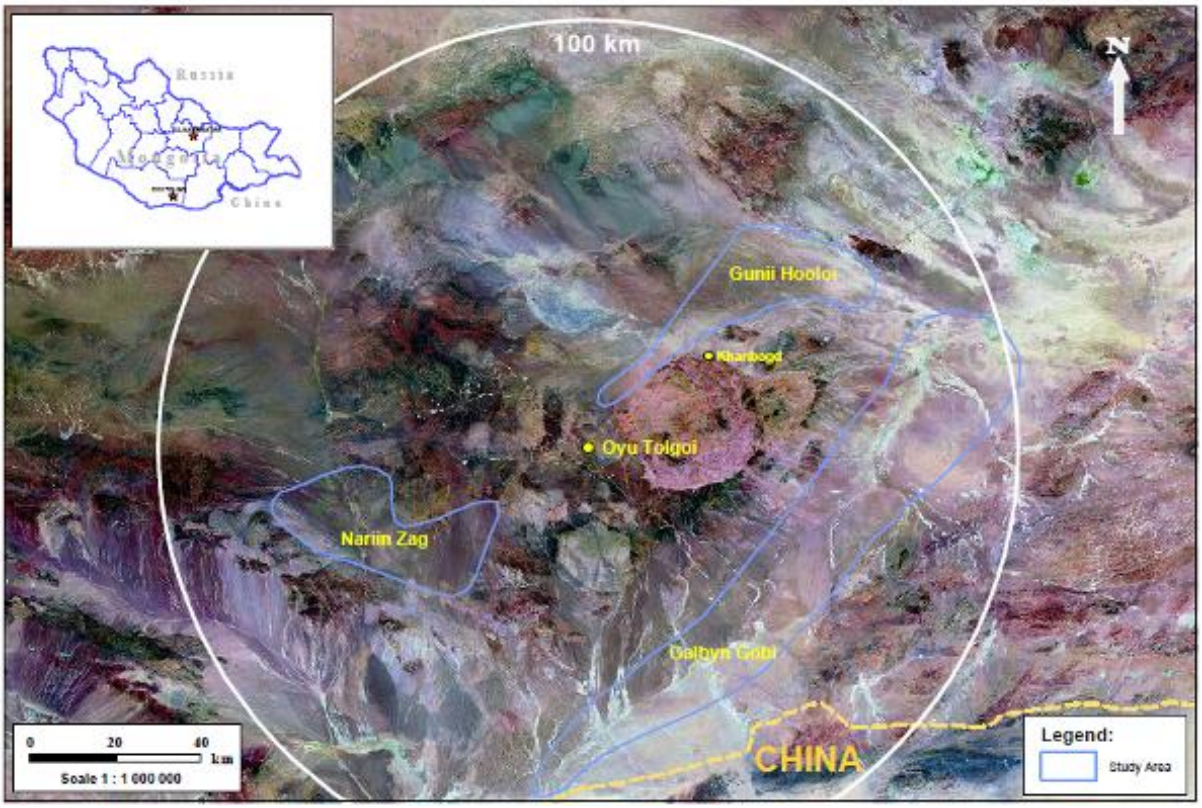

Figure 3: Significant aquifers around the Oyu Tolgoi project

The primary aquifer for the Oyu Tolgoi development is the Gunii Hooloi Aquifer (Late Cretaceous), from which the primary Gunii Hooloi Borefield is being developed to supply water

to the mine operations. There are no short to medium term plans to pump water from the Galbyn Gobi Aquifer (Late Cretaceous) because a) significant resources are defined within the Gunii Hooloi aquifer and b) concerns relating to environmental impacts to groundwater-dependent vegetation in the Galbyn Gobi area. Although the Gunii Hooloi and Galbyn Gobi basins essentially merge at their eastern ends in the Duut Toirem area, partly separated by a low fault defined ridge of basement (Figure 4), for the purposes of this assessment they are treated as individual units because the proposed exploitation area is in the central and western parts of Gunii Hooloi, a significant distance (over 50 km) from where the basins merge. The Galbyn Gobi is not considered further in this Options Paper however, the Oyu Tolgoi project does intend to establish future reserves which it can draw on as/ when required in the future and the option of utilising the Galbyn Gobi is likely to be further explored. Further monitoring of this aquifer as part of the Oyu Tolgoi project long term ground water monitoring programme should be undertaken to provide baseline data on the relationship between the Gunii Hooloi and Galbyn Gobi aquifers (which are thought to have a degree of connectivity) and to determine potential impacts of drawdown of the Gunii Hooloi on the Galbyn Gobi system.

Aquifers abstracted from during the construction are dispersed across the zone of influence of the mine license area and are not considered further here.

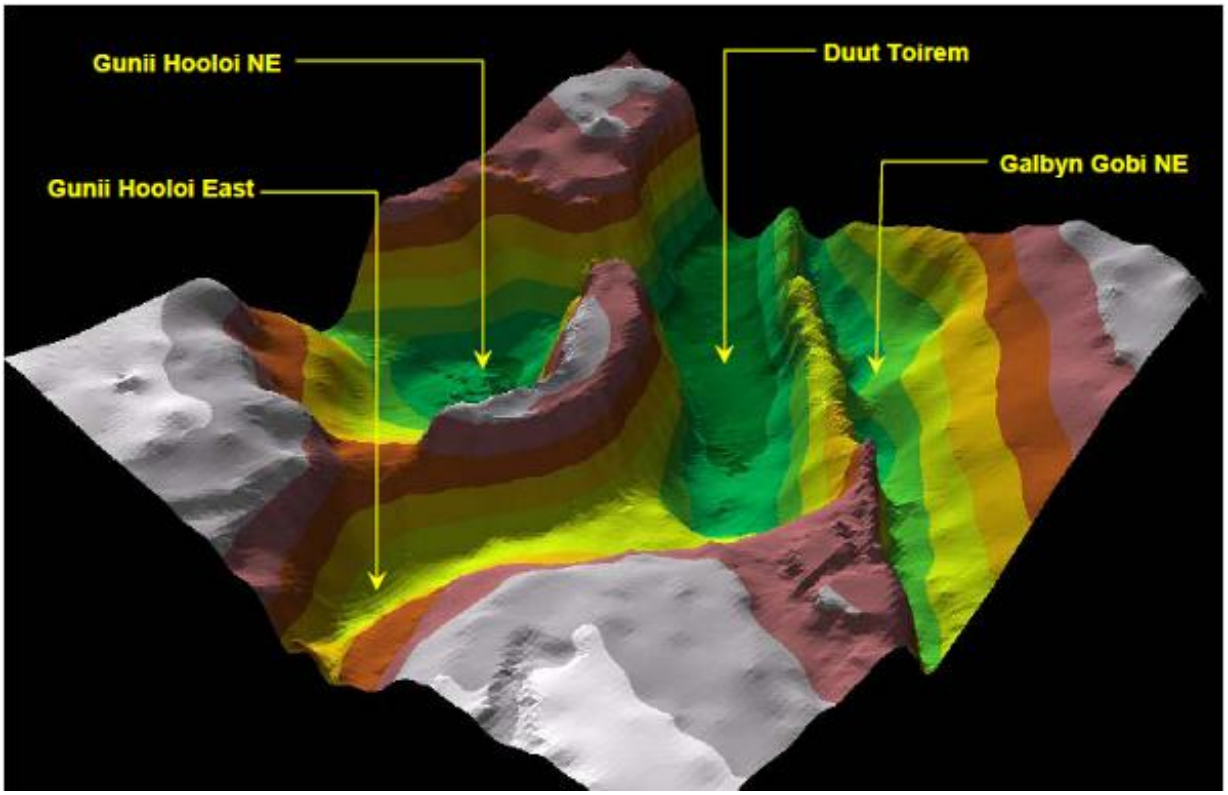

Figure 4: Major Cretaceous Aquifers within the scope of exploitation for Oyu Tolgoi (Aquaterra 2004)

The Gunii Hooloi borefield extends to the northeast of the Oyu Tolgoi mine. The Late Cretaceous aquifer is inferred to extend over 40 km, thickening to the northeast where it is approximately 10 km wide. It is generally separated from the shallow surficial aquifers by the low and impermeable sediments. The surficial aquifer is variably developed within the alluvium that exists over the surface of most of the Gunii Hooloi catchment area, however, it is only strongly developed along the ephemeral watercourses. Recharge to this surficial aquifer occurs directly by rainfall infiltration through the soils and more significantly by infiltration along the drainage courses during flow events. These surficial aquifers, mostly in the stream channel environments, are accessed by hand dug wells and are used by local herders for domestic and stock water supplies.

There are no apparent discharge areas for the groundwater in the basin, with no areas of springs or permanent deep rooted vegetation along the eastern edges of the basin. Flows from the basin may pass to a basin located further to the east (Gunii Hooloi NE Basin) or south-eastwards to merge with the Galbyn Gobi basin. The hydrogeological reports could not confirm that the targeted deep aquifer is not connected to other aquifers and surface water anywhere in the area of influence however, it is considered to pose the lowest risks (c.f. other Cretaceous aquifers) to groundwater dependent vegetation.

Groundwater plays an important role in water supply and the ecology of arid and semi-arid areas where the landscape is fragile due to frequent droughts over the past few decades (Cui *et al.* 2005). Water table depth is a key factor controlling the water balance, groundwater flow, and salt transportation in the saturated envelope. Drawdown of the water table is a primary cause of desert expansion (e.g. inland basins of north-west China). Ground water extraction is known to change the natural water cycle and balance and damage the delicate ecological environment, causing a series of ecological failures such as disappearance of springs, drying of inland lakes, land desertification of downriver areas and salinisation. The key to preventing ecological disaster is to keep the water table at a suitable depth above the 'withering depth' and below the root zone to prevent damage to roots. This will be different for different species - pasture plants have roots which extend up to 2–3 m and are sensitive to soil moisture content and shallow ground water (Cui *et al*. 2005); Saxaul has roots extending to depths of 30–40 m, and is reliant on deeper alluvial groundwater in and adjacent to ephemeral rivers.

Tall Saxaul Forest, Asiatic Wild Ass, Argali and Goitered Gazelle are all dependent on groundwater resources. Saker Falcon is dependent on elm and saxaul trees for nesting but may be able to nest on electricity transmission pylons being erected by the project. At present, it is not entirely clear what impact drawdown of water from the deep, late cretaceous aquifer will have on the shallow groundwater aquifers, upon which these features depend, because the detailed relationship between the recharge events from seasonal rainfall and potential losses from the surface aquifer to deeper formations through vertical permeability have not been adequately characterised (Box 5).

Box 5: Uncertain connectivity between aquifers

The extent of connection between the late cretaceous deep aquifer and the shallow groundwater aquifers is crucial for the impact of pumping from the deep aquifer on water levels in the streambed aquifers. Most of the potential impacts and their implications (on priority biodiversity features and existing wells) depend on the lowering of the water table in the shallow aquifer caused by pumping from the deep aquifer.

According to the ESIA (Environ, 2011) as a deep clastic aquifer, the Gunii Hooloi is reported to receive little or no recharge from annual rainfall. However, this is contradicted by statements in the Water DEIA (Citrus, 2010) which suggest that, in the west of the groundwater study area, there is likely to be recharge (which implies connectivity) to the system where the confining sediments are thinner and/ or more permeable allowing surface water infiltration.

This is supported by data from the Oyu Tolgoi project's monitoring borehole system which shows that in the west of the groundwater study area the piezometric head of the deep aquifer may coincide with the shallow aquifer associated with the water course in this area, indicating that some recharge may occur.

If the aquifers are found to be hydrologically connected then the threat rating, and associated mitigation actions, to the priority biodiversity features considered would necessarily be reviewed.

The impact assessment in this paper is necessarily based upon assumptions outlined in the ESIA (chapter C6 Water Rev D, 2010) which states that, with the exception of the deeper herder well, the Oyu Tolgoi project considers any impact on the shallow groundwater aquifers (and herder wells) unlikely however, it recognises that there is the potential for an impact to exist.

Priority biodiversity features would suffer significant consequences if drawdown of groundwater resources in the deep aquifer causes drawdown in the shallow surficial aquifer. The consequence of this is assessed as serious for Tall Saxaul Forest, and moderate for Saker Falcon and ungulates. Given that the Oyu Tolgoi project recognises that there may be limited hydrological connectivity, and therefore a risk of drawdown in the shallow aquifer, these impacts are assessed as possible, resulting in High Risk.

Further long-term monitoring of flow events and stream sediment storage characteristics tied to monitoring water levels in all aquifers, including in the near-surface aquifers used by the herders hand dug wells, must be undertaken by Oyu Tolgoi. The results of this monitoring will better inform the relationship between shallow surficial aquifers and rainfall and whether there are any drawdown impacts measurable in this shallow aquifer. If the aquifers are found to be hydrologically connected then the threat rating, and associated mitigation actions, to the priority biodiversity features considered would necessarily be reviewed.

The primary risk is posed by loss of habitat from drawdown of groundwater resources at the Gunii Hooloi borefield. In order for these risks to be mitigated, first a comprehensive

understanding of the hydrological linkages between the deep and alluvial aquifers needs to be established. The key issue here is to what extent the deep and shallow alluvial aquifer at Gunii Hooloi are connected - this is not known yet, but it is crucial to the impact of pumping from the deep aquifer on groundwater levels in the shallow surficial aquifers. Most of the potential impacts and their implications (on priority biodiversity features and existing wells) depend on the lowering of the water table in the shallow aquifer caused by pumping from the deep aquifer.

Although monitoring is not considered to be a mitigation action *per se*, here it is considered pre-requisite to establishing effective mitigation actions. The deep aquifer is fairly well studied and, with the monitoring during operation of the borefield, the knowledge of the groundwater flow system will further improve. A similar approach is needed for the shallow, surficial aquifer, defining the baseline and dedicated monitoring (rainfall, infiltration, groundwater levels, flowpaths) will build the understanding of this aquifer and show:

- How the current system works (water balance): recharge, lateral flow, vertical flow evaporation, baseflow to streams, abstraction, water level fluctuations
- If any future changes in groundwater levels (or stream flows) and/ or groundwater quality are due to pumping from the deeper aquifer or caused by changes in the shallow system itself (rainfall variability, changes in land use, increased abstraction etc)
- How local interventions (linkage between landscape management and water buffering, management of the aquifer recharge, micro climate interventions) can prevent or mitigate the impacts on priority biodiversity features, ecosystems services and local water supply (whether caused by pumping or by changes with the minor aquifer itself).

The latter will be important for the Oyo Tolgoi project because any future changes in the (ground) water system (wells falling dry, vegetation changes etc) are likely to be attributed to the deep groundwater abstraction (A. Tuinhof *in litt.* July 2011).

Tall Saxaul Forest and priority ungulate species will all be adversely impacted if groundwater availability in the shallow surficial alluvium is reduced. In this event, if abstraction from highly water stressed areas is halted and the surficial aquifer recharges, then it may be possible to rehabilitate Tall Saxaul Forest, and priority ungulates will return to the area. However, in the event that it is not possible to re-establish groundwater in the surficial aquifer, no rehabilitation of Tall Saxaul Forest would be possible and a suitable offset would need to be identified.

I.8 Connectivity between the deep Durulj Mount Southern aquifer and overlying surficial aquifers

Khanbogd centre is located at the foothill of the Khanbogd massif on the southern side of the Gunii Hooloi basin. Water is supplied from a mixture of private and public wells which abstract groundwater from the surficial quaternary sediments. These sediments are believed to be recharged by groundwater flowing through the fractures and fissures of the weathered zones of the granite body immediately to the south and the associated sedimentary formations (ESIA 2010). They are also believed to be separate from the Gunii Hooloi aquifer system, being present around the periphery of the Khanbogd massif in a sub-basin to the south of the main basin however, full characterisation of the Gunii Hooloi borefield has not been undertaken. There is little detail on the well construction and generally no information on the aquifer parameters has been gathered.

In order to satisfy the demands of the predicted in-migration, the Oyu Tolgoi project has contracted a geophysical investigation covering a 20 by 10 km area around Khanbogd Centre to study the potential groundwater resources. The geophysical survey has identified a prospective groundwater aquifer called the Durulj Mount Southern Basin (Geomaster Engineering 2010) which is located 2-6 km from Khanbogd Centre. The Oyu Tolgoi project has commissioned the drilling of seven exploration boreholes in this aquifer (water level is anticipated to be at an average depth of 150-200 m) and the results will be used to prepare a submission of a water reserve estimate to enable the design of the water abstraction system.

As described in previous sections, groundwater plays an important role in water supply and the ecology of arid and semi-arid areas where the landscape is fragile due to frequent droughts over the past few decades (Cui *et al.* 2005). Water table depth is a key factor controlling the water balance, groundwater flow, and salt transportation in the saturated envelope. Drawdown of the water table is a primary cause of desert expansion (e.g. inland basins of north-west China). Ground water extraction is known to change the natural water cycle and balance and damage the delicate ecological environment, causing a series of ecological failures such as disappearance of springs, drying of inland lakes, land desertification of downriver areas and salinisation. The key to preventing ecological disaster is to keep the water table at a suitable depth above the 'withering depth' and below the root zone to prevent damage to roots. This will be different for different species - pasture plants have roots which extend up to 2–3 m and are sensitive to soil moisture content and shallow ground water (Cui *et al*. 2005); Saxaul has roots extending to depths of 30–40 m, and is reliant on deeper alluvial groundwater in and adjacent to ephemeral rivers.

Riverine Elm Trees, Tall Saxaul Forest, Asiatic Wild Ass and Goitered Gazelle are all dependent on groundwater. Saker Falcon is dependent on tall elm and saxaul trees for nesting but may be able to nest on electricity transmission pylons being erected by the project. Until the results of the groundwater investigations at the Durulj Mount Southern aquifer are available, it is not possible to infer whether or not groundwater abstraction from this aquifer will cause a drawdown in groundwater in any of the shallow surficial aquifers upon which these features depend (Box 6) or, indeed, whether abstraction will go ahead at all.

Box 6: Uncertain impacts of water abstraction from Durulj Mount Southern Aquifer

Priority biodiversity features would suffer significant consequences if drawdown of groundwater resources in the deep Durulj Mount Southern aquifer impacts any of the shallow surficial aquifers. Until studies are completed to characterise this aquifer and its hydrological connectivity with adjacent shallow surficial aquifers, it is not possible to make any estimates of surficial groundwater drawdown and therefore impact on priority biodiversity features. If significant connectivity is detected between the deep and shallow aquifers, the likelihood of impacts would be Likely or Almost Certain, and if this impacts an extensive area, this implies Critical or High Risks/ threats to Riverine Elm Trees and Tall Saxaul Forest and High Risks/ threats to ungulates. In this case, an alternative source of water supply for Khanbogd should be investigated.

Appendix II: Project impacts

These descriptions are updated consolidations of the impact information given in each of the eight individual Biodiversity Management Plan Options Papers. Impacts are primarily documented where they lead to a high or critical risk to a priority biodiversity feature, based on the risk assessment process (Appendix III). In addition, owing to concerns about connectivity issues prior to mitigation actions, this issue is also discussed – even though it only ranked as a 'medium risk'.

II.1 Direct habitat loss

Habitat supporting many priority biodiversity features will be lost under the Oyu Tolgoi project's direct infrastructure footprint. This includes 64 km^2 in the mine licence area, 1.5 km^2 for the airport and 1.3 km^2 for the borefield/pipeline corridor. The additional direct footprint of the road upgrade to Gashuun Sukhait is small, primarily comprising 19.4 km of linear infrastructure of c.15 m width, as the remainder of the road will be constructed over an existing track, which has deteriorated in places to a series of tracks where vehicles have followed parallel routes. There will be very little direct habitat loss under the medium-voltage and high-voltage power distribution lines as there will be no vegetation clearance except for very small direct losses under the pylon supports. It is assumed that no significant habitat loss will occur under the Undai and Budaa diversions, the borefield *per se* or the Khanbogd Area.

The vast majority of this area is open dry rangeland habitat. However, the Mine License Area footprint will also destroy c.52 ha of the ephemeral Undai river, including the Bor-Ovoo Spring, and c.7 ha of numerous small ephemeral water courses which flow into Budaa water course (ESIA 2011; Purevsuren Nyambuu pers. comm. 2011).

Most significant impacts will be on plants, which cannot move. *Potaninia mongolica* is known from the pipeline route, according to the DEIA. The other rare plants are not known to occur under planned infrastructure, but there is a possibility that they occur as they are widespread in the general area. Impacts are also expected on the largely resident species and, to a lesser extent, migrant birds. Impacts on other priority species are not expected to be significant because they are not likely to use the area substantially or are largely passage migrants that only fly through the area. Three individual Riverine Elm Trees are known to have been impacted – these were transplanted away from the mine site but their long-term survival prospect is unknown. Tall Saxaul Forest may be impacted by the Gunii Hooloi borefield but most saxaul forest is low and heavily degraded.

These risk assessments and mitigation plans assume that the Oyu Tolgoi project will follow standard best practice for minimisation and restoration of construction (including construction camps, access roads, borrow pits and temporary parking areas) and operation footprints.

II.2 Indirect habitat loss due to avoidance

Many priority biodiversity features are predicted to avoid areas close to project infrastructure and activities. Such avoidance is not complete and total: for example, avoidance may be 100%

within several metres of a road, 50% within 500 m, 25% within 1 km, etc. Avoidance distances depend on factors such as noise, dust, local topography and vegetation, and hunting pressure. Within the Oyu Tolgoi Area of Influence, background hunting pressure is the strongest driver of avoidance, especially for Asiatic Wild Ass and other ungulates avoiding vehicles and people. Avoidance distances are likely to be higher during construction, when noise and dust pollution will be greatest, and animals have not yet habituated to the infrastructure. Most of the soil, at least in the Mine License Area, comprises a 10-15 cm thick layer of fine to very fine particles (0.1 mm-0.001 mm in diameter) beneath a gravelly protective surface layer (Amendment to Mine and Processing DEIA 2010). Once the protective surface layer is eroded, e.g. by vehicles, the fine particular material, which is usually very dry, will be carried by winds and contribute to the avoidance impact. Some data on avoidance distances may be possible to obtain empirically (e.g. by aerial surveys) and monitoring. For example, Asiatic Wild Ass in the southern Gobi region are estimated to avoid areas within 5 km of vehicles (P. Kaczensky *in litt.* 2011). However, given likely habituation to static infrastructure, it has been necessary to infer and extrapolate avoidance distances. For example, impacts have been demonstrated up to 1,600 m for Great Bustard (Lane *et al.* 2001; López-Jamar 2010; Raab 2011) and Reindeer have shown reduced population effects up to 17 km from similar infrastructure where historically hunted (Benítez-López *et al.* 2009). Complete avoidance creates a barrier effect and fragmentation but powerlines and fully mitigated roads are not expected to act as full functional barriers to any species (see Section II.3 below).

Avoidance of powerlines by (hunted) ungulates is predicted to be significantly less than from other infrastructure associated with human or vehicular activity. There is however predicted to be a significant avoidance of powerlines by Houbara and Great Bustards based on avoidance measured up to 800 m and possibly up to 1600 m for Great Bustard (Lane *et al.* 2001; Raab 2011) and strong avoidance by Little Bustard within 400 m of power lines (J.-P. Silva *in litt.* 2011; Silva *et al.* 2010). Based on these limited data, a precautionary estimate of 1 km avoidance distance was made for bustards and powerlines. Similar data for roads and agricultural buildings lead to similar estimates of 1 km avoidance distances for bustards. Avoidance distances from Khanbogd town for all species was estimated to be much greater given the likelihood of regular human and vehicular traffic radiating out from the town.

Provisional estimates of avoidance distances are given in Table 7:

Table 7: Provisional estimates of avoidance distances for priority biodiversity features from project infrastructure

Priority biodiversity feature	Hunted?	Mine site/airport	Busy road	Powerlines	Khanbogd town
Mongolian Chesney	n/a	n/a	n/a	n/a	n/a
Snow Leopard	yes	n/a	n/a	n/a	n/a
Asiatic Wild Ass	yes	5 km	5 km	500 m	10 km
Argali	yes	500 m	1 km	0	5 km
Goitered Gazelle	yes	1 km	5 km	500 m	10 km

Mongolian Gazelle	yes	1 km	5 km	500 m	10 km
Long-eared Jerboa	no	n/a	n/a	n/a	n/a
Swan Goose	yes?	likely some avoidance but very limited habitat for this rare migrant			
Ferruginous Duck	yes?	likely some avoidance but very limited habitat for this rare migrant			
Short-toed Snake-eagle	no	0	0	0	0
Saker Falcon	(no)	0	0	0	0
Egyptian Vulture	no	0	0	0	0
Great Bustard	yes	1 km	1 km	1 km	5 km
Houbara Bustard	yes	1 km	1 km	1 km	5 km
Relict Gull	no?	likely some avoidance but very limited habitat for this rare migrant			
Pallas' Sandgrouse	no	0	0	0	0
Mongolian Accentor	no	n/a	n/a	n/a	n/a
Mongolian Ground-Jay	no	0	0	0	0
Yellow-breasted Bunting	no	0	0	0	0
Granit Outcrop Floral Communities	no	n/a	n/a	n/a	n/a
Riverine Elm Trees	no*	n/a	n/a	n/a	n/a
Ephemeral Lakes and Pools	no*	n/a	n/a	n/a	n/a
Tall Saxaul Forest	no*	n/a	n/a	n/a	n/a
Eastern Gobi desert-steppe	no	n/a	n/a	n/a	n/a
Alashan Plateau semi-desert	no	n/a	n/a	n/a	n/a

*Although not hunted and not showing avoidance distances, plants and habitats may be collected or otherwise impacted. The rapid biodiversity assessment team has not estimated the impact distances of collection as this is a social research question.

The Oyu Tolgoi road upgrade to Gashuun Sukhait is likely to act as a deterrent to some animal populations, causing avoidance of habitat near the road and thus indirect habitat loss. The impacts of this indirect habitat loss are factored into the discussion of road mitigations and Net Positive Impact calculations.

II.3 Fragmentation (reduced connectivity) of populations

The Oyu Tolgoi project has made a world-leading commitment to put in place appropriate and sufficient underpasses along the road upgrade to Gashuun Sukhait. This demonstration is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure. These are planned to be appropriate for the wide-ranging species of conservation concern in the region, given best international knowledge to date, and are planned to be sufficient to allow ecological permeability, given known animal daily ranging distances. Given this, the fragmentation impacts of this road upgrade are expected to be negligible in the medium- to long-term (after animals have habituated to the road, and a concurrent anti-poaching programme has sufficiently reduced hunting such that animals have reduced fear of vehicles). In particular, it is considered that

cumulative impacts will be negligible given the existing presence of the unmitigated Tavan Tolgoi 'coal road' and its heavy traffic volumes. The 'coal road' runs approximately parallel to the Gashuun Sukhait road upgrade, and is likely to have already fragmented ungulate populations (as discussed below). The residual, cumulative risk of the Oyu Tolgoi road upgrade to Gashuun Sukhait causing fragmentation of ungulate populations was assessed as:

- likely (loss of some of the feature would occur in majority of cases) likelihood
- minor (would cause an insignificant noticeable portion to be lost) consequence
- therefore 'medium' risk

Although few data yet exist to assess impacts, the pre-existing 'coal road' from Tavan Tolgoi to Gashuun Sukhait, and its heavy traffic volumes, is likely to be having a significant fragmentation effect on wide-ranging species in South Gobi. Cumulatively (i.e. over and above this existing road), a well-mitigated Oyu Tolgoi road upgrade to Gashuun Sukhait would be likely to have negligible fragmentation impacts.

The Trans-Mongolia railway acts as a barrier that Asiatic Wild Ass are unable to cross, such that 17,000 km^2 of suitable habitat on the eastern side of the railway has now been lost (Kaczensky *et al.* 2006; Kaczensky *et al.* 2011). Likewise, Mongolian Gazelle find the railway an almost impermeable barrier, despite the presence of concrete box culverts designed for livestock passage (Ito *et al.* 2005, 2008). Because the Chinese border fence to the south presents another major barrier to movement, east-west connectivity across Umnogobi and Dornogobi is vital. Although little quantitative research has been carried out on roads in the region, traffic volumes of >2,000 vehicles/day have been shown to have a barrier effect (Sawyer & Rudd 2005; Clevenger & Huijser 2011) and volumes of >4,000 vehicles/day are considered "strong to complete barriers to wildlife movements" in North America (Mueller & Berthoud 1997). In the open environments of southern Mongolia, where wild animals have a much clearer view of long stretches of road and are very wary of vehicles due to hunting pressure and harassment, it is likely that – without the world-leading mitigation planned by the Oyu Tolgoi project – the predicted traffic volume on the road upgrade to Gashuun Sukhait (>1,600 vehicles/day by 2030) would create a complete functional barrier to ungulates (i.e. some individuals will be able to cross, but functional ecological and genetic connectivity would be lost). P. Kaczensky (*in litt.* 2011) has estimated a serious barrier effect for Asiatic Wild Ass at 400 vehicles/day and a complete ecological barrier at 1,000 vehicles/day[2]. Current traffic volumes are below 400 vehicles/day and are expected to decline immediately after construction (increasing again owing to non-mine traffic in the longer term). Current traffic volumes would thus be expected to have a partial, but not total, barrier effect if appropriate and sufficient underpasses had not been planned. Current traffic volumes on the 'coal road' from Tavan Tolgoi to Gashuun Sukhait

2 The figure of 400 is based on fleeing distances of c. 1 km, maximum speeds of 4 km/h, and thus a need for a break in traffic of 15 minutes for an animal to feel comfortable crossing. This equates to an average of 96 vehicles/day if evenly spaced. Assuming vehicles are not evenly spaced (i.e. bunched), perhaps four times as many cars could still leave similar gaps in traffic – i.e. 400. These are of course very rough approximations, and based on continued hunting (and thus car avoidance). They do, nonetheless, provide some level of assessment tailored to the situation in the area.

are expected to have a complete functional barrier effect.

Fragmentation can occur for all terrestrial species to some extent, but is most significant in this region for ungulates (Asiatic Wild Ass, Argali, Goitered Gazelle and, to a lesser extent because it is on the limit of its distribution in this area, Mongolian Gazelle). Fragmentation splits populations into smaller, more vulnerable and genetically weak units. For nomadic or migratory species, fragmentation can cut off access to critical resources, directly kill animals (e.g. Ito *et al.* 2008) and thus lead to overall population decline or regional extinction (e.g. Ben-Shahar 1993). A study of effects on wildebeest (a similarly wide-ranging large ungulate) of a proposed road in the African Serengeti concluded that, even without factoring in habitat loss, the barrier effect of the road could cause the Wildebeest population to decline by a third because it would no longer be able to effectively track temporal shifts in pasture resources across the landscape (Holdo *et al.* 2011). As a result of this study, and public concern, the road has recently been cancelled (http://news.mongabay.com/2011/0623-hance_serengeti_road.html). The similarities between the temporal shifts in pasture resources required for wildebeest regional survival and the ecological situation faced here by the large ungulates are significant.

Powerlines are not expected to act as functional barriers creating significant population fragmentation or reduced connectivity (but are expected to be avoided by some species, creating indirect habitat loss).

II.4 Direct mortality from collision with vehicles and powerlines, and electrocution by power distribution lines

Some priority biodiversity features are at risk of death and injury from collision with vehicles and power lines, and from electrocution by power lines.

Several priority species are susceptible to injury or death from collision with vehicles. This risk increases with the speed and size of vehicles. Large vehicles are less able to brake or take evasive action. In a study of animal collisions in Israel, 31% of 226 collisions were with (domestic) horses and donkeys and 3 of 18 collisions with wild animals were with gazelle (Inbar *et al.* 2006). Asiatic Wild Ass, a close relative of the horse and donkey, may potentially be at elevated risk owing to their propensity to run when alarmed. However, another study found medium-sized animals most at risk of collisions (Barthelmess and Brooks 2010), perhaps owing to greater avoidance of more obvious large animals. Overall, mortality from collision with vehicles is likely to be limited, with impacts manifested more as avoidance of roads with heavy traffic unless hunting is controlled and animals habituate to traffic.

Although a range of bird species suffer mortality from collisions with wires, bustards and birds of prey are particularly susceptible to collisions with power lines (Martin & Shaw 2010). Mortality from such power lines can be severe; appearing to have exceeded 10% of total population in the short-term in some studies of Houbara Bustard (Martin *et al.* 2006) and accounting for high percentages of overall mortality in many studies (e.g. >80% of mortality in adult Great Bustard in one study was caused by collision with power lines and fences; García-

Montijano *et al.* 2002). Estimates of total bird collision rates vary from about 0.1 to 80 casualties per km per year (Jenkins *et al.* 2010). Ludwig's Bustard *Neotis ludwigii*, which is particularly susceptible (as it undertakes daily flights to and from roost sites as well as longer distance movements; Allan 2005) has an average of several casualties per km per year (> 0.63 corpses found per km plus those removed by scavengers; Jenkins *et al.* 2011).

The high-voltage power transmission lines are planned to be suspended at 25.8 - 49.5 m above ground level (three vertically parallel sets of lines plus two optical ground wires [OPGWs]). These heights are above normal flight heights by Houbara Bustards during the breeding season (which is extremely limited; N. Batbayar pers. comm. 2011; O. Combreau pers. comm. 2011) but within the range of migration flight heights (mostly below 100 m altitude; O. Combreau *in litt.* 2011). Houbara Bustard migrates east-west in this region (Tourenq *et al.* 2004; Judas *et al.* 2006; Gao *et al.* 2009), perpendicular to the power line orientation and thus exposed to maximum threat. Houbara Bustard is also known to migrate both by day and at night (O. Combreau pers. comm. 2011). At night, Houbara Bustard may suffer a higher rate of collisions because wires are less visible, as is the case for Little Bustard (J.-P. Silva pers. comm. 2011). Thinner wires (such as the earth wires) pose more of a risk of collision owing to their lower visibility (e.g. Faanes 1987). The risk to other priority bird species is less well known but resident Egyptian Vulture and migrating Swan Goose, Great Bustard and Relict Gull are assessed as being at moderate risk.

There is also a risk of electrocution to any medium or large bird that can span the distance between the conductors or grounded and energised hardware (e.g. Tintó *et al.* 2010). A range of bird of prey species, including Saker Falcon, often perch and nest on power line poles and pylons (Potapov *et al.* 2001), which makes them particularly susceptible to electrocution. The conductors on the pylons used at the Oyu Tolgoi project are at least 2.5 m from any grounded hardware and so do not represent a significant electrocution risk for birds. However, the designs chosen for the Oyu Tolgoi medium-voltage power distribution lines do cause significant risk owing to short distances between conductors and grounded/energised hardware. Electrocutions, mostly from medium voltage power lines, were responsible for 54% of 64 Saker Falcon found dead in Mongolia 1998-2004 (Sundev *et al.* 2001) and Harness *et al.* (2008) found 0.7 dead birds/km under concrete poles along medium-voltage power lines in Mongolia, of which 19% were Saker Falcons (many fewer were found under older wooden poles).

II.5 Indirect mortality from illegal hunting and collecting facilitated by increased access and in-migration

The primary threat to the survival of Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard is illegal hunting. Hunting for sale of meat caused catastrophic declines of Asiatic Wild Ass in Central Asia in the 1990s, including extirpation from Kazakhstan, Uzbekistan and Ukraine (IUCN 2010). Likewise, high levels of hunting in the 1980s severely decreased the species' populations in northern China (IUCN 2010). Wingard & Zahler (2006) reported that approximately 3,000 Asiatic Wild Ass were illegally hunted and traded in Mongolia in 2004, out of an estimated total of 17,513-19,309 in Mongolia (Lhagvasuren 2007). This rate is

unsustainable and would lead to the species' extirpation (Moehlman *et al.* 2008). Total numbers of Argali in Mongolia appear to have declined from about 60,000 in 1985 to 13,000-15,000 in 2001 (Amgalanbaatar *et al.* 2002). Hunting levels are less well known for Goitered Gazelle. Houbara Bustard are currently primarily hunted in their non-breeding range outside of Mongolia, where declines in some areas have reached 30% per annum (Tourenq *et al.* 2005). Saker Falcon is also at risk of being collected for the falconry trade although there is currently a moratorium on the export of Saker Falcons. Tall Saxaul Forest is at risk from collection for firewood, which is largely illegal. Saxaul collection is increasing as more people move to Khanbogd soum, remote areas become more accessible by road and there is increased demand by roadside restaurants for fuelwood (Schmidt *et al.* 2011).

The Mongolian 'Law on Fauna' prohibits hunting of 'very rare' and 'rare' species including Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard except under licence. Mongolia has also ratified the 'Convention on International Trade of Endangered Species' (CITES) which strictly regulates trade in Appendix I species including Asiatic Wild Ass, and regulates trade in Appendix I species including Argali and Saker Falcon.

The Oyu Tolgoi project prohibits hunting by employees but hunting and collecting is likely to be increased by the regional influx of people not employed by the project, and by increased use of the roads by public traffic. In-migration associated with economic activities at the Oyu Tolgoi project may see an influx of up to 32,000 people into the soum (ESIA, Draft Influx Management Plan 2010). Hunting is a traditional activity for many Mongolian and Chinese people, and subsistence hunting alone is unlikely to pose a significant threat. However, pursuit with fast-moving vehicles and hunting with fire-arms are a much higher threat. Hunters can and will drive off-road, but will tend to follow better (faster) roads where available. Furthermore, the upgraded road to the border at Gashuun Sukhait increases accessibility to China, the world's biggest market for wild animal products. The rate of such hunting will be determined by factors such as local access to fire-arms and ammunition and enforcement of laws against hunting these species by non-mine traffic along the road, but is poorly-known and needs monitoring.

Fuel needs of local people in this sphere of influence are primarily met by dried livestock dung and, in winter, when heating needs are high, woody plants – primarily saxaul (Damdin 2011). Elm, Poplar and Tamarisk species are not commonly used for fuel in the area (Damdin 2011). The majority (93%) of local households used wood, charcoal and dung in unknown proportions (Center for Policy Research 2009 in Environ 2011). Availability of trucks has enabled recent over-harvesting of woody plants, notably saxaul (Damdin 2011; Environ 2011; K. Olson pers. comm. 2011; S. Schmidt *in litt.* 2011).

II.6 Indirect mortality from increased populations of natural predators

Among priority biodiversity features, this impact is mainly relevant to Houbara Bustard nesting in the area. The primary predators of breeding and migrant Houbara Bustard in the region are mammals, notably foxes *Vulpes spp.* (Combreau *et al.* 2002; Yang *et al.* 2002). A range of other predators, including smaller mammals and birds such as Long-legged Buzzard *Buteo rufinus* and Common Raven *Corvus corax,* are likely to predate eggs and chicks (Heredia 1995;

Combreau & Smith 1998; Combreau *et al.* 2002). Although Saker Falcon is commonly used by falconers to hunt Houbara Bustard, wild Saker Falcon appear to very rarely hunt Houbara Bustard in this region (Sundev *et al.* 2001; G. Sundev pers. comm. 2011).

Terrestrial predation levels are often elevated along roads and other linear infrastructure. Vehicles and powerlines will inevitably kill and injure at least small mammals and birds, resulting in some dead and injured animals along the route. These, along with litter that has been thrown from vehicles along the road, are likely to increase populations of scavengers such as Raven, Black Kite, foxes and Long-eared Hedgehog *Hemiechinus auritus* (all potential predators of nests, including those of Houbara Bustard) along the route. Increased use of linear routes and predation rates has been demonstrated for Wolves *Canis lupus* (James and Stuart-Smith 2000; Whittington *et al.* 2011). Avian predators, including buzzards, Black Kite, Saker Falcon and Common Raven, perch and nest on all types of power line towers and raised artificial structures where there is a lack of elevated perching and nesting sites (e.g. Potapov *et al.* 2001). Thus, susceptible species including Houbara Bustard are likely to suffer increased terrestrial and avian predation rates along road and power line routes. The sum of elevated mortality from these varied types of elevated predation pressure is difficult to calculate without monitoring actual impacts. This was assessed for the ground-nesting Houbara Bustard and Mongolian Ground-Jay as having a 'medium' consequence (i.e. a noticeable portion degraded/lost, but viability/function not reduced) and hence a 'high' risk following Rio Tinto's risk assessment matrix (Appendix III).

Appendix III: Risk assessment

In order to assess the risk represented to priority biodiversity features, each impact and feature was individually assessed according to standard Rio Tinto Biodiversity Action Planning methods (Rio Tinto 2010). Rio Tinto risk assessment is in line with its Health, Safety and Environment Quality Management Systems (HSEQMS) and attempts to classify risks based on the consequence and the likelihood of an event. A set of subjective but practical 'Biodiversity Likelihood and Consequence Descriptors' have been developed (Table 8a, 8b) for use in the risk assessment matrix (Table 9). At the outset, to identify a baseline, these assume that no mitigation is put in place.

Table 8a: Biodiversity-specific descriptors for (a) likelihood

A- Almost Certain	B- Likely	C- Possible	D- Unlikely	E- Rare
Degradation/loss of some/all of biodiversity feature is *inevitable* because of the company's existing/proposed activities. E.g. tailings site will be located where individuals of an endangered plant species are present.	**Degradation/loss of some/all of biodiversity feature *would occur in the majority of cases* because of the company's existing/proposed activities.** E.g. berry crops harvested by native communities are in the company's airshed and may receive some particulate matter under prevailing wind conditions.	**Degradation/loss of some/all of biodiversity feature will not occur in the majority of cases, *but is not unexpected*, because of the company's existing/proposed activities.** E.g. high precipitation event (once in 10 years) increases sedimentation to river from company lands.	**Degradation/loss of some/all of biodiversity feature is *not impossible but should not occur under normal circumstances* because of the company's existing/proposed activities.** E.g. unpredicted subsidence from block caving causes loss of natural features important to local indigenous community.	**Degradation/loss of some/all of biodiversity feature *will only occur under force majeure* under the company's existing/proposed activities.** E.g. an act of sabotage results in dam malfunction causing excessive flooding and scouring of fish habitat.

Table 8b: Biodiversity-specific descriptors for (b) consequence

1- Minor	2- Medium	3- Serious	4- Major	5- Catastrophic
The company's existing/proposed activities cause an insignificant portion of the biodiversity feature to be degraded/lost. E.g. reduction in forest cover in mine concession causes slight reduction of water availability in dry season, with no discernible effect for downstream users.	**The company's existing/proposed activities cause a noticeable portion of the biodiversity feature to be degraded/lost, but the viability/function of feature is not reduced.** E.g. company activities cause the loss of several individuals of a threatened plant species, but this does not reduce the viability of the local population.	**The company's existing/proposed activities cause a significant portion of the biodiversity feature to be degraded/lost, and the viability/function of some portion of the feature *is* reduced.** E.g. company activities reduce the viability of the local population of a threatened plant species, but national and global conservation status of the species is unchanged.	**The company's existing/proposed activities cause a significant portion of the biodiversity feature to be degraded/lost, and the viability/function of the entire feature is reduced.** E.g. reduction in forest cover in mine concession causes significant reduction of water availability in dry season, resulting in regular dry season water shortages for downstream users.	**The company's existing/proposed activities cause the entire biodiversity feature to be degraded/lost.** E.g. company activities cause the extinction of a threatened plant species known only at that site. E.g. reduction in forest cover in mine concession permanently eliminates dry season water flow for downstream users.

Table 9: Risk assessment matrix

Likelihood	Consequence				
	1 - Minor	2 - Medium	3 - Serious	4 - Major	5 - Catastrophic
A - Almost Certain	Moderate	High	Critical	Critical	Critical
B - Likely	Moderate	High	High	Critical	Critical
C - Possible	Low	Moderate	High	Critical	Critical
D - Unlikely	Low	Low	Moderate	High*	Critical
E - Rare	Low	Low	Moderate	High*	High*

Risk assessment tables were populated in each of the eight BMP options papers for each key biodiversity feature x impact. In the interests of space, these are not copied here but are available in the eight BMP options papers, but these are potentially outdated as the list of

priority biodiversity features has been updated and some new baseline data may have become available. Examples are given below in Tables 10 and 11. Mitigation actions were developed only those impacts assessed as High or Critical risk to specific priority biodiversity features (Table 2).

Table 10: Threat rating from indirect mortality from hunting and collection at the Khanbogd Area

Feature	Likelihood	Consequence	Threat rating
Mongolian Chesney	Possible	Serious	High
Asiatic Wild Ass	Possible	Major	Critical
Argali	Possible	Serious	High
Goitered Gazelle	Possible	Serious	High
Mongolian Gazelle	Possible	Medium	Moderate
Swan Goose	Unlikely	Minor	Low
Ferruginous Duck	Unlikely	Minor	Low
Short-toed Snake-Eagle	Unlikely	Minor	Low
Saker Falcon	Possible	Serious	High
Egyptian Vulture	Unlikely	Minor	Low
Great Bustard	Possible	Medium	Moderate
Houbara Bustard	Possible	Serious	High
Relict Gull	Unlikely	Minor	Low
Mongolian Ground-jay	Unlikely	Minor	Low
Yellow-breasted Bunting	Unlikely	Minor	Low
Gobi Naked-toed Gecko	Unlikely	Minor	Low
Riverine Elm Trees	Possible	Medium	Moderate
Tall Saxaul Forest	Likely	Serious	High

Table 11: Threat rating from direct loss of habitat at the Khanbogd area

Feature	Likelihood	Consequence	Threat rating
Mongolian Chesney	Possible	Minor	Low
Asiatic Wild Ass	Almost certain	Minor	Moderate
Argali	Possible	Minor	Low
Goitered Gazelle	Almost certain	Minor	Moderate
Mongolian Gazelle	Unlikely	Minor	Low
Swan Goose	Unlikely	Minor	Low
Ferruginous Duck	Unlikely	Minor	Low
Short-toed Snake-Eagle	Possible	Minor	Low
Saker Falcon	Almost certain	Minor	Moderate
Egyptian Vulture	Possible	Minor	Low
Great Bustard	Possible	Minor	Low
Houbara Bustard	Almost certain	Minor	Moderate
Relict Gull	Unlikely	Minor	Low
Mongolian Ground-jay	Almost certain	Minor	Moderate
Yellow-breasted Bunting	Possible	Minor	Low
Gobi Naked-toed Gecko	Possible	Minor	Low
Riverine Elm Trees	n/a	n/a	n/a
Tall Saxaul Forest	n/a	n/a	n/a

Appendix IV: Background to construction of wildlife passes

From a realistic, current perspective, options to minimise fragmentation effects of roads as a barrier to animal movement or to improve connectivity across roads primarily comprise (in order of effectiveness) underpasses (raised sections of road); wildlife overpasses (wildlife-specific bridges); wildlife culverts (small crossings under roads designed for wildlife); and road closures at key times. Construction of tunnels, underpasses, wildlife overpasses and wildlife culverts is considered best practice in Europe and North America (Bruinderink & Hazebroek 1996; Clevenger & Huisjer 2011; www.wildlifeandroads.org). These are expensive but proven effective solutions to the barrier effects of roads on wildlife. The type, size, design, frequency and location of such 'wildlife crossings' are tailored to specific sites and species. Burying the road in tunnels would be preferable but is apparently too expensive and would cause too long a construction delay. In southern Mongolia, available evidence indicates that underpasses would be the next most effective wildlife crossings, although they are expensive in areas of flat topography.

Wildlife overpasses are essentially vegetated bridges for wildlife that are built over a road and are wide enough to screen the road from view. In closed environments such as forests, widths are usually a minimum of 50 m as trees and tall shrubs screen the road from view by wildlife. However, this design has no functioning precedent in open environments (where animals can see a long way), though experimental designs are in development for Pronghorn Antelope *Antilocapra americana* in North America. Expert opinion is mixed over whether overpasses would be suitable (e.g. P. Kaczensky pers. comm. 2011) or not (e.g. K. Olson pers. comm. 2011) for the open habitats and sensitive ecosystems of southern Mongolia. If such a design were to be trialled experimentally in this area, such a trial should be outside of the Small Gobi Strictly Protected Area (to avoid further construction of unproven value), closely monitored to assess connectivity value, and such overpasses should be as wide as possible (minimum 500 m; P. Kaczensky pers. comm. 2011) to avoid animals' perception of being on a bridge. Given the uncertainty over success of overpasses in the open habitats of the Gobi, underpasses or culverts are the most appropriate wildlife crossings. As no overpasses have been built for hunted open-country species anywhere, their efficacy is unknown in this environment, and any overpasses would be considered an experiment rather than a mitigation action. Crossings designed for larger species will generally be effective for smaller species. Given the importance of the unit of analysis for Asiatic Wild Ass, the largest priority species, it is crucial to understand what kind of crossings are suitable for this species.

The only infrastructure barrier minimisation attempted to date specifically for Asiatic Wild Ass has been in eastern Mongolia (on the Ulaanbaatar-Beijing railway) and in India. Asiatic Wild Ass and Mongolian Gazelle do not use concrete box culverts (c. 2.5 m high and 4 m wide) under the Ulaan Baatar-Beijing railway that are used by vehicles and livestock (Ito *et al.* 2005, 2008; Kaczensky *et al*. 2006, 2011). In India, where Asiatic Wild Ass are not hunted and are well-habituated to humans and human infrastructure, animals occasionally used culverts of 2.5 m height and 7 m width (on a natural substrate) but more frequently used culverts of 3 x7 m and 5 x 24 m (World Bank 2002). Given the limited information available on suitability of wildlife

crossings for Asiatic Wild Ass, it is useful to draw on closely-related species in similar environments elsewhere. Kiang *Equus kiang* (formerly considered to be the same species as Asiatic Wild Ass), Tibetan Antelope *Pantholops hodgsonii* and Tibetan Gazelle *Procapra picticaudata* use underpasses and culverts of 3.9-8 m high and 15-3,500 m width under the Qinghai-Lhasa railroad, but not underpasses 2.5 m high even when >11 km in length (Baofa *et al.* 2006; Xia *et al.* 2007). Further, although Tibetan Gazelle and Tibetan Antelope were recorded using culverts 7-8m high and 3 m wide, Kiang have not been recorded using these narrow culverts (a view of the horizon is believed to be important in encouraging wild ass to use crossings). Natural, non-waterlogged substrate with no obstacles was optimal for maximising wildlife use of these crossings (Baofa *et al.* 2006; Xia *et al.* 2007). More detailed studies of large ungulate species in North America have shown that culverts for Bighorn Sheep *Ovis canadensis* and Mountain Goat *Oreamnos americanus* need to be a minimum of 4.5 m high and 12 m wide, and 4 m x 7 m for other large ungulates (Clevenger & Huisjer 2011).

Where large mammal crossings are used in North America, they are located every 1.5-6 km (average 1.9 km) (Clevenger & Huisjer 2011). An ecological spacing metric based on animal home range sizes recommends that passes are provided at intervals of territory size (or 'linear measure of home range area') to achieve ecological 'permeability' across the road (Bissonette & Adair 2007). Asiatic Wild Ass do not have standard territories but given that the species walks an average of 12 km/day (Kaczensky *et al.* 2006), this correlates to one crossing every 12 km. An equivalent distance for Mongolian Gazelle is c. 3 km (Olson *et al.* 2010; Mueller *et al.* 2011; K. Olson *in litt.* 2011). Equivalent distances are not known for Goitered Gazelle and Argali, but are likely to be longer than the ecologically closest American species, Pronghorn Antelope *Antilocapra americana* and Bighorn Sheep. Dodd *et al.* (2011) who concluded that one crossing every 5 km (half the average daily travel distance) is necessary for Pronghorn Antelope which are ecologically similar to, but better-studied than, gazelles, and Bissonette & Adair (2007) recommended one crossing is at least every 3.3 km for Bighorn Sheep which have small territory sizes. Fewer crossings are likely to be required along the road upgrade to Gashuun Sukhait as the key species are more mobile and nomadic than species with fixed home ranges. On a precautionary basis, one appropriate crossing every 6 km (c. 2 days' walk for a gazelle or 0.5 day's walk for an ass between crossings) is likely to facilitate effective ecological permeability. Less frequent crossings will enable a level of connectivity, but not effective permeability: such reduction, but not removal, of fragmentation effects will still result in negative residual impacts on connectivity. In extreme situations such as droughts or *dzuds*, animals will walk long distances in an attempt to cross linear barriers (e.g. 90 km by Asiatic Wild Ass; Kaczensky *et al.* 2006), but this may induce considerable stress and mortality.

A full cost analysis of underpasses and overpasses has not been conducted here as it is best performed by engineers familiar with materials and labour costs in Mongolia. However, some figures from elsewhere are detailed here for guidance. Estimates of – presumably higher – bridge construction costs in the US are $100-150/square foot; Sawyer & Rudd 2005). Underpasses have, for example, cost US$9 million for a 200 m wide (along highway) underpass in Canada in 2007 (Huiijser *et al.* 2007) or US$680,000–1,000,000 for a 60 m wide (along highway) underpass in the US in 2005 (Sawyer and Rudd 2005). Example costs of specific

wildlife underpasses are US$40,000/m width for underpass 13 m wide x 5 m high in Canada in 2007 and c. $220,000 for underpasses 7 m wide x 4.8 m high x 22 m long (Huiijser *et al.* 2007), and US$33,000-55,000/m width for underpasses 7- 10 m wide x 5 m high in Netherlands in 2005 (Kruidering *et al.* 2005). Underpasses specifically designed for Asiatic Wild Ass in India were estimated at c. $230,000 for those 5 m high x 10.4 m wide and c. $189,000 for those 4 m high x 10 m wide (World Bank 2002). Costs for overpasses are potentially higher – e.g. $1.75-2.5 million for a small overpass of 30 m width and 45 m length (Sawyer & Rudd 2005), with – for example – materials costs of c. $540,000 for a 30 m-wide overpass across a dual-carriageway in the US in 2010 (Dodd *et al.* 2010). Other examples are c. US$1.2 million for an overpass 52m wide x 70 m long in Canada in 2007 and $1.5-2.4 million for an overpass across a two-lane highway in the US in 2007 (Huiijser *et al.* 2007) or c.US$1.7-7.0 million for each of seven different overpasses in Netherlands (Kruidering *et al.* 2005).

Annex C: RBA Appendix 4: Biodiversity Offsets strategy for the Oyu Tolgoi Project

the biodiversity consultancy

FAUNA & FLORA INTERNATIONAL

ESIA Appendix 4

Biodiversity offsets strategy

for the Oyu Tolgoi project

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This report has been written by:
The Biodiversity Consultancy Ltd and Fauna & Flora International, Cambridge, UK,
with contributions from Oyu Tolgoi LLC and the Wildlife Conservation Society

Contents

1 Executive Summary

To reach Net Positive Impact, biodiversity offsets are required for the Oyu Tolgoi project. These offsets constitute actions over a large Offsets Landscape of c. 50,000 km^2 across the soums east and west of Khanbogd soum. To compensate for project residual losses, gains may be generated through reducing hunting levels, improving rangeland management and strengthening protected areas. It is estimated that hunting levels can be reduced by 25% in the next 25 years; and about 10% of this offset landscape can be improved in habitat condition by just 7.5%. These estimates are precautionary and allow for uncertainties, and risks of partial failure. An investment of c.$70 million is likely to be required to capitalise a fund to finance these activities over this timescale. This offsets strategy requires full stakeholder consultation to develop into a stakeholder and government agreed Biodiversity Offsets Plan. The Rio Tinto Offset Design process provides a useful framework for taking this process forward.

This offsets strategy has been written for the Oyu Tolgoi project to assess the technical feasibility of biodiversity offsets to achieve Net Positive Impact in the long term. This strategy requires extensive stakeholder consultation and review to progress the document to being the officially endorsed strategy and then towards a stakeholder agreed plan. Hence this current document indicates the 'Technical Feasibility' of offsets, but it does not define locations or address 'Political Feasibility'.

The Oyu Tolgoi project has attempted to follow the mitigation hierarchy, whereby the project avoids, minimises, mitigates, rehabilitates and restores and finally offsets its negative impacts on biodiversity. The Oyu Tolgoi project is committed to having a Net Positive Impact on biodiversity, in which the gains generated by offsets are greater than the residual losses of project impacts, as required by the project lenders and Rio Tinto corporate policy. The highest-profile species involved; the Khulan or Asiatic Wild Ass, could be adopted as a flagship icon for Oyu Tolgoi's offsets programme.

The predicted residual impacts from the project are primarily an increase in illegal hunting and collecting, habitat loss and collisions with powerlines, each for a number of priority biodiversity features. These will be addressed by the following offset objectives:

- Reduce illegal hunting
- Improve rangeland management
- Reduce the impacts of non-project powerlines (elsewhere in southern Gobi region)
- Strengthen protected areas management
- Demonstrate and contribute to best-practice regional development
- Establish strong enabling mechanisms
- Monitor and evaluate
- Build Oyu Tolgoi capacity

Given the very large geographical ranges of individual Asiatic Wild Asses impacted by the project and the limited improvements anticipated per unit area, offset actions must be undertaken over very large areas. The final offsets landscape will be determined based on proper stakeholder consultation. However given the known distribution of Asiatic Wild Ass and the calculated required spatial scale of offset activities required to produce Net Positive Impact, an area the size of Bayan-Ovoo, Khatanbulag and Khuvsgul soums will be required as the Offsets Landscape. Note this excludes the Small Gobi Special Protected Area, where compensation actions are already mandated; and Khanbogd soum, where most actions will be

mitigations rather than offsets. This offset strategy takes into account the precautionary principle and acknowledges the significant uncertainties involved in offset design and implementation. Therefore the strategy's scale and proposed interventions aim to exceed the minimum requirements with a significant contingency.

One important but often neglected aspect of conservation programmes is monitoring and evaluation to feed into adaptive management. This is of particular importance for demonstrating NPI where losses and gains need effective monitoring and evaluation, including quantified measures of success and triggers for action and review. The proposed offsets actions require long-term commitment and may be best financed by an up-front investment in a long-term financing mechanism (such as a trust fund). It is anticipated that this would require an up-front investment of approximately $70 million to deliver the necessary resources. The Oyu Tolgoi project does not wish for the Offsets Plan to be implemented by expatriate staff in external institutions but wishes to build the capacity of its Mongolian staff.

The Oyu Tolgoi project will discuss and revise this strategy with stakeholders, notably the Government of Mongolia and other regional developers and planners including The Nature Conservancy's *Development by Design* - Gobi Region Landscape Assessment project. Actions need to start as soon as practical to minimise the risk of third-party negative impacts within the offset landscape. Actions need to be integrated with the project's biodiversity mitigation plans and its social development plans. If the proposed actions are successfully implemented, it is considered to be 'Technically Feasible' for the Oyu Tolgoi project to have a Net Positive Impact on biodiversity by the time of project closure. The offsets strategy calculates losses and gains within a timeframe 2011-2036, a period of 25 years which is reasonable for stakeholder requirements and potentially realistic for NPI.

Adequate staffing and resourcing at appropriate levels within Oyu Tolgoi is required in order to ensure Net Positive Impact and compliance with supporting lender requirements.

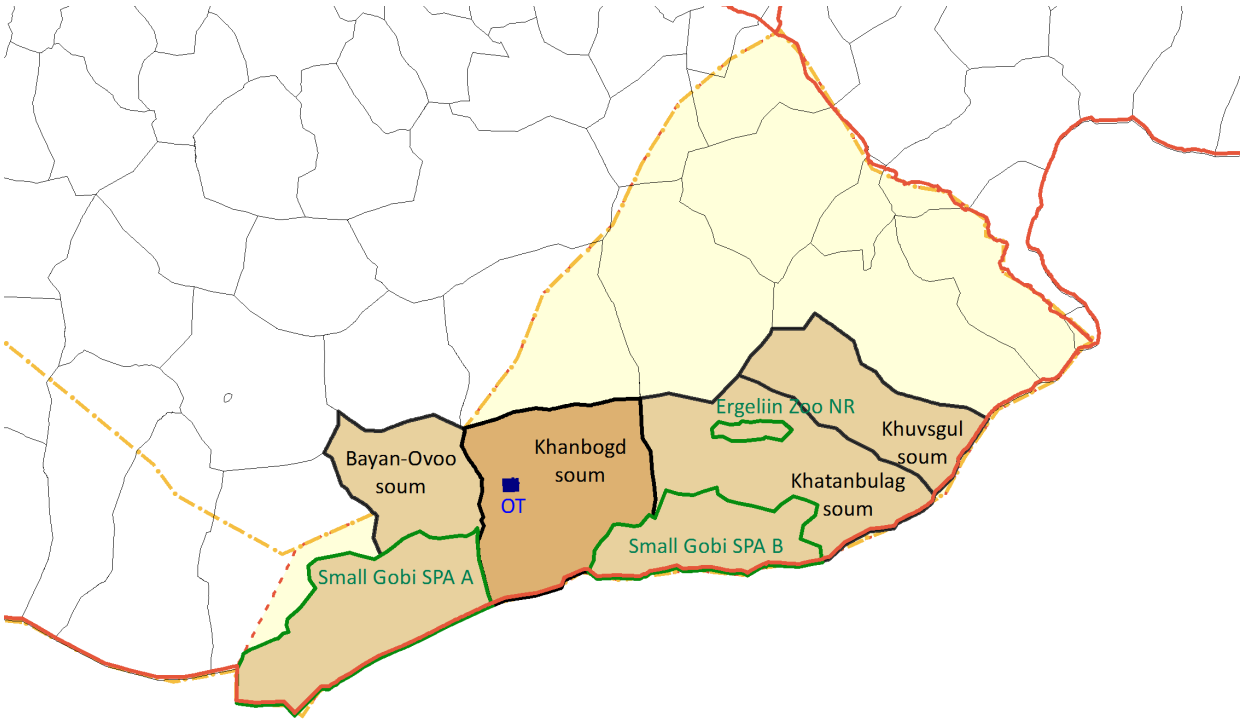

Figure 1: Potential Offsets Landscape (mid-brown), Buffer Zone (yellow) and mitigation zone (dark brown)

2 Context and objectives

2.1 Purpose and business case

This Biodiversity Offsets Strategy outlines what needs to be achieved for the Oyu Tolgoi project to have a Net Positive Impact (NPI) on biodiversity. This strategy is based on wide technical consultation and aims to demonstrate the 'Technical Feasibility' of achieving NPI. This strategy has not yet been formally endorsed by the Oyu Tolgoi project, but it is a proposal which will undergo extensive stakeholder consultation in 2012 and 2013 to generate a formal stakeholder agreed and financed Offsets Plan. It is written by the Rapid Biodiversity Assessment team with input from Oyu Tolgoi LLC and is complemented by the accompanying appendices:

- Appendix 1 Oyu Tolgoi LLC Biodiversity Strategy
- Appendix 2 Critical Habitat Assessment
- Appendix 3 Biodiversity Impacts and Mitigation Actions
- Appendix 5 Net Positive Impact forecast
- Appendix 6 Monitoring & Evaluation

The business case for the Biodiversity Offsets Strategy includes compliance with lender requirements (and reduced project delays), compliance with the Rio Tinto Biodiversity Strategy (2004, 2008), and potential for becoming a developer of choice in Mongolia, including access to land and resources and a seat at the policy table. Hence, the Biodiversity Offsets Strategy fulfils the requirements of the project's lenders, notably the International Finance Corporation's Performance Standard 6 (IFC PS6) and the European Bank for Reconstruction and Development's Performance Requirement 6 (EBRD PR6). Further, it demonstrates mining leadership in the region, 'raising the bar', and encouraging cumulative activities to ensure the project operates within a sustainable landscape in which offsets are viable. Rio Tinto's Biodiversity Strategy (Rio Tinto 2004, 2008) and commitment to Net Positive Impact will thus confer a significant reputational gain to the Oyu Tolgoi project. This reputation will be increasingly valuable in the company's ongoing relationship with the government of Mongolia and other governments responsible for allocating exploration and mining licences and conditions.

2.2 Social, political and economic context of the southern Gobi region

Economic activity in Mongolia has traditionally been based on herding and agriculture, but extensive mineral deposits have recently attracted foreign investors and now account for a large part of government revenues. Severe winters and summer droughts (*dzuds*) in 2000-02 (and again in 2010) resulted in massive livestock die-off and zero or negative GDP growth but growth averaged nearly 9% per year from 2004-08 largely because of high copper prices. In October 2009, the government passed legislation to develop Oyu Tolgoi, one of the world's largest untapped copper deposits. The Asian Development Bank (2011) notes that private sector development is impeded by a "harsh climate, small domestic market, human resource constraints, infrastructure bottlenecks, corruption, legal inadequacies, weak contract enforcement, and poor capital markets" while "Mongolia's economic recovery has been accompanied by a substantial degradation of its natural resource base." The Asian Development Bank (2011) specifically identifies overgrazing and the unsustainable management of water basins as factors that have "undermined living standards and hampered growth". These are factors that the four-year World Bank Country Assistance Strategy, currently

being renewed, has being aiming to address through "enhancing regional, rural and environmentally sustainable development". Meanwhile, as well as focusing on mining, the Government of Mongolia has also identified a need to modernise the country's livestock industry. Through their 'Mongol Mal Program', the government will pay more attention to livestock, seeing herders as manufacturers and providing financial and technical, including veterinary, education and assistance to them (http://www.infomongolia.com/ct/ci/900/60/). This aligns with some of the activities in this offsets strategy, increasing their chances of being seen as 'politically feasible'. However, elections are due by June 2012, which could result in an altered focus from any new incoming decision-makers. Irrespective of specific government policies, Mongolia's international commitments to the Convention on Biological Diversity, iterated within its Biodiversity Conservation Action Plan (1996) contains specific Action Programs that are supportive of all the key elements of this Offset Strategy. The integration of this offset strategy with national and regional government policies for natural resource management and nature conservation is a key component of the next phase, to development of a full Offsets Plan.

2.3 Priority biodiversity values

Priority biodiversity features are defined as species or habitats which trigger Critical Habitat as defined by the lenders (IFC PS6 and EBRD PR6) or which are considered significant under Rio Tinto Biodiversity Action Plan guidelines. A number of other priority biodiversity features (Snow Leopard, Long-eared Jerboa, Mongolian Accentor, Ephemeral Lakes and Pools) occur in the Units of Analysis (as defined in Appendix 2 Critical Habitat assessment) but are not Critical Habitat qualifying-features and, because they have no significant predicted impact, are excluded from Table 1, which solely addresses features covered by the Offsets Strategy. 'Granite outcrop floral communities' are not predicted to be impacted, but are a Critical Habitat-qualifying feature and – owing to stakeholder concerns – are thus precautionarily included in the offsets strategy. Ecosystem services are considered to be a component of biodiversity but offset actions for ecosystem services are not discussed here because these need socio-economic, rather than biodiversity, assessment.

Table 1: Priority biodiversity features addressed by the Offsets Strategy

Taxonomic group	Biodiversity feature	Scientific name	Critical Habitat	IUCN Red List status	National Red List status	Status in unit of analysis
Plant (herb)	Mongolian Chesney[1]	*Chesneya/Chesniella mongolica*	Tier 2	-	EN?	Patchily distributed throughout
Mammal (ungulate)	Asiatic Wild Ass	*Equus hemionus*	Tier 1	EN	EN	Nomadic 'resident'
Mammal (ungulate)	Argali	*Ovis ammon*	Tier 2	NT	EN	Localised resident
Mammal (ungulate)	Goitered Gazelle	*Gazella subgutturosa*	Tier 2	VU	VU	Migratory 'resident'
Mammal (ungulate)	Mongolian Gazelle	*Procapra gutturosa*	-	LC	EN	Rare visitor from the east
Migratory Bird	Swan Goose	*Anser cygnoides*	-	VU	NT	Likely a regular migrant over the area
Migratory Bird	Ferruginous Duck	*Aythya nyroca*	-	LC	VU	Likely a regular migrant over the area
Bird	Short-toed Snake-eagle	*Circaetus gallicus*	Tier 2	LC	EN	Breeds
Bird	Saker Falcon	*Falco cherrug*	-	VU	VU	Breeds
Bird	Egyptian Vulture	*Neophron percnopterus*	-	EN	LC	Probably breeds
Migratory Bird	Great Bustard	*Otis tarda*	-	VU	VU	Regular migrant (stops over in the area)
Bird	Houbara Bustard	*Chlamydotis undulata*	-	VU	VU	Breeds
Migratory Bird	Relict Gull	*Larus relictus*	-	VU	EN	Likely a rare migrant over the area
Bird	Pallas' Sandgrouse	*Syrrhaptes paradoxus*	-	LC	LC	Breeds
Bird	Mongolian Ground-jay	*Podoces hendersoni*	-	LC	VU	Breeds
Migratory Bird	Yellow-breasted Bunting	*Emberiza aureola*	-	VU	NT	Likely a regular migrant
Species Assemblage	Granite Outcrop Floral Communities	n/a	-	n/a	n/a	Khanbogd massif and other massifs
Habitat	Riverine Elm Trees	n/a	-	n/a	n/a	Mostly in Undai riverbed
Habitat	Tall Saxaul Forest	n/a	-	n/a	n/a	Mostly in borefield and depressions
Habitat	Eastern Gobi desert-steppe	n/a	-	n/a	n/a	Major habitat type in the region - widespread
Habitat	Alashan Plateau semi-desert	n/a	-	n/a	n/a	Major habitat type in the region - widespread

2.4 Distinguishing Oyu Tolgoi mitigation from offset commitments

OT has committed to a suite of mitigation actions within Khanbogd soum as detailed in Appendix 3 (Biodiversity Impacts and Mitigation Actions). The biodiversity offsets strategy should be designed and implemented with reference to these mitigation actions and also the project's social/community programme. As the primary offset action is similar to the mitigation action of reducing illegal hunting, for simplicity actions to reduce illegal hunting in Khanbogd soum are labelled as mitigations, and actions in other soums are labelled as offsets. Similarly,

[1] An umbrella species for 18 poorly known possibly threatened plants which may possibly occur in the project area. These are all considered, on present knowledge, to have similar impacts and mitigation/offset measures and so are represented here by this one species.

fitting 'bird flight deflectors' to powerlines are considered mitigation actions when undertaken on project powerlines, but offset actions when on non-project powerlines.

2.5 Residual impacts, NPI and offsets

The predicted impacts of the Oyu Tolgoi project on priority biodiversity features are analysed in Appendix 3 (Biodiversity Impacts and Mitigation Actions). Mitigation actions were identified for all impacts predicted to have a High Risk or Critical Risk on these species. Residual impacts are the net impact after the Oyu Tolgoi project has taken all practicable actions to avoid, minimise, rehabilitate and restore its impacts (Figure 2), as documented in Appendix 3. Residual impacts were quantified in Appendix 5 (NPI forecast) and summarised as:

- *Direct habitat loss* will occur due to the Oyu Tolgoi project's physical infrastructure footprint, notably 64 km^2 in the mine licence area
- *Indirect habitat loss* will also be caused for some priority biodiversity features because hunted species avoid areas close to project infrastructure and activities due to human and vehicle activity, noise and dust (to varying degrees). For example, Asiatic Wild Ass in the southern Gobi region show avoidance of areas within at least 5 km of vehicles (P. Kaczensky *in litt.* 2011), and impacts have been demonstrated up to 1,600 m for Great Bustard (Lane *et al.* 2001; López-Jamar 2010; Raab 2011). Species-specific estimates of likely avoidance distances, taking into account habitat type, threat of hunting etc, were made for each species concerned.
- *Illegal hunting* of wild animals and illegal collecting of plants (e.g. for firewood) will increase as secondary impacts of increased human population drawn to the area by the Oyu Tolgoi project.

A Net Positive Impact on biodiversity means minimisation of project impacts and contribution to biodiversity conservation to ensure that the region ultimately benefits as a result of a company's presence (Figure 2). To achieve NPI, OT offsets need to generate more 'gains' in priority biodiversity features than these residual losses. These gains are additional to the project's mitigation actions.

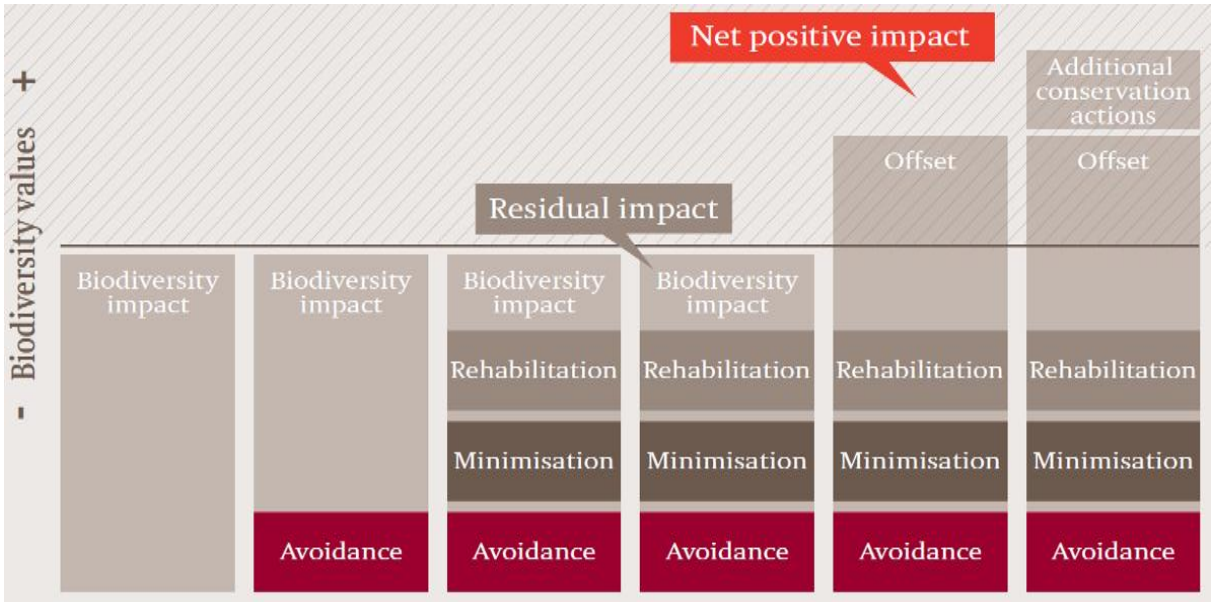

Figure 2: Rio Tinto's mitigation hierarchy, and net positive impact

The NPI forecast (Appendix 5) calculates the scale of offsets necessary to achieve NPI. A

nominal time of 25 years to reach NPI was set. This is based on some very approximate estimations of the likely improvement in the rate of illegal hunting and the quality of rangeland habitat. While aware that these estimations lead to considerable uncertainty in the final figures, the forecast estimates that offset areas need to be in the order of:

- Control of illegal hunting across c.50,000 km^2
- Improving rangeland management across c.50,000 km^2
- Mitigate impacts of 64 km of non-OT powerlines

A quantified summary of the predicted losses and projected gains is given in Table 2, for which more details are available in Appendix 5 (NPI forecast):

Table 2. Projected net position in 2036 for priority biodiversity features addressed by the offsets strategy (Quality Hectares)

Name	Direct & indirect habitat loss (1000 ha)	Quality of habitat lost (0-1)	Loss from increased hunting (1000 QH)	Residual loss (1000 QH)	Gain from hunting control (1000 QH)	Gain from rangeland manage-ment (1000 QH)	Predicted overall offset gain (1000 QH)	Net position (1000 QH)	NPI?
Mongolian Chesney[1]	9	0.9		8	0	21	21	13	Yes
Asiatic Wild Ass	155	0.5	392	470	530	21	551	59	Yes
Argali	30	0.5	392	407	530	21	551	122	Yes
Goitered Gazelle	130	0.5	392	458	530	21	551	72	Yes
Mongolian Gazelle	76	0.5	392	431	530	21	551	99	Yes
Swan Goose	0			0	0	0	0		Yes[2]
Ferruginous Duck	0			0	0	0	0		Yes[2]
Short-toed Snake-eagle	9	0.9		8	0	21	21	13	Yes[2]
Saker Falcon	9	0.9		8	0	21	21	13	Yes[2]
Egyptian Vulture	9	0.9		8	0	21	21	13	Yes[2]
Great Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Houbara Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Relict Gull	0			0	0	0	0		Yes[2]
Pallas' Sandgrouse	9	0.9		8	0	21	21	13	Yes[2]
Yellow-breasted Bunting	9	0.9		8	0	21	21	13	Yes
Mongolian Ground-Jay	9	0.9		8	0	21	21	13	Yes
Granite Outcrop Floral Communities[4]	0			0	0	0	0	0	Yes
Riverine Elm Trees	0			0	0	+	+	+	Yes[5]
Tall Saxaul Forest	+	?	-	+	+	+	+	+	Yes[6]
Eastern Gobi desert-steppe	5.5	0.9		5	0	9	9	4	Yes
Alashan Plateau semi-desert	3.5	0.9		3	0	12	12	9	Yes

[1] Assumed here to represent all 18 'very rare' plants known or predicted from the project area
[2] Assuming mitigation is put in place on all OT powerlines plus an additional >64km of non-OT powerlines
[3] Yes if there is an appropriate additional offset
[4] Even though these are not predicted to be impacted, they are included here since they are a Critical Habitat-qualifying biodiversity value in the area
[5] Yes if the three translocated trees survive; offset gains depend on specific offset site
[6] Yes assuming adequate control of illegal collecting (not quantified)

To be precautionary, losses and offsets gains were estimated against a static baseline, meaning that there is assumed to be no acceleration in development in the southern Gobi region and

concomitant increased impacts on biodiversity. An alternative counterfactual situation of greatly accelerated growth related to additional mines (although acknowledged by the project to be more realistic) was not used as this would be difficult to quantify, assume ineffective mitigation and be non-precautionary. Furthermore, there is experience that stakeholders are unlikely to accept large background rates of loss as the baseline against which losses and gains are measured (Temple *et al.* 2011). An estimate of predicted future growth could be factored into the NPI forecast based on the best opinion of regional planning experts. The project's success in addressing cumulative regional impacts would need to be factored into this estimate. The current assumption of no accelerated impacts is therefore precautionary but subject to revision.

Strengthening Protected Areas is an important enabling/supporting offset action to ensure sustainability of Protected Areas, the offset outcomes and biodiversity gains required for NPI.

3 Offset design

This Offsets Strategy is based on dedicated offset intervention research, literature reviews, expert consultation, other biodiversity papers prepared for (or by) the Oyu Tolgoi project, and other published information. This version has benefited from the Critical Habitat Assessment, the eight Biodiversity Management Plans, the Environmental and Social Impact Assessment, and publications as listed in the references. A broad group of specialists has been consulted and questioned in designing the strategy, as listed here. In addition, a dedicated rangeland management workshop was organised at the World Bank in Washington D.C. on 20 December 2011. The authors are grateful for the expert opinion of Nyambayar Batbayar (Wildlife and Conservation Science Centre of Mongolia), Chimed-ochir Bazarsad (WWF Mongolia), Amanda Fine and Ray Victurine (Wildlife Conservation Society), Sundev Gombobaatar (National University of Mongolia), Petra Kaczensky (University of Veterinary Medicine Vienna), Robin Mearns (World Bank Social Team), Erdenesaikhan Naidansuren (Environ LLC), Kirk Olson (University of Massachusetts), Dennis Sheehy (International Center for the Advancement of Pastoral Systems) and Tungalag Ulambayar and Maria Fernandez-Gimenez (Mongolian Rangelands Research Team, Colorado State University).

The offset design process has been guided by the Rio Tinto Biodiversity Offsets Guidance (Rio Tinto 2011), itself developed based on growing international expertise on biodiversity offsets (e.g. Australian Government regulatory requirements and guidance, and Business and Biodiversity Offsets Program 2011a, 2011b).

3.1 Methods

Together with Appendix 5 (NPI forecast), the first three of the four stages of Offset Design outlined within the Rio Tinto Offsets Design Guidance (Figure 3) were followed in this Offsets Strategy:

1. **Offset Scoping** – goals were identified and a list of potential sites in the country were broadly considered as possibilities for offsets.
2. **Offset Screening** – the potential offset sites were screened against biological, political, economic and social criteria. This involved brief consideration of possible types of conservation intervention and additionality criteria: what actions could be undertaken and would these make a real difference on the ground? Offset financing was calculated based on these required actions.

3. **Net Positive Impact (NPI) Accounting** – estimates of projected biodiversity gains were made. This is in fact a transaction process, part of which is required to estimate the magnitude of the interventions required in Offset Screening.
4. **Final Approval and Selection** – this Biodiversity Offsets Strategy will be discussed with stakeholders for consultation, revision and agreement as a Biodiversity Offsets Plan.

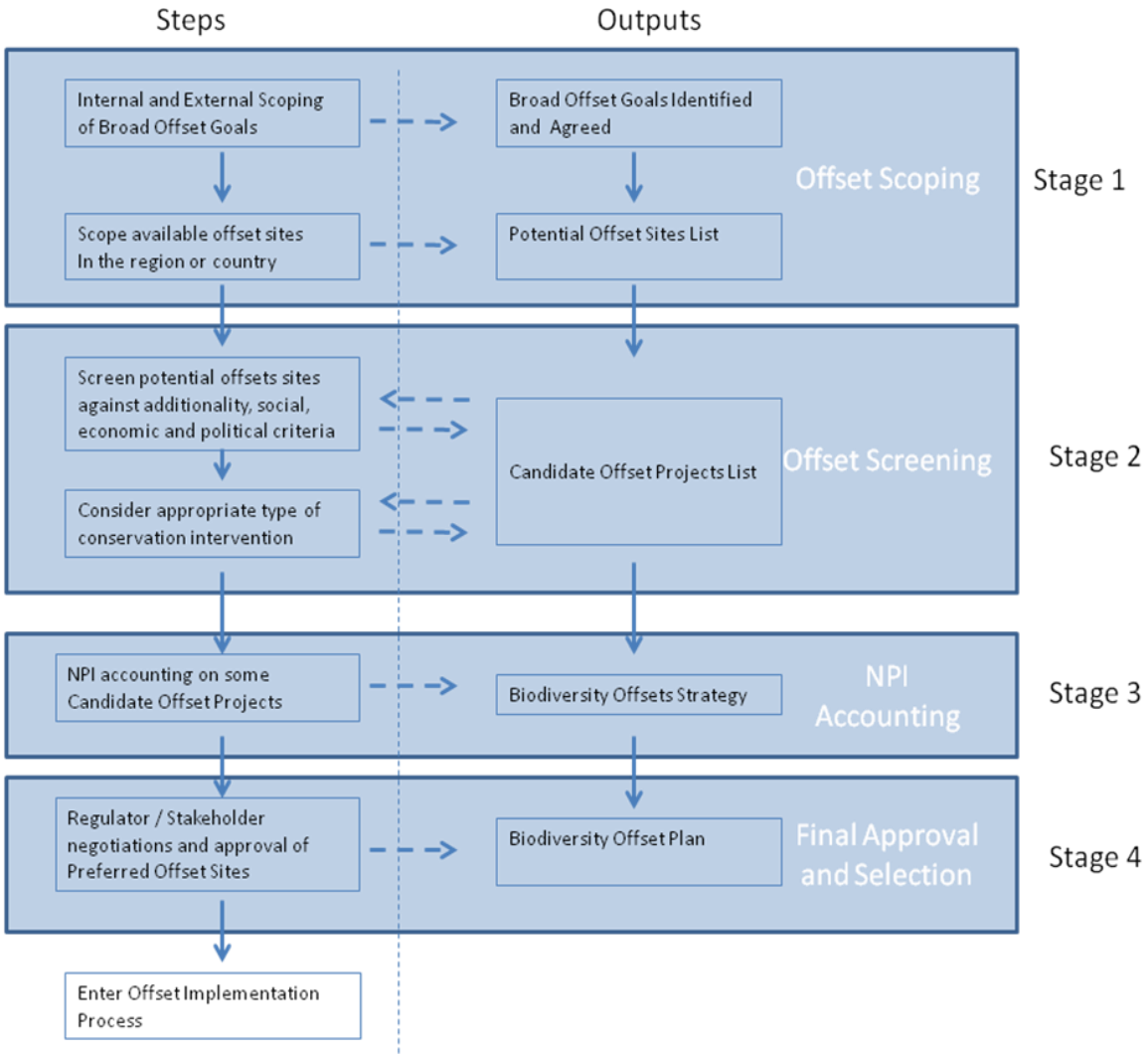

Figure 3: Four stages of offset design from draft Biodiversity Offset Guidance (Rio Tinto 2010). This document represents Stage 3 Outputs – 'Offsets Strategy'

Potential offset actions were developed to effect gains in priority biodiversity features addressed by the offset strategy compared with background rates of loss (e.g. hunting) and potential rates of restoration (e.g. rangeland management). These estimates were all based on expert consultation. The residual impacts and other impacts (including those caused by factors external to the Oyu Tolgoi project) were analysed to assess the ultimate and proximate factors causing negative impacts on the priority biodiversity features addressed by the offsets strategy. Conservation interventions already implemented elsewhere in Mongolia (e.g. by WWF) were analysed to assess which actions could address the project's impacts and which

were most effective, lowest risk, most practical and socio-politically feasible. The interventions that appeared to be most suitable were then aggregated into generic potential offset actions.

The process for identifying potential offsets sites and the Offsets Landscape is discussed below.

3.2 Offset site selection

Offset site selection within the Rio Tinto Offset Design Process leads to a larger 'Potential Offsets Sites' list based on biological criteria alone; then a smaller 'Candidate Offset Sites' list based on screening against requirements for offset interventions (spatial scale, gains required versus offset interventions), and social, political and economic constraints and opportunities. In the case of the Oyu Tolgoi project, Potential Offset Sites are severely constrained by the global and national distribution of Asiatic Wild Ass, the largest and highest priority residual impact requiring offsetting. There are three major populations in the South Gobi, so only three 'Potential Offset Sites' or landscapes exist. Its largest global population occurs within and to the east of the project area, making this area the most suitable and likely offset site. This population, located across several soums, is relatively small and conservation actions are required across the core area of c.50,000 km^2 to bring about the required conservation gains. There are a number of political, economic and social constraints which therefore have to be faced within this chosen offset site, which is effectively an offset landscape given the broad spatial scale over which actions are required to reduce hunting and improve rangeland management.

3.2.1 Spatial scale, barriers and boundaries

Scale: The scale of Offsets Landscape is dictated by the scale of the residual impacts and the 'offsets ratio'. In this case, no generic offsets ratio was applied; instead an area was calculated for each priority biodiversity feature based on a precautionary estimate of the gains likely to be achieved by offset actions over the defined time period of 25 years until 2036[2]. As detailed in Appendix 5 (NPI forecast), although very approximate, this estimates that offsets areas need to be in the order of tens of thousands of square kilometres.

Barriers: Intact fences are barriers to Asiatic Wild Ass and gazelle movement (Kaczensky *et al.* 2010; Olson *et al.* 2009). Main roads are likely to act as impermeable barriers to Asiatic Wild Ass if they support more than about one vehicle every 15 minutes, i.e. c. 100 vehicles/day (P. Kaczensky *in litt.* 2011). Current and proposed fences, railways and busy roads in the southern Gobi region that could act as barriers include:

- Ulaanbaatar – Beijing railway (north-south)
- Mongolia - China border fence (west-east)
- Proposed Tavan Tolgoi – Sainshand railway (west-east)
- Tavan Tolgoi – Gashuun Sukhait road (north-south)
- Proposed Tavan Tolgoi – Gashuun Sukhait railway (north-south)
- Oyu Tolgoi – Gashun Sukhait road (north-south)
- Khanbogd – Oyu Tolgoi road (west-east)

[2]If the total gains required are 1500ha of pristine rangeland, and the conservation interventions are predicted to provide 0.1ha 'gain' per ha by 2036, then the minimum offset site area for no net loss for this time period is 1500/0.1 = 15,000ha, hence a ratio of 10x. Issues such as uncertainty, risk, and time discounting will likely mean the total offsets intervention should be greater than this. Offset ratios are not however necessarily the best method to deal with offset risk etc.

Boundaries: Most of the priority biodiversity features addressed by the offsets strategy that have residual impacts occur across extensive areas of contiguous habitat. At a broad level (disregarding micro-habitat variation), these ecosystems vary little over distances of hundreds of kilometres, and there are few clear boundaries delineating candidate offset areas. Potential boundaries were based on the base-case development scenarios outlined in the World Bank regional environmental assessment (Walton 2010) and recommendations for safeguarding important habitat alongside economic development (BirdLife Asia 2009). The southern Gobi region habitat is currently mapped at a coarse scale and habitat condition is very dependent on stochastic precipitation patterns, so only very coarse-scale habitat maps were used at this stage. More detailed research on habitat types will form part of the monitoring to feed into the Offsets Plan.

Given the lack of distinct habitat types, their variation in space and time, and the related nomadic behaviour of key ungulates, administrative boundaries are an appropriate boundary for defining offsets. Soums are the most appropriate level. Most offset actions will be administered and delivered at a soum level, whereas aimag-level actions are impractical for on-the-ground delivery, and bag-level actions would lack the necessary authority. Potential barriers, Protected Areas, Important Bird Areas and soums are shown in Figure 4:

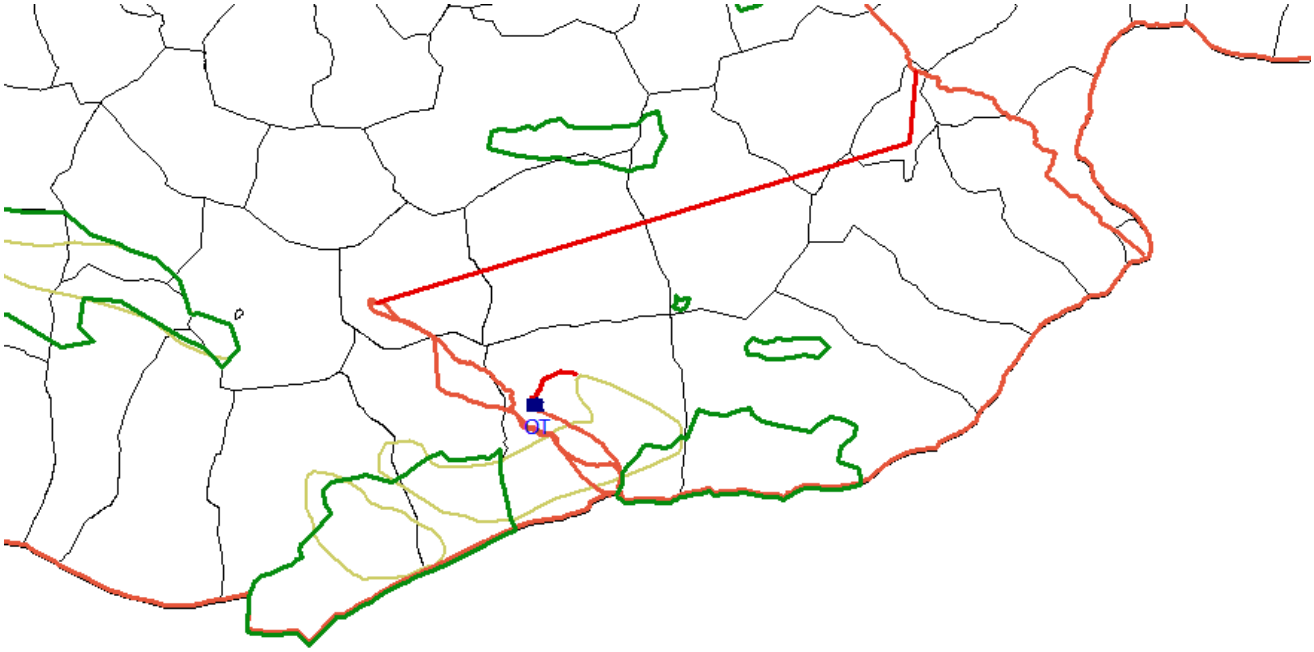

Figure 4: Potential offset boundaries: barriers (red), protected areas (dark green), important bird areas (light green) and soums (black)

This Offsets Strategy proposes that the Offsets Landscape could potentially be the soums overlapping with the core population of Asiatic Wild Ass, harbour the majority (or all) of the priority biodiversity values suffering residual impacts, and be closest to the Oyu Tolgoi project. The areas of several of these soums were combined to just exceed the area estimated to be needed to achieve sufficient biodiversity gains for NPI, based on the NPI accounting. Excluding Khanbogd soum as the area for mitigation activities and the Small Gobi SPA (A&B) as an area for specific mandated compensation, the potential Offsets Landscape is therefore Bayan-Ovoo, Khatanbulag and Khuvsgul soums (Figure 5). This can only be confirmed through thorough stakeholder consultation. A further technical consideration is the risk that rangeland habitat

quality gains cannot be achieved in the 'non-equilibrium' drier habitats, and these offset actions need to be extended to wetter habitats to the east.

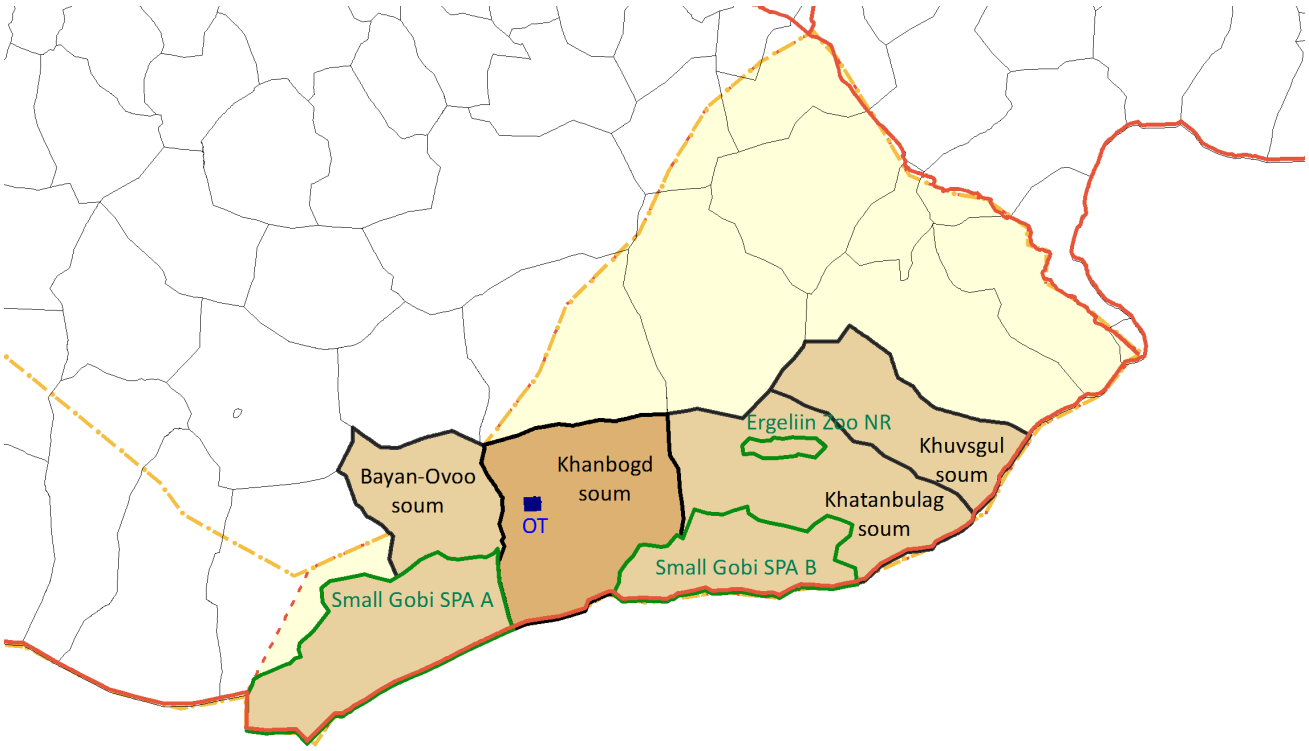

Figure 5: Potential Offsets Landscape (mid-brown) and Buffer Zone (yellow) around mitigation zone (Khanbogd soum; dark brown)

To ensure the long-term survival of the Asiatic Wild Ass subpopulation in the south-eastern Gobi, some activities to reduce illegal hunting may be needed across the range of this subpopulation. Asiatic Wild Ass utilise very large areas to find patchy food resources in this climatically irregular and drought-prone environment. Given that the area (minimum convex polygon) used by individual Asiatic Wild Asses in the south-east Gobi ranged from 11,400 km^2 (over 18 days) to 70,000 km^2 (over 297 days) (Kaczensky *et al.* 2011), individuals may wander over much of the subpopulation range and be at risk from any illegal hunting outside of the Offsets Landscape. It is therefore proposed to define the subpopulation range as Buffer Zone for the Offsets Landscape, with activities undertaken within this buffer zone to reduce illegal hunting. The eastern boundary of the Buffer Zone (shaded yellow in Figure 5) is the fenced Ulaanbaatar-Beijing railway, the southern boundary is the mostly fenced Mongolia – China border and the northern and western boundaries are estimated based on expert opinion (P. Kaczensky *in litt.* 2011) supported by satellite-tagging, surveys and recent literature (e.g. Kaczensky *et al.* 2008, 2010, 2011; Moehlman *et al.* 2008). Recent genetic connectivity with western sub-populations has been demonstrated (Kaczensky *et al.* 2011) but the Tavan Tolgoi – Gashuun Sukhait road may now act as a barrier. The boundaries of this Buffer Zone will be revised based on outcomes of the project's monitoring and evaluation programme.

3.2.2 Which priority biodiversity values occur at which offset sites?

The aim of this step in the Offsets design process is to identify which biodiversity values suffering residual impacts are to be found at which offset sites. Offset site selection and project design aims to minimise costs and maximise gains to biodiversity by where possible

designing projects which lead to multiple benefits to different biodiversity values within a single site or landscape. This is effective and integrated conservation management.

Most of the priority biodiversity features addressed by the offsets strategy that have residual impacts occur across extensive areas of contiguous habitat and there are few clear boundaries delineating candidate offset areas. Potential boundaries include current and proposed fences, railways and busy roads, protected area boundaries, Internationally Recognised Area boundaries and administrative boundaries. Candidate areas for offset actions were defined based on the Rio Tinto Offset Guidance Note; the principles of the Business and Biodiversity Offsets Program; and the specific criteria that offsets must be within the range of the Asiatic Wild Ass' south-eastern Gobi sub-population's range. Existing protected areas, Internationally Recognised Areas (of which only Important Bird Areas have been identified in this region) and individual soums were considered as candidate areas. Candidate offset areas in the neighbouring protected areas and soums appear to support sufficient quantities of all of the priority biodiversity features addressed by the offsets strategy that have residual impacts, except perhaps Asiatic Wild Ass and Houbara Bustard (Table 3). For Asiatic Wild Ass, the whole range of its south-eastern Gobi sub-population should be considered as part of the Buffer Landscape. For Houbara Bustard monitoring may prove that additional offset sites, where actions are undertaken to address illegal hunting, need to be established outside Mongolia on its migratory route. Other biodiversity features not identified as Critical Habitat triggers or Rio Tinto priorities are likely to be adequately conserved by the Offsets Strategy given their usually large geographical range and more secure conservation status, but this would require specific research to corroborate.

The proposed Offset Landscape is composed of large landscape-scale administrative units. Some offset activities, notably improved rangeland management, will need to be focused in specific areas within the Offset Landscape. The choice of areas will be informed by stakeholder consultation, project monitoring and evaluation and external processes such as The Nature Conservancy's *Development by Design* - Gobi Region Landscape Assessment project.

Table 3: Priority biodiversity features addressed by the offsets strategy in each potential offset area

	TOTAL OYU TOLGOI POTENTIAL BIODIVERSITY OFFSET				
	POTENTIAL OFFSET LANDSCAPE			BUFFER ZONE	Outside Mongolia
	Small Gobi (A+B) SPA	Bayan - Ovoo soum (excl. Small Gobi SPA)	Khatanbulag + Khuvsgul soums (excl. Small Gobi SPA)	Asiatic Wild Ass south-east Gobi range	Houbara Bustard migratory range
PRIORITY BIODIVERSITY VALUES ADDRESSED BY THE OFFSETS STRATEGY					
Eastern Gobi desert-steppe	+	+	+	+	-
Alashan Plateau semi-desert	+	+	+	?	-
Mongolian Chesney	?	?	?	?	-
Asiatic Wild Ass	+	+	+	+	?
Argali	+	+	+	+	-
Goitered Gazelle	+	+	+	+	+
Mongolian Gazelle	?	?	+	+	-
Swan Goose	+	+	+	+	-
Ferruginous Duck	+	+	+	+	?
Short-toed Snake-eagle	+	+	-	-	?
Saker Falcon	+	+	+	+	+
Egyptian Vulture	?	?	?	?	?
Great Bustard	+	+	+	+	-
Houbara Bustard	+	+	+	+	+
Relict Gull	+	+	+	+	-
Pallas' Sandgrouse	+	+	+	+	?
Mongolian Ground-jay	+	+	+	+	-
Yellow-breasted Bunting	+	+	+	+	+
Granite Outcrop Floral Communities	?	+	?	?	-
Riverine Elm Trees	+	+	?	?	-
Tall Saxaul Forest	?	?	?	?	-
Total no. features present	**17**	**16**	**15**	**14**	**4**
Total area / km^2	18,000	7,000	21,000	>50,000	?

+ = present
? = possibly present
- = absent

4 Biodiversity offsets strategy

The aim of this section is to elucidate the development of the proposed offset projects based on research and consultation to date, taking into account conservation experience in Mongolia and the biological, social, political and economic constraints evident within the chosen Offsets Landscape.

The aim of OT's biodiversity offsets strategy is:
'to achieve Net Positive Impact on biodiversity through the generation of gains in priority biodiversity features to offset residual project losses'

It is proposed to achieve this aim through a series of six objectives as summarised in the logical framework and detailed below:

- Reduced illegal hunting and collecting
- Improved rangeland management
- Reduced impacts of non-project powerlines
- Strengthened Protected Areas
- Raised bar in regional development
- Strong enabling mechanisms established
- Monitoring and evaluation informs adaptive management
- Oyu Tolgoi capacity built

These objectives and their supporting activities have undergone a process of expert consultation to determine that they are the best available options. Given the poor state of knowledge of ecological baselines and the limited number of analogous previous conservation initiatives, no-one can be absolutely certain as to whether these activities will actually generate the required offset gains. Project stakeholders will be aware that higher certainty of outcomes requires significantly more research time than the six-month period made available for development of this strategy. However, expert opinion[3] is that these activities are indeed the most appropriate actions, and will generate gains as proposed (and indeed there is the potential for greater gains as estimates are precautionary). Given the appropriate actions and the proposed contingencies in scale and resourcing, it is the RBA team's opinion that this offsets strategy demonstrates the 'technical feasibility' of achieving the required gains. Following 'technical feasibility', the practical and political feasibility of these activities and outcomes can only be demonstrated through a stakeholder engagement process, as outlined in Section 4.3, and adaptive management during implementation. The outcomes and compliance with lender requirements can only be assessed using a comprehensive Monitoring & Evaluation programme (Appendix 6).

[3] *T. Ulambayar & M. Fernandez-Gimenez (Mongolian Rangelands Research Team, Colorado State University), D. Sheehy (International Center for the Advancement of Pastoral Systems), R. Mearns (World Bank Social Team), A. Fine (Wildlife Conservation Society) and E. Bowen-Jones (The Biodiversity Consultancy) at a rangeland management expert workshop at World Bank, D.C. on 20 December 2011. Additional expert input was received from Nyambayar Batbayar, Chimed-ochir Bazarsad, Sundev Gombobaatar, Petra Kaczensky, Erdenesaikhan Naidansuren, Kirk Olson, Dennis Sheehy and Ray Victurine.*

4.1 Logical framework

AIM	OBJECTIVES	RECOMMENDED ACTIVITIES	OUTCOMES	KEY ASSUMPTIONS
To achieve Net Positive Impact on biodiversity through the generation of gains in priority biodiversity features to offset residual project losses	Reduced illegal hunting and collecting	Implement 5 Mobile Anti-Poaching Units – 3 in the Offsets Landscape and 2 in the Buffer Zone	Reduction in illegal hunting of protected animals Reduction in consumption, trafficking and collection of protected animals Reduction in over-harvesting of saxaul and other fuelwood sources Increased populations of priority biodiversity features	Can achieve reduced demand as well as supply Can recruit staff with charisma and power to enforce law Can overcome economic, political and community vested interests
		Build capacity, resources and networking of government institutions to increase prevention, detection and conviction rates of wildlife crime		
		Reduce hunting of bustards migrating outside Mongolia	Increased survival of bustards when away from offsets landscape	Stakeholders support working outside Mongolia
	Improved rangeland management	Support herders to transition to more ecologically sustainable stocking ratios	Reduced degradation of rangeland by livestock leading to improved habitat quality Increased population of priority biodiversity features Reduced disturbance to wild ungulates Increased wild ungulate populations	OT able to establish trust and facilitate transparent conflict resolution around probable tensions between livelihood and conservation objectives. OT able to reduce these conflicts through its social livelihood programmes. Capacity can be built in soum administrations
		Implement conservation incentive scheme to compensate herders for opportunity costs		
		Develop an alternative livelihoods programme to assist herders' transition to a more biodiversity-friendly system		
		Revitalise soum-level grazing planning to enable strategic decisions about herder entitlements and ecologically appropriate stocking levels, in line with national government policy		
	Reduced impacts of non-project powerlines	Install best-practice bird flight diverters on non-OT project powerlines	Reduced bird collisions with powerlines Fewer impacts on bustard populations	OT able to negotiate installation on non-OT infrastructure
	Strengthened Protected Areas	Implement protected area strengthening for Small Gobi SPA	Improved management in existing protected areas Improved sustainability of offset actions	Protected area agencies willing to work with OT Stakeholders support strengthened Protected Areas
		Review management of Ergeliin Zoo NR and Important Bird Areas, and implement recommendations as appropriate		
		Work with government to review and revise protected area extent and zoning		

AIM	OBJECTIVES	RECOMMENDED ACTIVITIES	OUTCOMES	KEY ASSUMPTIONS
To achieve Net Positive Impact on biodiversity through the generation of gains in priority biodiversity features to offset residual project losses	Raised bar in regional development helps sustain gains	Champion the need for, and benefits of, sustainable and biodiversity-friendly regional development	Agreement to cooperate Adoption of common standards and actions for biodiversity conservation across the region Reduced impacts on population connectivity of wild ungulates and bustards	Regional Stakeholders support regional planning OT able to facilitate effective collaborations
		Facilitate collaborative regional planning e.g. via the Southern Gobi Regional Development Council		
	Strong enabling mechanisms established	Establish long-term financing mechanism	Funding to resource ongoing management of the Offsets Landscape in perpetuity	Stakeholders agree on financing mechanism
		Implement a Stakeholder Engagement Plan	Stakeholders aware of OT's biodiversity offset objectives and actions	
	Monitoring and evaluation informs adaptive management	Design and implement M&E system to quantify losses and gains and feed into adaptive management	Dynamic, results-driven management system improving over time Demonstration of compliance with NPI requirements.	Capture of adequate data is technically feasible
	Sufficient Oyu Tolgoi capacity	Build OT's internal capacity for promoting, managing and implementing the Offsets Strategy	OT technically able to manage most offsets actions in 10-20 years time	OT effectively establishes and invests in its team

4.2 Reduced illegal hunting and collecting

Recommended Activities:

- Implement 5 Mobile Anti-Poaching Units – 3 in the Offsets Landscape and 2 in the Buffer Zone
- Build capacity, resources and networking of government institutions to increase prevention, detection and conviction rates of wildlife crime
- Reduce hunting of Houbara Bustards migrating outside Mongolia

Outcomes:

- Reduction in illegal hunting of protected animals
- Reduction in consumption, trafficking and collection of protected animals
- Reduction in over-harvesting of saxaul and other fuelwood sources
- Increased populations of priority biodiversity features

Assumptions:

- Can achieve reduced demand, as well as supply
- Can recruit staff with charisma and power to enforce law
- Can overcome economic, political and community vested interests

The primary threat to the survival of Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard is illegal hunting. An estimated 4,500 Asiatic Wild Ass are hunted annually in Mongolia (Wingard & Zahler 2006) out of an estimated total of 17,513-19,309 in Mongolia (Lhagvasuren

2007), which is unsustainable and would lead to the species' extirpation (Moehlman *et al.* 2008). Total numbers of Argali in Mongolia appear to have declined from about 60,000 in 1985 to 13,000-15,000 in 2001 (Amgalanbaatar *et al.* 2002). Hunting levels are less well known for Goitered Gazelle. Houbara Bustard are currently primarily hunted in their non-breeding range outside of Mongolia, where declines in some areas have reached 30% per annum (Tourenq *et al.* 2005). Pratt *et al.* (2004) attributed rising levels of illegal hunting in Mongolia to the rising market value of game animals in Asian markets, coupled with declining standard of living of many Mongolians during the transition to a market economy.

The Mongolian 'Law on Fauna' prohibits hunting of 'very rare' and 'rare' species including Asiatic Wild Ass, Argali, Goitered Gazelle and Houbara Bustard except under licence (Supplementary Technical Information 7.3). Mongolia has also ratified the 'Convention on International Trade of Endangered Species' (CITES) which strictly regulates international trade in Appendix I species including Asiatic Wild Ass, and regulates trade in Appendix II species including Argali and Saker Falcon.

The following priority biodiversity features are predicted to have residual impacts from increasing illegal hunting or collecting by the increased numbers of people moving to the Khanbogd area but not directly employed by the Oyu Tolgoi project:

- Asiatic Wild Ass, Argali, Goitered Gazelle, Great Bustard and Houbara Bustard are hunted illegally for parts, meat and sport
- Argali are hunted legally and illegally for sport
- Saker Falcon are collected legally and illegally for falconry
- Saxaul trees, the key species in Tall Saxaul Forest habitat, are collected largely illegally for firewood and timber (but local subsistence is allowed)

4.2.1 Implement five Mobile Anti-Poaching Units

Mobile Anti Poaching Units (MAPU) is the model used with significant success and recommended by WWF in Mongolia. Based on WWF experience, it is estimated that at least two MAPUs will be needed in the Offsets Landscape but given the crucial importance of their success, the risks in terms of personnel needs, and objections from vested interests, it is suggested that a precautionary approach is taken such that three MAPUs are planned and budgeted for. An additional two MAPUs should be planned and budgeted for the Buffer Zone.

MAPUs are staffed by government employees but should work closely with an independent institution, probably a non-government organisation, which the project would fund directly, as well as with the State Specialised Inspection Agency, border police and other key parties at national level and regional level. The primary focus should be upon illegal hunting of priority biodiversity species (i.e. Asiatic Wild Ass, Argali, Goitered Gazelle, Mongolian Gazelle, Great Bustard and Houbara Bustard). Work should also focus on illegal collecting of Saker Falcon and Tall Saxaul Forest. A limited number of Saker Falcon nestlings are collected annually for export under licence from the national government but it is suspected that higher numbers are illegally collected. Collection of saxaul for domestic firewood is a traditional practice but there are increasing reports of illegal collection for commercial use. MAPUs should be implemented as a package of field and intelligence gathering activities including field patrols, rewards, market patrols, informant networks, hotlines and support to government agencies. Activities will initially follow the basic model and the lessons learned from WWF's MAPUs (Breitenmoser *et al.* 2006) including:

- Agreement with the State Inspection Agency (or Ministry of Nature and Environment) for the Oyu Tolgoi project to supply (possibly via an NGO) technical guidance, equipment and finance, but not direct employment
- Start-up investment including vehicles
- On-going investment of salaries and running costs, including incentives for informants and telecommunications
- Operation through large network of volunteers and informants including local communities, groups, clubs, authorities, local authority rangers, protected area rangers and police, of which informant networks are likely to be the most effective
- Specific work with the Border Guard, police and judiciary
- Increasing awareness of conservation issues and laws, including creative means such as festivals or theatre
- Patrols and investigations in areas with suspected illegal hunting and markets
- Publicity and press exposure
- Support for the judicial process and funds to support prosecution
- Sharing income from fines with informants and local authorities (as already legislated)
- Advance these rewards to maintain motivation if cases are slow to progress through the courts.
- Development of incentives for herders co-existing with biodiversity

Given the potential conflicts with the vested interests of people and institutions complicit in illegal hunting, the MAPUs would need to work closely with Oyu Tolgoi project and independent social scientists to ensure that the communication and implementation of these activities are undertaken in a culturally appropriate manner.

4.2.2 Build capacity, resources and networking of government institutions to increase prevention, detection and conviction rates of wildlife crime

Although the primary activity is to operate through MAPUs, the police, border service, prosecution service and judiciary require support to increase prevention, detection and conviction rates for wildlife crime in the southern Gobi region. The new Environment Department in the National Police Force could be involved, once stakeholder engagement has generated a more detailed needs assessment and plan of action. This support could include training, capacity building and possibly payment for some additional operational costs. Payment of operational costs, if deemed appropriate, would necessarily be done with caution, based on a transparent needs-assessment, through an independent institution, and demanding transparent accountability. Of equal importance is the need to build networks between wildlife crime enforcement agencies.

4.2.3 Reduce hunting of bustards migrating outside Mongolia

The Net Positive Impact forecast (Appendix 5) concludes, precautionarily, that impacts of indirect habitat loss on Houbara Bustard and Great Bustard may not be adequately offset by improved rangeland management. Gains may possibly be generated by improved rangeland management but the impacts of different management on bustard populations are very poorly-known and require research. It is proposed to undertake specific research of Houbara Bustard breeding productivity in habitat under different management regimes at Oyu Tolgoi, probably in the Galba Gobi IBA which supports relatively high populations.

Given the lack of evidence for population gains from rangeland management, a necessary precautionary approach would be to undertake additional offsets for these species. These offsets should reduce hunting when these migratory birds are outside of the Oyu Tolgoi area as this is the primary threat to the individual birds using the Oyu Tolgoi area. Reduction of hunting of Great Bustards could be implemented by supporting a conservation project currently operational for Great Bustards in northern Mongolia, which includes those that migrate through the Oyu Tolgoi area. This could be supplemented by supporting the ongoing satellite tagging research to elucidate the migration routes, period and exact location of migratory stop-offs of Great Bustards in the Offsets Landscape (and hence whether improved rangeland management is creating gains for this species) and to investigate potential mortalities when satellite tags become stationary or lost (and hence better quantify residual losses and external threats).

For Houbara Bustards, there is a significant risk of failure of offsets outside Mongolia owing to the socio-political challenges of working in the countries involved. Most Houbara Bustards breeding in Mongolia and China migrate through Kazakhstan and central Asian states, and winter south to Iran to Pakistan (Combreau *et al.* 2011; Tourenq *et al.* 2004; Judas *et al.* 2006), and most Great Bustards winter in China (M. Kessler *in litt.* 2011; IUCN 2011). Results of satellite telemetry from Houbara Bustards elsewhere in Mongolia has indicated the migration and wintering sites illustrated in Figures 14-18 in the Supplementary Information. The exact migration routes, migration stop-offs and wintering grounds of individual bustards at Oyu Tolgoi is uncertain and should be researched with standardised satellite telemetry.

The primary offset activity for Houbara Bustard would be to initiate actions to reduce the level of hunting on the migration grounds of the Houbara Bustards breeding around Oyu Tolgoi. If this proves too challenging or unsuccessful, the project may also invest in retro-fitting bird flight diverters to powerlines in Houbara Bustard habitat elsewhere in Mongolia (in additional to the retro-fitting planned to offset the impacts of the Oyu Tolgoi powerlines). The budget for this action is precautionarily aligned with a higher budget for retro-fitting enough additional bird flight diverters to generate the required gains.

In summary, activities that could be undertaken to offset impacts of illegal hunting on Great Bustard and Houbara Bustard include:

- Research the breeding productivity of Houbara Bustards in areas with different rangeland management regimes
- Support the satellite tracking of Houbara Bustards to elucidate their migration and causes of mortality
- Initiate actions to reduce hunting on the migratory and/or wintering grounds of Houbara Bustard
- Support the satellite tracking of Great Bustards to elucidate their migration and causes of mortality
- Support the conservation project for Great Bustards in northern Mongolia
- Budget for retro-fitting additional powerlines in Mongolia

4.3 Improved rangeland management

Recommended Activities:

- Support herders to transition to more ecologically sustainable stocking ratios
- Implement conservation incentive scheme to compensate herders for opportunity costs
- Develop an alternative livelihoods programme to assist herders' transition to a more biodiversity-friendly system
- Revitalise soum-level grazing planning to enable strategic decisions about herder entitlements and ecologically appropriate stocking levels, in line with national government policy

Outcomes:

- Reduced degradation of rangeland by livestock leading to improved habitat quality
- Increased population of priority biodiversity features
- Reduced disturbance to wild ungulates
- Increased wild ungulate populations

Assumptions:

- OT able to establish trust and facilitate transparent conflict resolution around probable tensions between livelihood and conservation objectives
- OT able to reduce these conflicts through its social livelihood programmes
- Capacity can be built in soum administrations

Domestic livestock graze the natural vegetation across almost all of the southern Gobi region, causing some degradation in habitat quality by localised over-grazing and trampling, as well as small-scale infrastructure development and related disturbance to wildlife (i.e. wells, fences, vehicle tracks, shelters, and feed or cropland production; Sheehy *et al.* 2010). Many priority biodiversity species occur at lower population densities in degraded habitat. Restoring habitat quality through improved rangeland management could generate gains for these species.

The degree of over-grazing across open rangeland is unclear given the many different assessment methods. Moreover, the availability of graze is primarily determined by rainfall rather than livestock numbers, and thus varies between years irrespective of livestock grazing. However, there seems to be a general consensus among herders, government officials, donor institutions, and the public that Mongolian rangeland has been degraded, and continues to degrade, from a combination of livestock overuse and increasing climatic aridity (Sheehy *et al.* 2010). For instance, across 27 plots in Gobi-Altai between 1997-2008, plant species present in 1997 had declined by 33%, grasses and forbs decreased most on winter and summer pastures, vegetation cover and plant litter decreased, and plants preferred by livestock declined on all seasonal pastures (Sheehy *et al.* 2010). The State Inspection and Certification for Pasture Quality of 2010 classified 330 km^2 as slightly degraded and 14,370 km^2 as moderately degraded in Khanbogd soum but this conclusion is not universally supported (Damdin 2011). A baseline assessment of livestock and rangeland around the Oyu Tolgoi project site suggested that the area was over-stocked. However, in a different report, about 50% of the rangeland in four bags in Khanbogd soum was considered to be under-grazed because it is too far from water sources for grazing by sheep (Mongolian Society for Rangeland Management 2010). The number of livestock in Khanbogd soum is increasing, especially goats and sheep (Figure 6), however numbers crashed during the 2010 *dzud*. Horses compete for similar foodstuffs as Asiatic Wild Ass, and sheep and cattle compete the least (Sheehy *et al.* 2010). This indicates that returning livestock species ratios towards those maintained by the government collective pre-1990 would most benefit the Asiatic Wild Ass (D. Sheehy *in litt.* 2011).

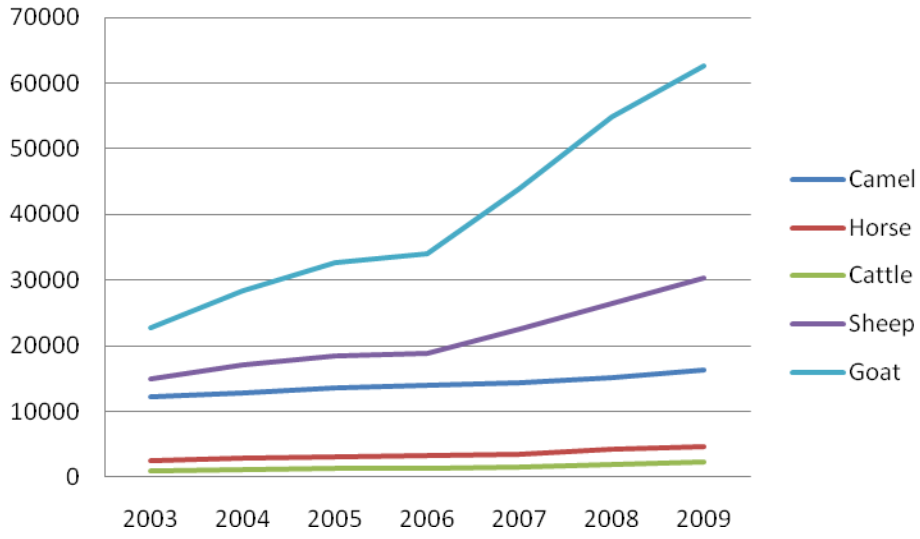

Figure 6: Livestock numbers in Khanbogd soum (Mongolian Society for Range Management 2010)

The majority of the Offsets Landscape has the grazing resources of 'non-equilibrium' drier desert, but some is relatively wetter 'equilibrium' semi-steppe habitat. Equilibrium grazing systems are characterised by relatively stable climates and constant plant production levels, enabling conventional rangeland management systems which balance grazing pressure with plant growth. Non-equilibrium grazing systems have consistently erratic timing and area of precipitation, which has much greater impacts on vegetation than do grazing impacts. Therefore in non-equilibrium environments, vegetation shows less response to management manipulations, and improvements in rangeland habitat quality are most likely to be achieved in wetter equilibrium habitat. Actions to improve rangeland management should be directed to these habitats since they support more sustained grazing pressure and are more important to both wildlife and livestock during droughts or dzuds (D. Sheehy, M. Fernandez-Gimenez & T. Ulanbayar pers comm. 2011). If monitoring shows that the required gains in habitat quality are not being achieved, the Offsets Landscape may thus have to be extended or shifted to include wetter equilibrium areas to the east.

Reducing competition between herders and wildlife by trying to reduce overall livestock numbers is socially complicated (R. Mearns pers. comm. 2011). It is probably more pragmatic, feasible and beneficial to focus on altering the livestock composition ratios by reducing numbers of goats (which are less selective in what they eat and hence more destructive) and increasing numbers of sheep. Goats have become favoured over sheep because they are better able to survive dzuds and drought (probably because of their greater ability to browse bushes) and perhaps because of wool (cashmere) prices. There is an opportunity to restore the preference for sheep as sheep meat is currently increasing in popularity and national policies such as Mongol Mal encourage reduced goat numbers to address over-grazing and encourage production of quality products.

Competition between livestock and wild animals around the limited water sources is often greater than competition for grazing. Wild ungulates are also often disturbed intentionally and unintentionally by livestock and people away from water sources. Competition is greater during droughts or dzuds. Direct activities are needed to reduce this competition and disturbance. The Offsets Plan could define an absolute limit to the number of old wells or other water sources which can be rehabilitated where there is a clear herder need but low risk of

adverse biodiversity impacts. Such a strategy should clarify that it will not open up any new wells.

Improved rangeland management could be achieved by a range of activities which are discussed in more detail below, including:

- Creation of an assured local market for sheep meat (e.g. the Oyu Tolgoi project buying meat for its employees)
- Provision of husbandry, veterinary and marketing support
- Implement conservation incentive scheme to compensate herders for opportunity costs
- Develop an alternative livelihoods programme to assist herders' transition to a more biodiversity-friendly system
- Revitalise soum-level grazing planning

Many of these actions could best be packaged into a regional biodiversity-friendly business strategy designed during the stakeholder engagement and management planning process. This may include wildlife-friendly grazing plans for various administrative levels, and integration with other regional livestock and business plans. Input would be needed from a multi-disciplinary team with expertise in livelihoods, social enterprise and rangeland ecology. It is emphasised that both conservation and livelihood objectives need to be addressed within a business framework. Activities may include resource use mapping at a bag or khot ail level. The outcome would necessarily be a negotiated 'deal' with local herders that incentivises them to transition to more sustainable biodiversity-friendly operations with decreased overall grazing levels and increased herder incomes.

Given the competition between livestock and wild ungulates for food and water, it is accepted that there is likely to be some potential for conflict between the objectives of rangeland management for biodiversity conservation and traditional livelihoods. A number of steps could be taken to minimise and mitigate this potential conflict. First, all actions should be subject to, and revised through extensive consultation with herders. Second, herders should be given an opportunity to opt out of, or into, these actions during consultations. Third, actions should be aligned where possible with relevant ongoing national and international programmes and initiatives. These include the World Bank's Sustainable Livelihoods Project and the national government's Mongol Mal which aims to prevent over-grazing. Fourth, actions should be focussed on win-win scenarios such as promoting livestock quality over quantity. Fifth, there should be a system of incentives to compensate for losses to any herders incurring opportunity losses through offset actions. Finally, the transition to more biodiversity-friendly livelihoods should be assisted through an alternative livelihoods programme.

Based on comparisons with the German development (GTZ) project which generated 15% relative increase in plant biomass through improved rangeland management (Hess *et al.* 2010), a precautionary estimate is made of half of this (7.5%) improvement in rangeland habitat quality over just 10% of the Offsets Landscape (i.e. assuming it is not politically or technically feasible to implement rangeland management over the whole landscape).

Given these potential conflicts, those responsible for delivery of the improved rangeland management activities would need to work closely with Oyu Tolgoi project and independent social scientists to ensure that the communication and implementation of these activities are undertaken in a culturally appropriate manner.

4.3.1 Support herders to transition to more ecologically sustainable stocking ratios

The Oyu Tolgoi project should buy quality sheep meat for its workforce from local herders. This market should encourage sheep over goats and the production of quality livestock rather than the current trend towards larger numbers of lower-quality livestock. The Oyu Tolgoi project should also address the currently inadequate technical husbandry and veterinary support, supply of good stock, winter forage crops, nutritional supplements and access to markets and organisation of herder communities. Herders preferring to keep some goats should also be encouraged to have lower numbers of better-quality animals as this improves wool (cashmere) yields. The herder community should be encouraged to aim for a 2:1 sheep to goat ratio (D. Sheehy pers. comm. 2011).

4.3.2 Implement conservation incentive scheme to compensate herders for opportunity costs

Community consultation should be undertaken to identify any need to compensate herders incurring costs as they transition to more wildlife-friendly rangeland management. Transitions to more sustainable biodiversity-friendly livelihoods may involve opportunity losses such as reduced livestock numbers, sale of goat wool (cashmere) or tolerance of wild ungulates at water sources and on prime grazing land. Compensation could be given as various conservation incentives including direct payments to households, community payments or non-cash benefits e.g. education or healthcare. There is also a need for an emergency fund to be made available for basic necessities at times of climatic and economic stress. These incentives may also engender a positive attitude to other aspects of the offsets strategy. The conservation incentive system should be designed carefully based on community consultation and learnings from other analogous programmes to avoid the creation of perverse incentives, to avoid raising expectations and to align with all other Oyu Tolgoi project biodiversity and social actions.

4.3.3 Develop an alternative livelihoods programme to assist herders' transition to a more biodiversity-friendly system

The Oyu Tolgoi project should implement an alternative livelihood activities programme to enable sustainable development alongside conservation incentives. Viable alternative livelihood activities should be developed in consultation with local stakeholders and taking account of lessons from analogous development projects. Examples could include financing for environmentally-friendly small and medium enterprise development. The aim here should be to exceed mere compensation for opportunity costs, and ensure a measurable improvement in local livelihoods. It would be critical to link support for all income generating and employment activities directly to conservation.

4.3.4 Revitalise soum-level grazing planning to enable strategic decisions about herder entitlements and ecologically appropriate stocking levels, in line with national government policy

The Oyu Tolgoi project should revitalise existing soum-level grazing planning bodies which are charged with controlling herding at local level, but are usually ineffective. This should be explicitly aligned with government initiatives like Mongol Mal which aim to prevent over-grazing, to provide Mongolian-derived ways of limiting overall stocking levels. This work could potentially be linked to the Pastureland User Groups that the Oyu Tolgoi project social team is establishing, and should definitely work in close conjunction with the afore mentioned groups ensuring that their objectives are fully compatible.

4.4 Reduced impacts of non-project powerlines

Recommended Activities:

- Install best-practice bird flight diverters on non-OT project powerlines

Outcomes:

- Reduced bird collisions with powerlines
  Fewer impacts on bustard populations

Assumptions:

- OT able to negotiate installation on non-OT infrastructure

The best like-for-like offset for the residual impacts of bird collisions with the Oyu Tolgoi project's high-voltage transmission lines is mitigation of similar powerlines within areas of similar population densities of susceptible priority biodiversity features elsewhere in the southern Gobi region. Given the lack of baseline data on population densities of Houbara Bustards and other susceptible priority biodiversity features and collision rates around the Oyu Tolgoi powerlines, the residual impacts of collisions cannot be quantified. Instead, the residual impact is expressed as a formula based on a baseline collision rate of *y* birds/km. Assuming that mitigation is 60% successful, which was the least successful rate in a review of the impacts of powerline mitigations on bustards in South Africa (Jenkins *et al.* 2010), then the residual losses would be 0.4*y* birds/km. The Oyu Tolgoi project is currently planning 95 km of high-voltage transmission lines, meaning an estimated residual loss of 38*y* birds. To offset these losses, similar mitigation should be retrofitted to *z* km of non-project power transmission lines where z * 0.6* *y* = 38*y*, or *z* = 64 km. This assumes a similar population density of priority biodiversity features in the offset area. The Oyu Tolgoi project should monitor either the population density or the collision rate of priority biodiversity species around both the impacted and offset powerlines. If the baseline collision rates and hence offset gains are lower at the offset site, then additional lengths of powerlines will need to be mitigated to ensure a net positive impact.

The offset action would be to install or retro-fit the same mitigation measures used on the Oyu Tolgoi project power transmission lines. These are detailed in Section 6.15 of Appendix 3 (Biodiversity Impacts and Mitigation Actions) and are, in summary, alternating flapper-type flight diverters and large spirals, alternating contrasting colours, at a frequency of at least one of each every 10 - 20 m, i.e. one device at least every 5 -10 m. Slight changes in design may be necessary for different powerline configurations. These will require ongoing maintenance to repair or replace damaged diverters.

It was assessed that the Oyu Tolgoi project low-voltage and medium-voltage power distribution lines would have no significant residual impacts on priority biodiversity features (Appendix 3 Biodiversity Impacts).

The key assumption for this activity is negotiating access to install and maintain diverters on non-project powerlines in areas with similar population densities of priority biodiversity features (notably Houbara Bustards).

4.5 Strengthened Protected Areas

Recommended Activities:

- Implement protected area strengthening for Small Gobi SPA (A & B)
- Review management of Ergeliin Zoo NR and Important Bird Areas, and implement the recommendations as appropriate
- Work with government to review and revise protected area extent and zoning

Outcomes:

- Improved management in existing protected areas
- Improved sustainability of offset actions

Assumptions:

- Protected area agencies willing to work with OT
- Stakeholders support strengthened Protected Areas

The Oyu Tolgoi project is committed to work in the Small Gobi SPA as an offset for the road upgrade to the Gashuun Sukhait border crossing the SPA. The lenders require that *"In circumstances where a proposed project is located within a legally protected area... the client will... implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area"* (International Finance Corporation's Performance Standard 6; European Bank for Reconstruction and Development's Performance Requirement 6).

Mongolian protected areas are, and are likely to continue to be, underfunded. Mongolia has rapidly expanded its protected areas network, but without an increase in the capacity and finances to manage the new reserves (Johnstad & Reading 2003; Reading *et al.* 1999). Recent figures indicated that Mongolia invested only US$2/km^2 in protected area management, well below the mean among developing nations of US$125/km^2, 194 rangers patrolled the nation's 20.7 million ha of protected areas and one ranger per soum patrolled the rest of the nation (Anonymous 2003 in Reading *et al.* 2006). The Small Gobi SPA has an annual budget of $20,000 excluding staff costs (Bold pers. comm. 2011). In addition to the work within the Small Gobi SPA mandated by lender requirements, the Oyu Tolgoi project should also look to improve the long-term security of tenure for conservation gains across the whole Offsets Landscape. This includes activities to strengthen the Small Gobi SPA, Ergeliin Zoo Nature Reserve (designated for geological not biodiversity conservation) and the Galba Gobi and the Borzon Gobi Important Bird Areas (which are the only Internationally Recognised Areas identified in the Offsets Landscape). It should also review legal and other opportunities to extend these Protected Areas and improve the long-term security of tenure for conservation gains across the Offsets Landscape.

A specific risk to potential conservation gains won through effective implementation of offset activities is the possibility of current mining exploration leases (which cover most of the Offset Landscape) being converted into actual mine exploration and operation. The key assumptions are that protected area authorities willingly work in partnership with the project to both review and strengthen protected area management, and that stakeholders support strengthening of tenure for conservation. The risk that stakeholders, particularly traditional herders, do not support stronger tenure should be addressed by implementing an ongoing programme of community awareness so that all decisions are based on full knowledge of the short- and long-term implications.

4.5.1 Implement protected area strengthening for Small Gobi SPA (A & B)

The Oyu Tolgoi project is committed to work in the Small Gobi Special Protected Area (SPA) as an offset for the road upgrade to the Gashuun Sukhait border which crosses the SPA Buffer Zone. The primary impacts on the SPA are illegal hunting and over-grazing by domestic livestock. Although established as a protected area, summer grazing camps are authorised and volunteer rangers are renumerated by allowing them to graze livestock within the SPA. A recent study suggested that the SPA could, if allowed, support 176,600 'sheep units' (1 sheep unit = 1 sheep or 1.1 goat or 0.2 camel or 0.17 cow or 0.14 horse) and 153,200 'sheep units' along the state borders, and this grazing opportunity attracts herders from outside Khanbogd soum (Damdin 2011). Any grazing of livestock may to lead to exclusion of wild animals such as Asiatic Wild Ass and gazelles. The SPA has a management plan which was reviewed in June 2011 (Bold & Olson *in litt.* 2011). This guides where the project can assist the park authorities to improve its conservation efficacy, including:

- needs assessment of the park and staff
- revise staffing levels, responsibilities and training
- build technical and management skills of staff
- re-zone, including better regulation of livestock grazing
- baseline surveys and monitoring of biodiversity and threats to biodiversity
- reduce illegal hunting and improve rangeland management as conducted outside the Protected Areas
- restore cultural links, traditional knowledge and relevant management practices
- promote tourism
- engage Buffer Zone communities with offsets actions in both Protected Area and wider Offsets Landscape
- pay salaries to volunteer rangers in exchange for them not grazing livestock
- work with Border Guard to help conserve biodiversity in the SPA
- develop sustainable financial income

All activities should be undertaken based on close consultation and partnership with the relevant government authorities.

4.5.2 Review management of Ergeliin Zoo NR and Important Bird Areas, and implement the recommendations as appropriate

The only significant formal protected area in the Offsets Landscape aside from the Small Gobi SPA is the 60,900 ha Ergeliin Zoo Nature Reserve, but this was established primarily for geological, not biodiversity, conservation. Ergeliin Zoo NR may suffer some secondary impacts from the project. The management of Ergeliin Zoo NR for biodiversity conservation should be reviewed and recommendations of these reviews implemented as appropriate. It may not be appropriate to implement recommendations which do not directly contribute to the long-term sustainability of conservation outcomes in the Offsets Landscape.

There are two Internationally Recognised Areas in the Offsets Landscape: the Galba Gobi and Borzon Gobi Important Bird Areas (Batbayar & Natsagdorg 2009). As Important Bird Areas, they have no legal government recognition or protection status. Currently, there they have no management plan or management activities. The Oyu Tolgoi project could look to work with the BirdLife International national partner, the Wildlife Science and Conservation Center of Mongolia, to develop management recommendations for the IBAs. Management recommendations should be implemented where they contribute to the long-term

sustainability of conservation outcomes in the Offsets Landscape. Results from monitoring across the Offsets Landscape could also be used to review the boundaries of these Important Bird Areas which are currently based on limited data on abundance of Houbara Bustards as extrapolated from very limited baseline data and topographic surrogates of suitable habitat (A. Tordoff *in litt.* 2011).

4.5.3 Work with government to review protected area extent and zoning, and expand as necessary

The long-term sustainability of the offsets gains would be improved if the tenure or land-use status across the Offsets Landscape was amended to incorporate conservation objectives. Tenure does not need be in the form of formal reserves as such tenure may have limited support from local stakeholders. Alternative models such as community-based local protected areas should be considered. Lessons can be learned from other organisations such as the Snow Leopard Trust which have been working with the Government of Mongolia to establish community-based local protected areas. A full review of options is, however, required as part of the broader offsets management planning process. This review should consider the range of legal opportunities and their stakeholder acceptability.

The zoning and boundaries of formally protected areas, notably the Small Gobi SPA, could be reviewed based on stakeholder consultation to improve its conservation efficacy, notably for sustaining priority biodiversity features. Increased security of tenure is most important for areas that support high populations of priority biodiversity features, notably Asiatic Wild Ass and Houbara Bustard. Expanding Small Gobi SPA B towards the north and east to include more of the core zone of the largest world population of Asiatic Wild Ass may be an effective conservation action if stakeholder support can be generated. Needs and challenges for expansion of the Mongolian protected areas network have recently been reviewed in Chimed-Ochir *et al.* (2010).

4.6 Raised bar in regional development helps sustain gains

Recommended Activities:

- Champion the need for, and benefits of, sustainable and biodiversity-friendly regional development
- Facilitate collaborative regional planning e.g. via the Southern Gobi Regional Development Council

Outcomes:

- Agreement to cooperate
- Adoption of common standards and actions for biodiversity conservation across the region
- Reduced impacts on population connectivity of wild ungulates and bustards

Assumptions:

- Regional stakeholders support regional planning
- OT able to facilitate effective collaborations

Perhaps the greatest risk to the sustainability of biodiversity gains is the impact of potential future development. This is a particular risk for the Khulan or Asiatic Wild Ass which would be susceptible to population fragmentation by poorly-designed roads and to illegal hunting by increased human populations. Given that Asiatic Wild Ass in particular require vast geographical ranges in order to find forage and water in the irregular and extreme climate, any

great losses outside the Offsets Landscape would risk becoming a 'population sink' for animals across the southern Gobi region. In the worst scenario, these losses could lead to the extirpation of this sub-population such that it also becomes lost from the Oyu Tolgoi area despite best-practice conservation around the mine site. This risk should be addressed by the Oyu Tolgoi project 'raising the bar' for the biodiversity conservation standards of new development across the southern Gobi region.

The Oyu Tolgoi project should become the model for infrastructure mitigation best practice, and then it should promote this model. There are few precedents for this approach in Mongolia and the Oyu Tolgoi project would have to innovate and adapt its approaches based on the leadership and ownership of management. The key assumptions are that regional stakeholders, especially governmental institutions, are supportive of improved standards, and that Oyu Tolgoi has the influence and leadership to facilitate effective collaborations.

4.6.1 Champion the need for, and benefits of, sustainable and biodiversity-friendly regional development

The Oyu Tolgoi project should clearly articulate the need for sustainability and biodiversity-friendly principles to be integrated into regional development planning, standards and practices. It should analyse the business case and drivers for both undertaking and leading regional biodiversity-friendly development. It then should champion these standards to ensure long-term sustainability of its biodiversity activities and to benefit from the reputational gains. The Oyu Tolgoi project should consider using the Khulan/Asiatic Wild Ass as a 'flagship' for both sustainable traditional lifestyles and biodiversity conservation (Bowen-Jones & Entwistle 2002) given that traditional herders view the species positively (Sheehy *et al.* 2010) but its conservation requires regional leadership.

4.6.2 Facilitate collaborative regional planning e.g. through the Southern Gobi Regional Development Council

The Oyu Tolgoi project should facilitate the integration of sustainability and biodiversity-friendly principles into regional development. The key is to avoid as many impacts as possible. Unavoidable impacts need best-practice mitigation as implemented at the mine site and championed by the Oyu Tolgoi project. This includes designing and retro-fitting wildlife underpasses under unavoidable roads, installing bird flight diverters on power transmission lines, potentially reducing fencing along railways and actions to combat increases in illegal hunting.

These standards need to be integrated into regional planning through close collaboration with planning and development authorities and forums such as the Southern Gobi Regional Development Council (which may need revitalising). One opportunity for institutionalising higher standards is through strengthening existing EIA procedures.

One activity that would further improve the sustainability of biodiversity gains and generate significant reputational gain would be to facilitate the population connectivity of Asiatic Wild Ass across the Ulaanbaatar-Beijing railway. This would enable animals to move into c.17,000 km^2 of land east of the railway from which Asiatic Wild Ass have been extirpated. This would also benefit Goitered Gazelle and Mongolian Gazelle which attempt to cross but often become entangled in fences and die. The World Bank is currently investigating the ecological and socio-economic opportunities to remove fences along stretches of the railway. Additional actions might be required to address illegal hunting and other threats east of the railway.

4.7 Strong enabling mechanisms established

Recommended Activities:

- Establish long-term financing mechanism
- Implement a Stakeholder Engagement Plan

Outcomes:

- Funding to resource ongoing management of the Offsets Landscape in perpetuity
- Stakeholders aware of OT's biodiversity offset objectives and actions

Assumptions:

- Stakeholders agree on financing mechanism

A range of supporting activities is needed to ensure effective design, management, implementation and adaptation of the offsets strategy. Two crucial processes are highlighted here: a funding mechanism and stakeholder engagement plan. As detailed in Section 6, the Oyu Tolgoi project will need a long-term financing mechanism to ensure the financial sustainability for its Offsets Programme. The Stakeholder Engagement Plan is discussed in Section 5.

4.8 Monitoring and evaluation informs adaptive management

Recommended Activities:

- Design and implement M&E system to quantify losses and gains and feed into adaptive management

Outcomes:

- Dynamic, results-driven management system improving over time
- Demonstration of compliance with NPI requirements

Assumptions:

- Capture of adequate data is technically feasible

Details of the monitoring and evaluation (M&E) needs are detailed in Appendix 6 (M&E). The M&E should be designed as an integral component of all offsets activities. M&E is needed to quantify the results of offset actions so that losses and gains can be measured and analysed. These results then need to be fed back into the offsets strategy as adaptive management. Adaptive management is a dynamic system of using monitoring results to ensure incremental improvements in offsets activities. Monitoring results are also crucial to measure and demonstrate compliance with the offsets aim of Net Positive Impact.

Monitoring of the offset activities themselves is required as good management practice, as well as monitoring their results. Monitoring should also identify changes in baseline pressures external to the Oyu Tolgoi project which could influence the efficacy of offset activities. For instance, a change in the market for a wild animal product may increase the baseline rate of illegal hunting in the Offsets Landscape.

Examples of monitoring theory and methods are given in Appendix 6 (M&E). For instance, rangeland quality can be monitored remotely via satellite imagery but monitoring Asiatic Wild Ass with enough precision to enable detection of significant changes in population size will require multiple aerial surveys over large geographical areas.

Monitoring and evaluation could be undertaken by an institution independent to the Oyu Tolgoi project, or some components could be contracted-out until sufficient in-house capacity is built. The analysis, conclusions and evaluation need to be subject to independent peer review.

Rio Tinto, in partnership with the IUCN, is developing, testing and implementing an independent process for verification of Rio Tinto's commitment to its NPI objective. As a Rio Tinto managed mining project with high biodiversity values, it is envisaged that in the future, the Oyu Tolgoi M&E process and conclusions would be used to independently verify the project's progress towards NPI.

4.9 Oyu Tolgoi capacity built

Recommended Activities:

- Build OT's internal capacity for promoting, managing and implementing the Offsets Strategy

Outcomes:

- OT technically able to manage most offsets actions in 10-20 years time

Assumptions:

- OT effectively establishes and invests in its team

The Oyu Tolgoi project aspires for as much as possible of the biodiversity offsets work to be managed and implemented 'in-house'. The Oyu Tolgoi project does not wish for the Offsets Plan to be implemented by expatriate staff in external institutions but wishes to build the capacity of its Mongolian staff. While the scope and technical detail of offset-related work outlined in this strategy is beyond the current capacity of the Oyu Tolgoi project biodiversity team, over the long-term in-house skills could be built by working closely with biodiversity partner institutions. In the short- to medium-term, it is recommended that partner institutions are contracted to coordinate and/or deliver some key offset activities. Future capacity can also be built through future transfer of staff from the offsets institution to the Oyu Tolgoi project biodiversity team. Capacity building would be facilitated by biodiversity champions within the company ensuring that Oyu Tolgoi project senior management take ownership of this Biodiversity Offsets Strategy. This is best done by having a senior Oyu Tolgoi manager take full responsibility for achieving Net Positive Impact and compliance with supporting lender demands.

5 Biodiversity Offsets Stakeholder Engagement Plan

The next step for the Offsets Strategy is to engage fully with stakeholders, and to revise the strategy based on their inputs into an Offsets Management Plan. It is anticipated that this engagement will run throughout 2012 and 2013 to align with the current (2011) Oyu Tolgoi Stakeholder Engagement Plan (SEP). Some engagement will need to be continued beyond finalisation of the Offsets Management Plan

Part of this stakeholder engagement plan is a stand-alone Communications Strategy to ensure that the key messages reach the right audiences at the right time. This should generate a broad media outreach and to continue beyond the finalisation of the Offsets Strategy. For example, the Oyu Tolgoi project might want to package its entire biodiversity programme in the southern Gobi region under the banner of 'Khulan / Asiatic Wild Ass conservation'. It may also wish to stress the outcomes of not just environmentally sustainable landscapes but also socially, politically and financially sustainable landscapes, alongside the outcomes of biodiversity conservation.

The next sections identify key stakeholders and summarise important issues for which stakeholder engagement is necessary. These are then synthesised into the Stakeholder Roadmap to outline a proposed schedule for engagement. The issues discussed are those which require co-development with stakeholders or which may cause confusion or conflict if stakeholders are insufficiently engaged. Mechanisms already mentioned in the current (2011) Oyu Tolgoi ESIA Stakeholder Engagement Plan (SEP) are **emboldened** to highlight places where the biodiversity offsets stakeholder engagement plan can be integrated with the overall ESIA SEP. The issues discussion and Stakeholder Roadmap follow a similar stakeholder classification to that in the broader ESIA SEP.

This Biodiversity Offsets Stakeholder Engagement Plan should be revised by the Oyu Tolgoi project biodiversity and social teams to incorporate ongoing developments and revised thinking.

5.1 Stakeholder Map

In alignment with the overall SEP, the following stakeholder categories and target groups are identified:

Affected parties:

- Herder households
- Soum residents, businesses and local government
- Oyu Tolgoi workforce

Interested parties:

- Ministry of Nature, Environment and Tourism (MNET)
- Ministry of Food and Agriculture (MFA)
- Ministry of Roads, Transportation, Construction and Urban Development (MRTCUD)
- Border Protection Agency (part of Ministry of Defence)
- State Specialised Inspection Agency (SSIA)
- Ministry of Mines and Energy (MME)
- Ministry of Justice and Internal Affairs (including the national police agency)
- Southern Gobi Regional Development Council (and other regional institutions e.g. South Gobi Homeland Committee)

- Aimag governments (various departments)
- Soum governments (various departments)
- Oyu Tolgoi project communities and social performance teams
- Industry associations and other business representatives
- International NGOs and scientific community
- National NGOs and scientific community
- Community Based Organisations (especially Pasture User Groups and alternative livelihood groups)
- Legal hunter groups (e.g. Mongolian Professional Hunters Society)
- Media organisations

5.2 Stakeholder issues

The issues discussed below are those which either need stakeholder engagement to feed into development of the Offsets Management Plan or which may cause confusion or conflict if stakeholders are insufficiently engaged.

5.2.1 Biodiversity offsets

Many stakeholders will be unfamiliar with the concepts of biodiversity offsets. Key points that need to be communicated include that they are the last step in the mitigation hierarchy; they compensate for residual impacts to biodiversity that cannot be mitigated onsite; and they are additional conservation actions beyond those already being done by others. Stakeholders with a basic knowledge of offsets need to understand the differences from standard Mongolian legal environmental obligations, the requirements of the project lenders and the Oyu Tolgoi project's own voluntary corporate policies.

Stakeholders also need to know the basic governance and accountability structure of the offsets actions, and that progress towards NPI will be independently monitored and evaluated. Similarly, nearly all stakeholders will have heard of the Oyu Tolgoi project. It is important to know whether they have any misconceptions and what views and opinions they hold. This baseline information may be collected by other Oyu Tolgoi project initiatives.

For some or many stakeholders it may be most appropriate to talk of the offsets programme as one promoting a type of 'sustainable landscape' in which mining, local herder livelihoods and biodiversity conservation can all co-exist. The communication and understanding of the project amongst government and community stakeholders would be the critical first step in appropriate structuring of the ownership of the programme with key dependants within Mongolia.

5.2.2. Illegal hunting

The activities to reduce illegal hunting require relatively little co-development with local stakeholders but do require extensive discussion with national government institutions, WWF, the MAPUs operated by WWF and the communities benefiting from MAPU work. Reducing illegal hunting in the Offsets Landscape and Buffer Zone would cause some conflicts with the economic, political and community vested interests which partake in or benefit from illegal hunting. Their perspectives would help in the design and implementation of these activities. Ongoing implementation would require extensive ongoing consultation and awareness at all levels. The whole population should be made aware of the need to enforce hunting laws and the consequences of non-enforcement. Enforcement activities would require co-development and collaboration with the Ministry of Nature, Environment, and Tourism, State Specialised

Inspection Agency, Border Guard, national police and judiciary. Long-term public events, outreach and education at multiple levels are needed. Successful convictions should be publicised by the media as a deterrent.

The development of activities to address hunting of bustards migrating outside of Mongolia would require extensive discussion with international NGOs and scientific community.

5.2.3 Rangeland management

It is accepted that there is likely to be some potential for conflict between the objectives of rangeland management for biodiversity conservation and traditional livelihoods. An explicit recognition of this potential conflict and the steps proposed to minimise and mitigate this potential conflict need to be clearly communicated and then discussed. Participation in the opportunities offered by the offsets activities, to enable more sustainable herder livelihoods, should be equitably negotiated. Such consultations will take time, requiring small teams of local communicators engaging in resource-use mapping, and potentially establishing mediation committees to address concerns that may arise around grazing restrictions, and negotiate solutions.

The Oyu Tolgoi Stakeholder Engagement Plan notes that the Oyu Tolgoi project and the Mongolian Society for Range Management (MSRM) plan to establish **a Pasture NGO and User Groups** of "herders within different *khot ail* to work collaboratively on pastureland management and preservation' in Khanbogd soum. Biodiversity offset objectives need to be integrated into this work, which could provide a model for scaling up across the broader offsets area. This is likely to be a complex process that would require use of a combination of Oyu Tolgoi's engagement tools including **community visioning and agreements**, **focus discussions and workshops**, and l**ocal community** (bagh dhural) **meetings**.

Other key stakeholders include the Ministry of Food and Agriculture (MFA) which may have relevant future agricultural strategies such as privatisation, fencing and market mechanisms to favour ecologically sustainable livestock ratios and levels. Local governments, especially soums, would be required to participate in the offset activities, notably grazing planning.

5.2.4 Alternative livelihoods

Community needs and aspirations for alternative livelihoods need to be discussed and considered for the Offsets Plan. Alignment and synergies need to be sought with the Oyu Tolgoi project's existing **community development programme.**

5.2.5 Sustainable financing

The establishment of a sustainable financing mechanism for long-term offset implementation, possibly an endowment-based trust fund, would require engagement with various national government ministries. Delivery mechanisms for distributing this money would need to be co-designed with the parties participating in improved rangeland management activities.

5.2.6 Infrastructure mitigation

Offsetting through retrofitting bird flight diverters to non-project powerlines would require negotiation with powerline owners, operators, managers and government. The project would also need to lead on facilitating mitigation of impacts of other infrastructure including roads and railways.

5.2.7 Strengthened Protected Areas

All actions in formal Protected Areas require collaboration and engagement with MNET and park authorities. Planning and implementing activities requires engagement with neighbouring communities. Oyu Tolgoi should also engage with non-government organisations such as BirdLife International's national partner the Wildlife Science and Conservation Center of Mongolia, to develop management actions for the Galba Gobi and Borzon Gobi Important Bird Areas.

5.2.8 Regional planning

The need for the Oyu Tolgoi project to champion and lead raised standards for sustainable biodiversity-friendly regional development should be clearly communicated to relevant stakeholders. The Oyu Tolgoi project would need to engage and work with the **Southern Gobi Development Council** (SGDC) and/or similar relevant agencies e.g. the South Gobi Homeland Committee. The SGDC apparently "includes senior civil servants of the relevant departments of key Ministries as well as representatives from Oyu Tolgoi LLC, other mining companies in the region and civil society" (Oyu Tolgoi 2011). The Oyu Tolgoi project would need to ensure that biodiversity is mainstreamed into the regional development strategy by building SGDC's technical awareness by broadening its membership or adding a Technical Advisory Committee, and communicating with decision-makers in Ulaanbaatar via SGDC's **update and briefing sessions**.

5.3 Stakeholder engagement road map

Stakeholder category & target group	Detailed engagement through discussion of main elements of draft Offset Plan							
	Biodiversity offsets	**Infrastructure mitigation**	**Rangeland management**	**Alternative livelihoods**	**Illegal hunting**	**Sustainable financing**	**Regional planning**	**Strengthened Protected Areas**
AFFECTED PARTIES *(agreement on offset design; some joint decision-making; information sharing)*								
Herder households								
Initial engagement								
Ongoing engagement								
Soum residents, businesses and local government								
Initial engagement								
Ongoing engagement								
Oyu Tolgoi workforce								
Initial engagement								
Ongoing engagement								
INTERESTED PARTIES (*consultation, joint decision-making and implementation partners*)								
Ministry of Nature, Environment, and Tourism (MNET)								
Preliminary engagement in 2011								
Initial engagement								
Ongoing engagement								
Ministry of Food & Agriculture (MFA)								
Initial engagement								
Ongoing engagement								
Ministry of Roads, Transportation, Construction and Urban Development (MRTCUD)								
Initial engagement								
Ongoing engagement								

Stakeholder category & target group	Detailed engagement through discussion of main elements of draft Offset Plan							
	Biodiversity offsets	**Infrastructure mitigation**	**Rangeland management**	**Alternative livelihoods**	**Illegal hunting**	**Sustainable financing**	**Regional planning**	**Strengthened Protected Areas**
Border Protection Agency								
Initial engagement								
Ongoing engagement								
State Specialised Inspection Agency [SSIA]								
Initial engagement								
Ongoing engagement								
Ministry of Mines & Energy (MME)								
Initial engagement								
Ongoing engagement								
Ministry of Justice and Internal Affairs								
Initial engagement								
Ongoing engagement								
Southern Gobi Regional Development Council								
Initial engagement								
Ongoing engagement								
Aimag, and then Soum, government								
Initial engagement								
Ongoing engagement								
Oyu Tolgoi Communities & Social Performance Team								
Initial engagement								
Ongoing engagement								

Stakeholder category & target group	Detailed engagement through discussion of main elements of draft Offset Plan							
	Biodiversity offsets	**Infrastructure mitigation**	**Rangeland management**	**Alternative livelihoods**	**Illegal hunting**	**Sustainable financing**	**Regional planning**	**Strengthened Protected Areas**
Industry associations								
Initial engagement								
Ongoing engagement								
International NGOs & scientific community								
Preliminary engagement in 2011								
Initial engagement								
Ongoing engagement								
National NGOs and scientific community								
Preliminary engagement in 2011								
Initial engagement								
Ongoing engagement								
Community Based Organisations								
Initial engagement								
Ongoing engagement								
Legal hunter groups, e.g. Mongolian Professional Hunters Society								
Initial engagement								
Ongoing engagement								
Media								
Initial engagement								
Ongoing engagement								

6 Financing

An indicative budget has been prepared, but many costs are extremely approximate and dependent on the results of stakeholder engagement, contractors' budgets to undertake the monitoring and evaluation work, and the ongoing adaptive management feedback from monitoring and evaluation. Therefore, no budget is presented here. However, ongoing costs are estimated to be approximately US$3 million / year (approximately equal costs for reduced illegal hunting, improved rangeland management, M&E, and management and other costs combined), and start-up and short/medium-term costs totalling an additional approximately US$8 million. This indicates that endowment of a trust fund to finance the Oyu Tolgoi project Biodiversity Offsets Strategy into perpetuity would be in the order of US$70 million.

Offset gains need to be maintained in perpetuity through continual management. Funding such management is best guaranteed by up-front capitalisation of a long-term financing mechanism to provide stable, predictable and sustainable financing. Rio Tinto's experience in financing long-term sustainable development initiatives around other existing operations has clearly demonstrated that the most cost-effective and secure way to fund long-term management actions is through establishing an endowment (IUCN 2007). More than 50 conservation trust funds have been established in developing countries globally during the last 20 years, managing a total of over $1.5 billion (Spergel & Wells 2009). Almost all conservation trust funds are independent legal entities and, owing to the requirements of international donors, have governing boards made up of representatives of public and private sectors and civil society. Such funds often offer low transaction costs (most larger conservation trust funds have administrative costs of 10-12%), openness, transparency, flexibility, credibility with a broad array of national as well as international stakeholders, and have proven very effective if insulated from excessive government influence (Spergel 2011). Other overarching governance principles include ensuring that financial structures and payments are independent from the Oyu Tolgoi project itself, decisions and transactions are fully transparent, minutes and transactions are fully disclosed to the public, and technical decisions are made by a committee including national and international experts. These principles need to be considered when determining details of the administration and management of a financing mechanism.

It is worth noting that there is a precedent for a Mongolian trust fund, the Mongolian Conservation Trust Fund (METF[4]) which the Ministry of Nature, Environment and Tourism (MNET) tried to establish in 1997. METF's lack of success was due to international funding pledges not materialising, largely as a result of not hiring professional fundraisers (Markandya 2010).

Mitigation actions will be financed from the Oyu Tolgoi project's operational budget and will continue up to closure and post-closure as necessary. The financing mechanism for any mitigation actions post-closure may depend on the actions themselves and has not currently been determined.

[4] METF was developed to hold its capital investment off-shore, with a separate Mongolian account for disbursement; its governance structure comprised a nine-member Board of Directors with representatives from the Mongolian government, NGOs, academic sector plus international donors; a Scientific and Technical Advisory Committee was to advise on the feasibility and environmental impact of proposed projects; and a Financial Advisory Committee was to advise the Board on all matters relating to national and international compliance.

7 Risks to achieving Net Positive Impact

7.1 Uncertainty

There are large uncertainties in the estimates underpinning the NPI forecast, notably in the baseline estimates of key biodiversity features and their pressures, and the lack of models enabling accurate estimation of the gains predicted from the chosen offset actions. Thus, the Oyu Tolgoi project should aim to exceed the likely minimum requirements by a large margin to be confident of achieving NPI. This should be coupled with intensive monitoring and evaluation to refine the estimates of these uncertainties and to inform adaptive management of the whole Offsets Strategy.

A number of hydrogeological uncertainties are highlighted in Appendix 3 (Biodiversity Impacts and Mitigation Actions). If monitoring shows hydrological connectivity between various aquifers, then additional impacts are likely and additional offsets would be needed.

7.2 Socio-political risks

The Oyu Tolgoi project recognises the potential risk posed if there is a lack of ownership from senior management and/or lack of financial and human resourcing for the Offsets Plan. Although the COO has ultimate responsibility for ensuring the overall outcome of Net Positive Impact (and hence compliance with PS6 / PR6), the Oyu Tolgoi project will also need to ensure adequate staffing and resourcing at lower levels to ensure achievement of these outcomes.

The offset activities risk being negated by poor standards of development elsewhere in the Offsets Landscape and even elsewhere in the southern Gobi region. The Oyu Tolgoi project should seek to address this risk by championing and facilitating a raised bar in standards for regional development.

A related risk is the threat to long-term sustainability of the offsets gains by inadequate long-term security of land tenure including existing mining and oil exploration leases. The Oyu Tolgoi project should work with stakeholders to investigate and implement opportunities to improve the security of tenure for biodiversity outcomes across the Offsets Landscape and indeed the southern Gobi region.

The potential for conflict between traditional herder attitudes and biodiversity-friendly rangeland management has been highlighted and a number of offsets activities have been developed specifically to ensure that herders benefit significantly if they wish to opt into the package of changes and benefits.

Herders' likely wish for greater provision of water (e.g. boreholes) would risk increased degradation of rangeland and disturbance in areas currently able to support lower livestock densities. It is recommended that the Oyu Tolgoi project defines an absolute limit to rehabilitating old wells where there is a clear herder need but low risk of adverse biodiversity impacts, and not open up any new wells.

The risk of additional herders immigrating into the Offsets Landscape to exploit the package of offsets benefits will need to be addressed in the design of the final Offsets Management Plan, including defining which herder groups have rights to the lands based on resource-use mapping.

Demand for products of illegal hunting is largely dependent upon external influences such as the market for products used in Chinese traditional medicine. The Oyu Tolgoi project should monitor these non-project pressures, to establish solid collaborations with external agencies and to continue to improve awareness of the issues and the consequences of uncontrolled illegal activities.

The Oyu Tolgoi project's ability to champion and lead raised standards of regional development would be compromised by any significant delays in implementation of best-practice mitigation to its own infrastructure.

7.3 Technical risks

It is understood that 'non-equilibrium' habitats across most of the offset landscape may be ecologically unresponsive to improved rangeland management (D. Sheehy *pers. comm.* 2011). If the necessary biodiversity outcomes are not generated in these habitats, the Offsets Landscape may need to be extended to wetter 'equilibrium' habitats to the east.

In the short-term, extreme weather events may reverse biodiversity gains and socio-political support. In the long-term, climate change may cause similar disruption. The Oyu Tolgoi project should mitigate these risks by aiming to generate significant contingencies in biodiversity gains, especially connectivity across large landscapes, and socio-political support.

8 Recommendations

As discussed above, to begin to implement biodiversity offsets and manage the associated risks, the Oyu Tolgoi project should:

- Implement the stakeholder engagement plan and convert this Offsets Strategy into an Offsets Plan
- Aim to exceed the likely minimum requirements by a large margin to be confident of achieving NPI (if extra offsets outcomes are verifiably achieved, these could even be traded as 'biodiversity credits'.) This is best achieved by a combination of precautionary measures including:
- Research legal and other opportunities for ensuring long-term security of offset gains
- Investigate opportunities for liaison and partnership with other projects developing infrastructure and considering offsets in the southern Gobi region (e.g. The Nature Conservancy's Development by Design project)
- Ensure collaboration between environmental and social teams so that the objectives and actions for mitigation actions for local communities are consistent with the objectives and actions for biodiversity mitigation and offsets
- Ensure adequate staffing and resourcing at lower levels for delivering the overall outcome of Net Positive Impact (and hence compliance with PS6 / PR6)

9 Supplementary Technical Information:

9.1 Detailed distribution of some priority biodiversity features in the Offsets Landscape

This section provides some more detailed technical information on the distribution of some priority biodiversity features, and how these data were used in offset site selection and project design. The occurrence of priority biodiversity features addressed by the offsets strategy at each potential offset site is summarised in Table 3. It is acknowledged that there are inadequate baseline data. This should be addressed by specific monitoring and evaluation and by liaison with parallel processes such as The Nature Conservancy's Development by Design project.

The Khulan or Asiatic Wild Ass has been highlighted as a potential 'flagship' species given the global importance of the southern Gobi region to this rapidly declining Endangered species and the large predicted residual impacts of the Oyu Tolgoi project. This species formerly had an extensive range across central Asia from the Arabian Peninsula to Mongolia, but the southern Gobi region now holds about 50% of its current total global population (Figure 7; Moehlman *et al.* 2008; Appendix 2). No other priority biodiversity feature has its global range or population so concentrated in the Oyu Tolgoi project's area of influence. Based on field surveys (e.g. Figures 8-10), there is a zone of high Asiatic Wild Ass population density across an extensive area of the south-eastern Gobi. Largest numbers occur in south-western Dornogovi/eastern Omnogovi where 11,187 individuals (95% confidence intervals = 4,012-31,196) were estimated in 2009 (out of a total of 7,799-38,163 estimated in the whole of Mongolia, with about 73% of the additional animals in the Great Gobi B SPA; Lkhagvasuren *et al.* 2010). However, it should be noted that this is a nomadic species, moving in response to food availability, and its geographical distribution thus varies by hundreds of kilometres over months and years. Its distribution in the southern Gobi region should be monitored by the project.

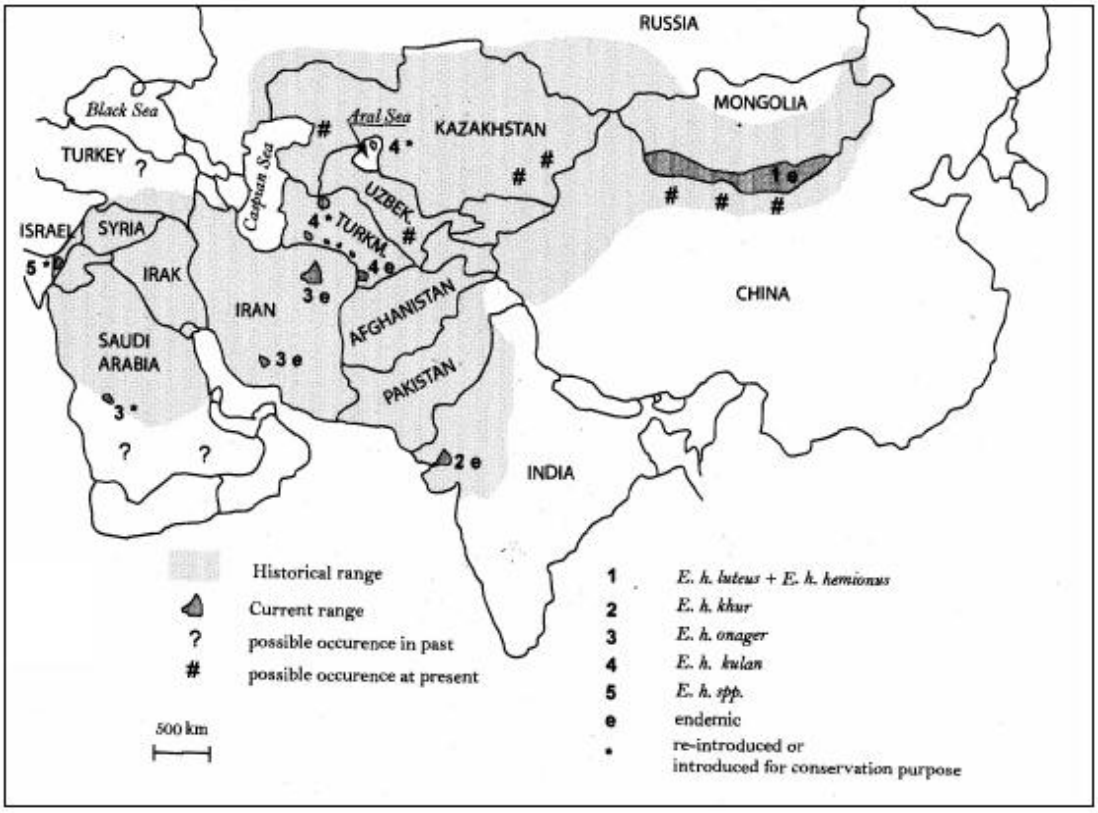

Figure 7: Historic and current global range of Asiatic Wild Ass (from Feh et al. *2002)*

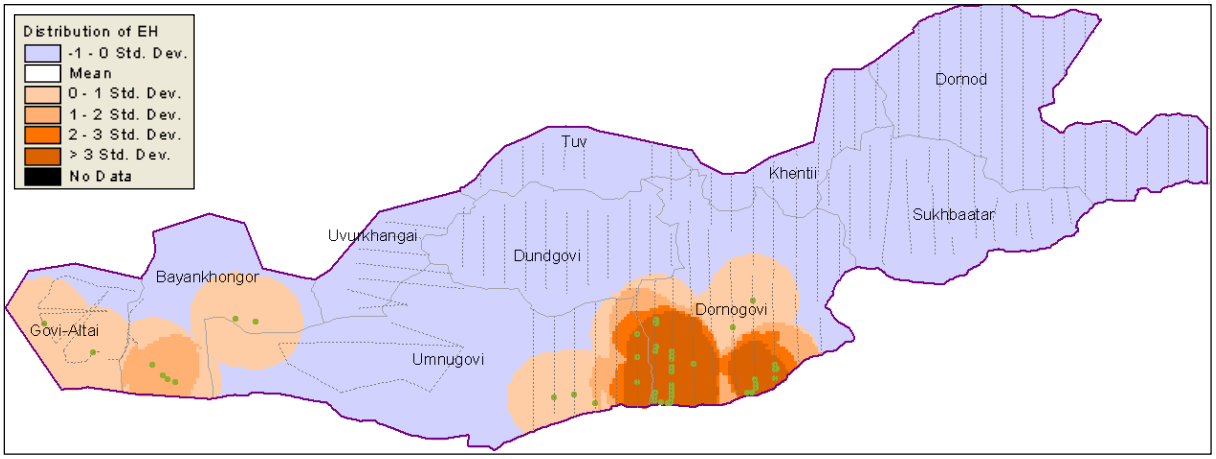

Figure 8: Asiatic Wild Ass recorded in 2009 surveys, showing estimated population density and survey transects (Lkhagvasuren et al. *2010)*

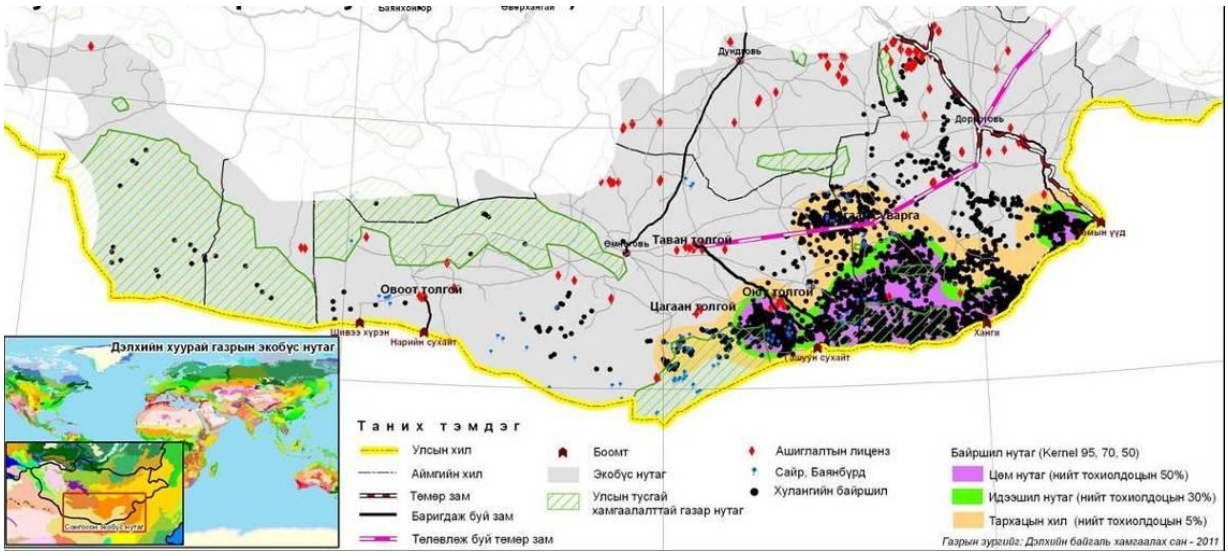

Figure 9: Asiatic Wild Ass recorded 2003-2010, showing estimated population density

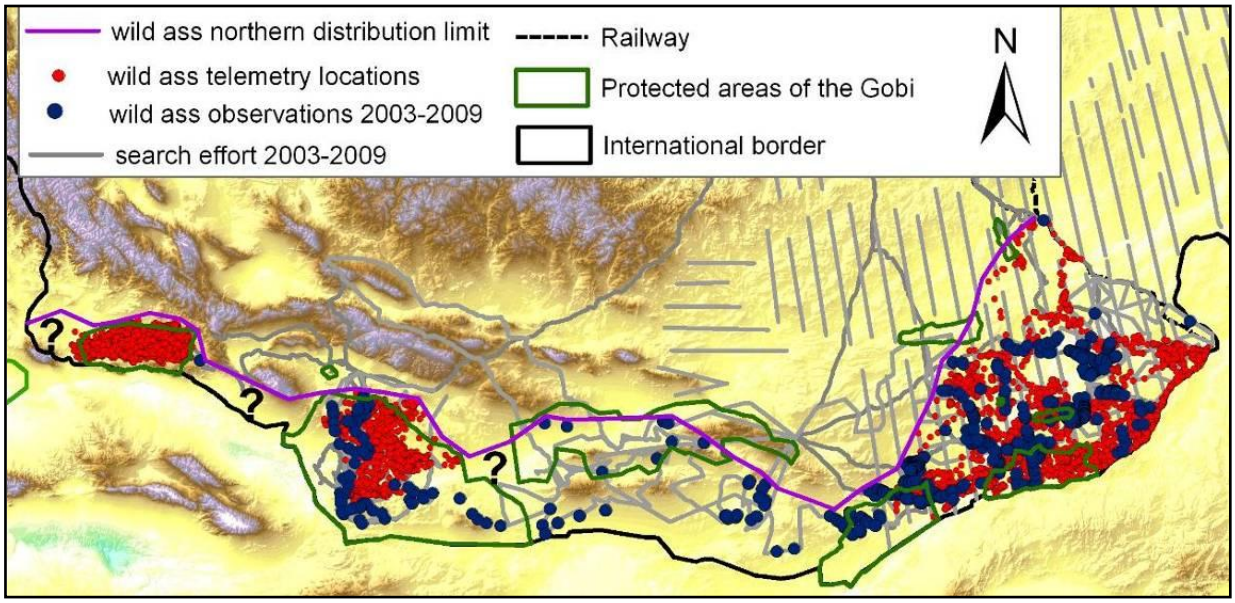

Figure 10: Asiatic Wild Ass observations and telemetry locations (Kaczensky et al. *2011) in the South Gobi*

Note that the high-density area in the south-east Gobi is defined here as the Offsets Buffer Zone. This could be extended to include the higher-rainfall region to the north which supports habitat more suited to Asiatic Wild Ass but from which they have become recently extirpated. However, the reasons for extirpation need to be investigated and addressed before attempting to encourage them into this area. Similarly, another extension could be to the c.17,000 km^2 east of the Ulaanbaatar – Beijing railway from which Asiatic Wild Ass have become recently extirpated. This would require removal of sections of fence (if authorities were open to such actions; a subject being currently investigated by the World Bank) and addressing any other reasons for extirpation from this area. Enabling crossing this railway would also benefit Goitered and Mongolian Gazelle and reduce the mortality currently caused by animals attempting to cross but becoming entangled in fences.

- Goitered Gazelle are also found over much of the southern Gobi region with moderate numbers occuring in south-western Dornogovi/eastern Omnogovi where 5,103 individuals (95% confidence intervals = 2,027-12,849) were estimated in 2009 (out of a total of 6,458-25,035 estimated in the whole of Mongolia; Lkhagvasuren *et al.* 2010). However, it should again be noted that this is a nomadic species – moving in response to food availability – and its geographical distribution thus varies by hundreds of kilometres over months and years. Ongoing fieldwork would be needed to assess numbers using any potential offset areas.

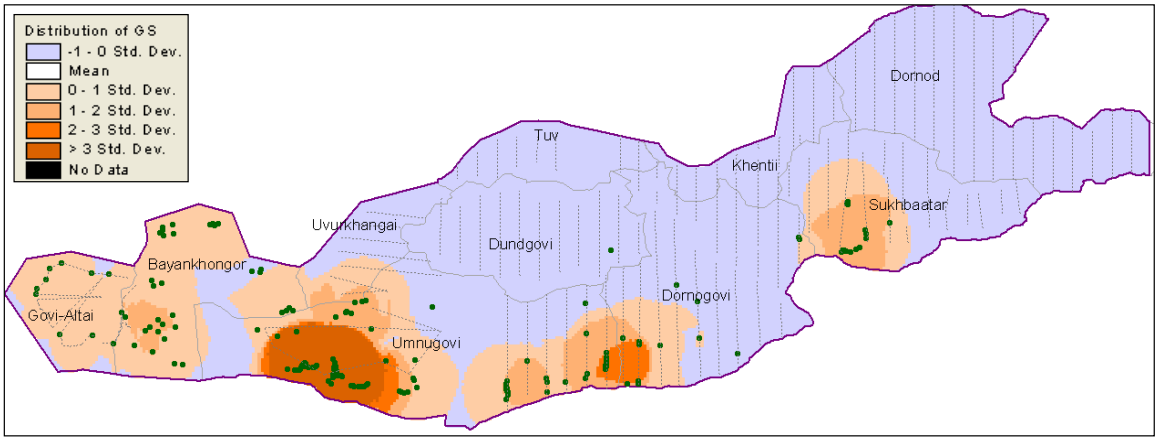

Figure 11: Goitered Gazelle recorded in 2009 surveys, showing estimated population density and survey transects (Lkhagvasuren et al. *2010)*

- Mongolian Gazelle are found in small numbers over some of the southern Gobi region where 1,124 individuals (95% confidence intervals = 654-1,931) were estimated in 2009 in south-western Dornogovi/eastern Omnogovi (out of a total of 3.3-9.8 million estimated in the whole of Mongolia (Lkhagvasuren *et al.* 2010).

- Argali are restricted to hilly areas. Surveys of Argali in the southern Gobi region indicate that they occur in significant numbers. In 1997, an estimate of 3,900 (± 1,132 standard error) was made in Dundgovi, Omnogovi and Dornogovi (Reading *et al.* 1997) and in 2009, an estimate (within 95% confidence limits) of 1,361-4,967 Argali was made in Dornogovi, 1,505-15,408 in Dundgovi and 1,198-4,852 in Omnogovi (Lkhagvasuren *et al.* 2010). Its occurrence and abundance in the chosen suite of offset sites should be confirmed by discussion with national Argali experts.

- Swan Goose, Ferruginous Duck, Great Bustard, Relict Gull and Yellow-breasted Bunting are migrant birds, occurring in small numbers in transit between northern breeding and southern non-breeding areas, and can be reasonably assumed to occur in similar numbers across any proposed offset areas.

- Within Mongolia, Short-toed Snake-eagle is uncommon or rare and essentially restricted to Khanbogd, Nomgon, Bayan-Ovoo, and Khurmen soums (N. Batbayar *in litt.* in Appendix 2).

- Egyptian Vulture is dependent on rocky areas for nesting. Fieldwork is needed to assess its baseline distribution in the area of influence of the Oyu Tolgoi project, from where there are very few records, its estimated residual loss, and its occurrence in any proposed offset areas.

- Saker Falcon is likely to be widespread where there are adequate numbers of small and medium-sized mammals for prey and trees or cliffs for nesting, is known to be widespread in the Galbyn Gobi region and to range across the southern Gobi region (Batbayar *et al*. 2011) and can be reasonably assumed to be widespread across any proposed offset areas.

- Houbara Bustard probably breeds in much of the area containing the candidate offset sites (draft Red List for birds per G. Sundev *in litt.* 2011 in Appendix 2). It is dependent on shrub-lands in desert and semi-desert area (Tourenq *et al.* 2004). The only recent data from the southern Gobi region are from a survey in the Galba Gobi Important Bird Area, which indicated the species' occurrence throughout the area surveyed, including north to the mine site and Khanbogd town (Figure 12; Batbayar *et al.* 2011) and fieldwork for the Oyu Tolgoi project which recorded the species south-west of the mine site and near the Small Gobi SPA (Tseweenmyadag 2011).

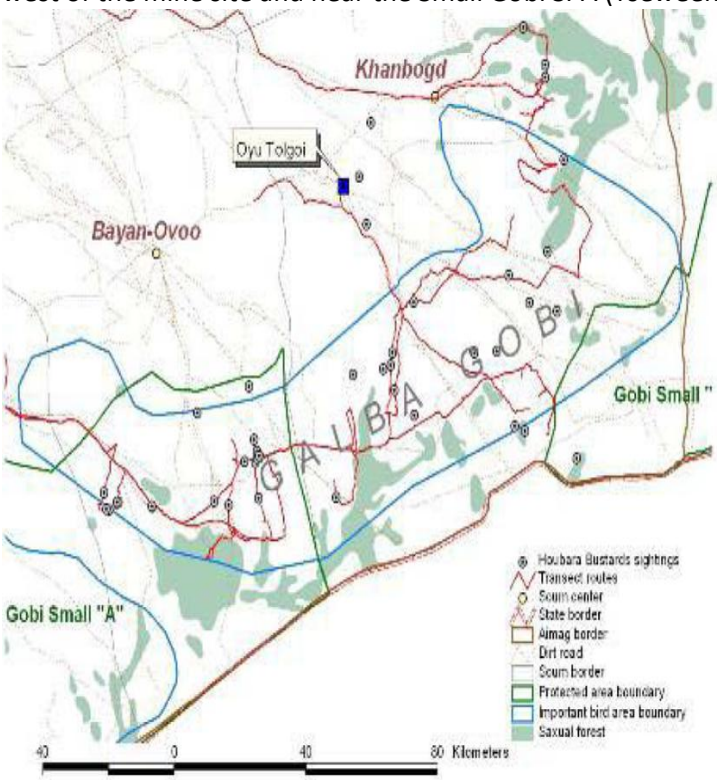

Figure 12: Records of Houbara Bustard in Galba Gobi Important Bird Area (Batbayar et al. *2011).*

- Pallas' Sandgrouse and Mongolian Ground-jay are common species throughout the Galba Gobi (Batbayar *et al.* 2011) and can be reasonably assumed to be widespread across the proposed regional offset areas.

- Mongolian Chesney has a range across southern Mongolia but is most abundant in the south-east (around the project area). Fieldwork is needed to assess its baseline distribution in the area of influence of the Oyu Tolgoi project, its estimated residual loss, and its occurrence in any proposed offset areas. This is true of all 18 'very rare' plants known or predicted to occur in the project area.

- Riverine Elm Trees now have a significant portion of their range confined to the unit of analysis comprising Khanbogd, Manlai and Bayan-Ovoo soums and the Small Gobi SPA, and the distribution to the east and south has now been much reduced by anthropogenic pressures (H. von Wehrden *in litt.* in Appendix 2). As Riverine Elms Trees

have a very patchy distribution (see mapped distribution within Khanbogd soum; Figure 12), fieldwork would be needed to assess the abundance and quality of this feature in any offsets. Riverine Elm Trees may not occur in significant quantities in candidate offset areas to the east, but significant potential exists for propagating and planting new trees.

- Ephemeral Lakes and Pools are an extremely rare feature in the arid south of Mongolia, yet South Gobi contains several large and important ephemeral lakes and pools, most in Small Gobi B SPA, but also in Small Gobi A SPA and less frequently in Galbyn Gobi (H. von Wehrden *in litt.* in Appendix 2).

- Although saxaul is widespread in the southern Gobi region (46% of the Mongolian total is in Omnogovi and 6% in Dornogovi; NSO & MNE 2000 in Crisp *et al.* 2004), the unit of analysis comprising Khanbogd, Manlai and Bayan-Ovoo soums and the Small Gobi SPA contains extreme and very unusual examples of the habitat, with exceptionally high and broad trees (H. von Wehrden *in litt.* in Appendix 2), identified here as the feature Tall Saxaul Forest. As saxaul occurrence is patchy and its quality variable (see mapped distribution within Khanbogd soum; Figure 13), fieldwork would be needed to assess the quality as well as distribution of this feature in any offset, and it may not occur in significant quantities in offsets outside of this unit of analysis.

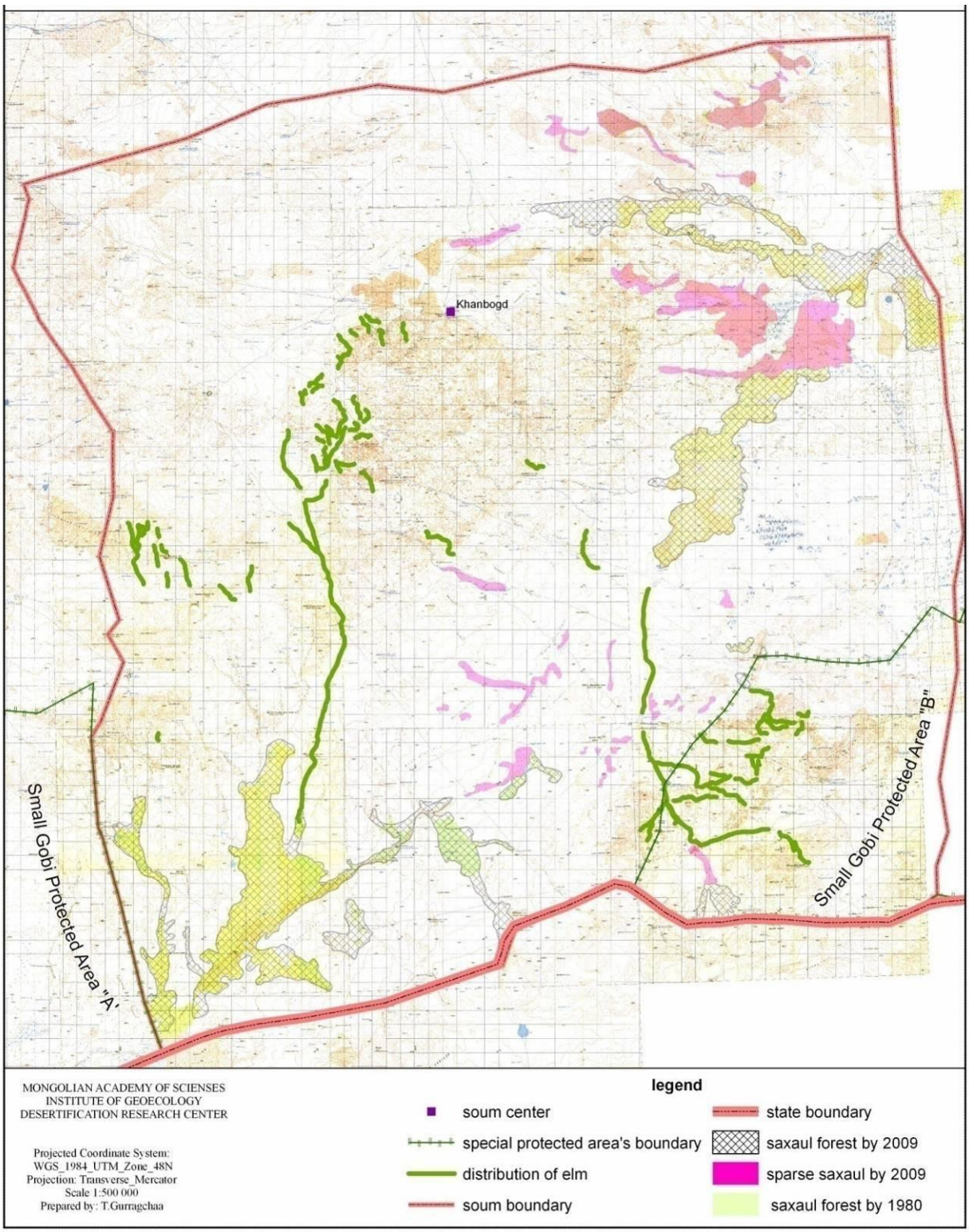

Figure 13: Distribution of elm trees and saxaul forest in 2009 (legend for saxaul forest in 1980 and 2009 may need transposing)

9.2 Migration routes and wintering grounds of Houbara Bustards

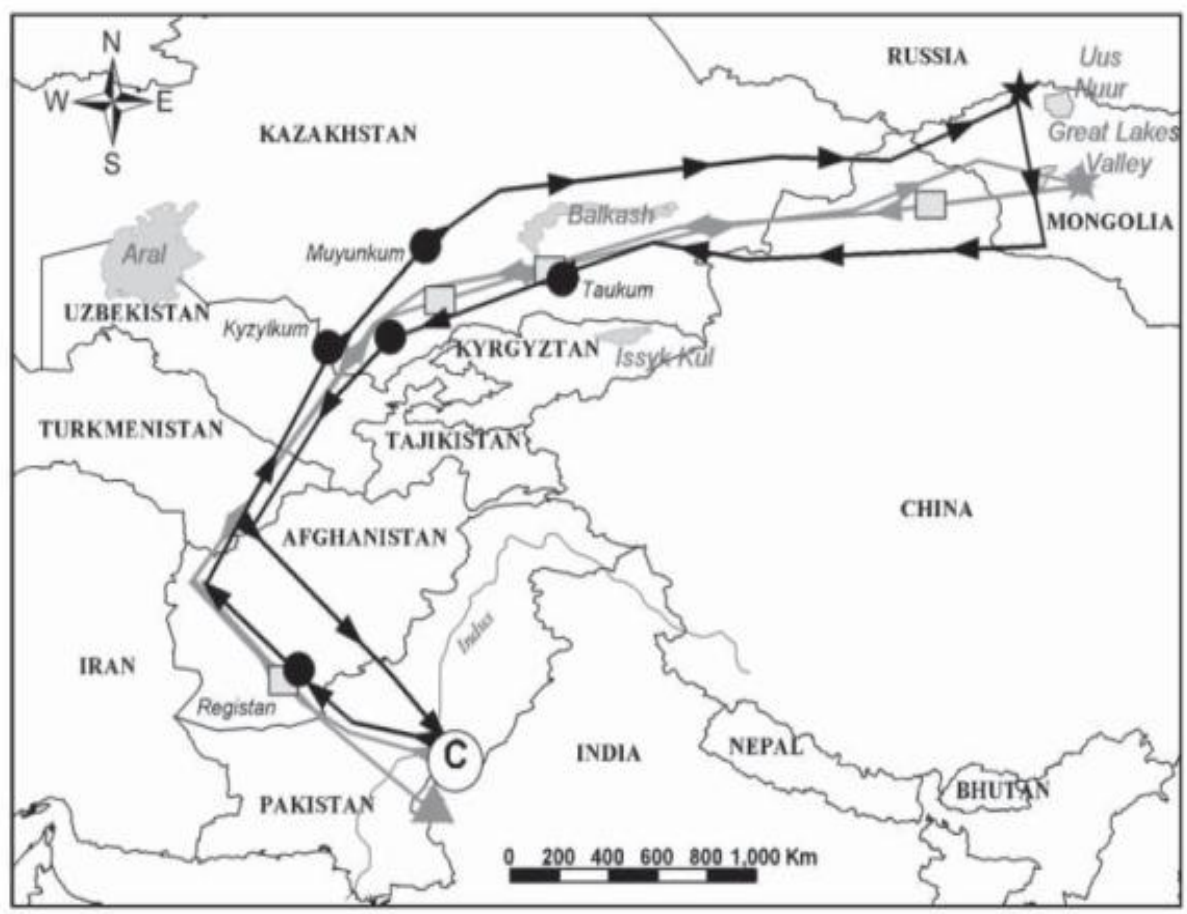

Figure 14: Migration routes of two Houbara Bustards, showing breeding sites (stars), long stop-overs (circles and squares) and wintering sites (©) (Tourenq et al. *2004)*

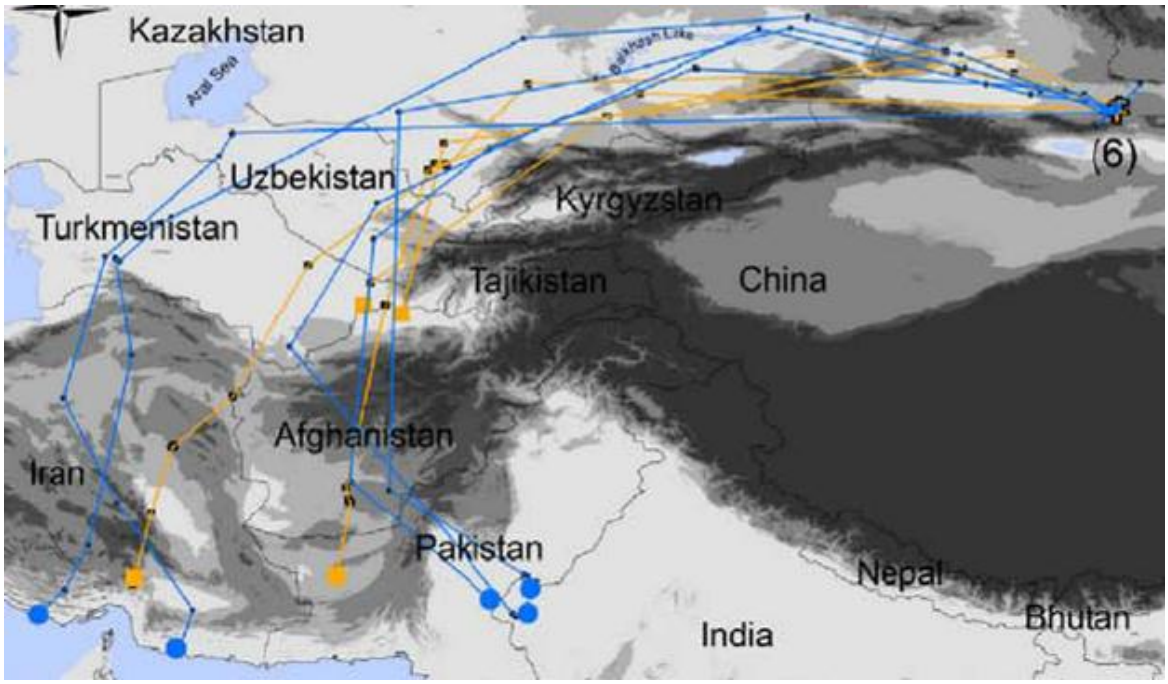

Figure 15: Migration routes of Houbara Bustards from the East Jungar Basin of Xinjiang, China. Males in orange, females in blue and altitude shaded (Combreau et al. *2011)*

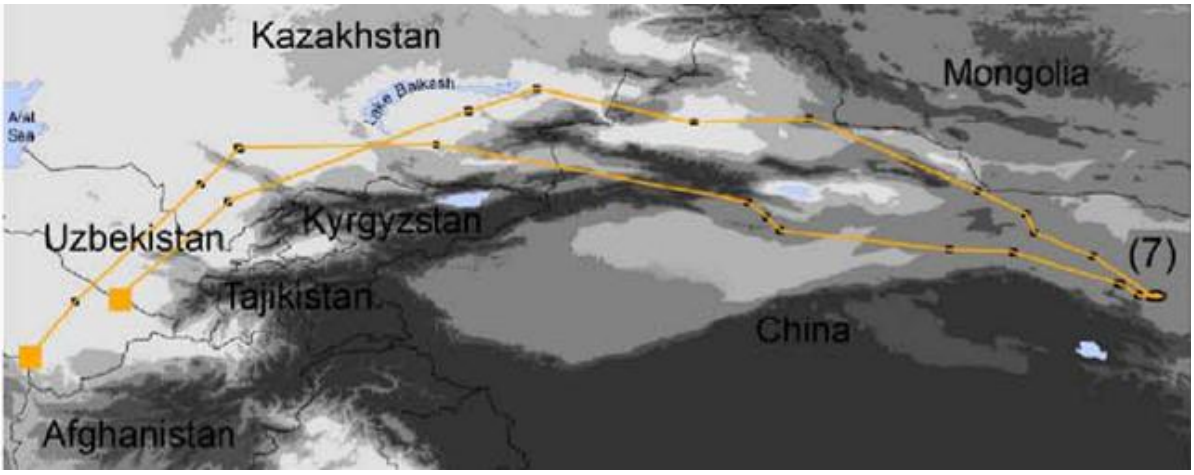

Figure 16: Migration routes of two male Houbara Bustards from the south-west Gobi of Gansu, China; altitude shaded (Combreau et al. *2011)*

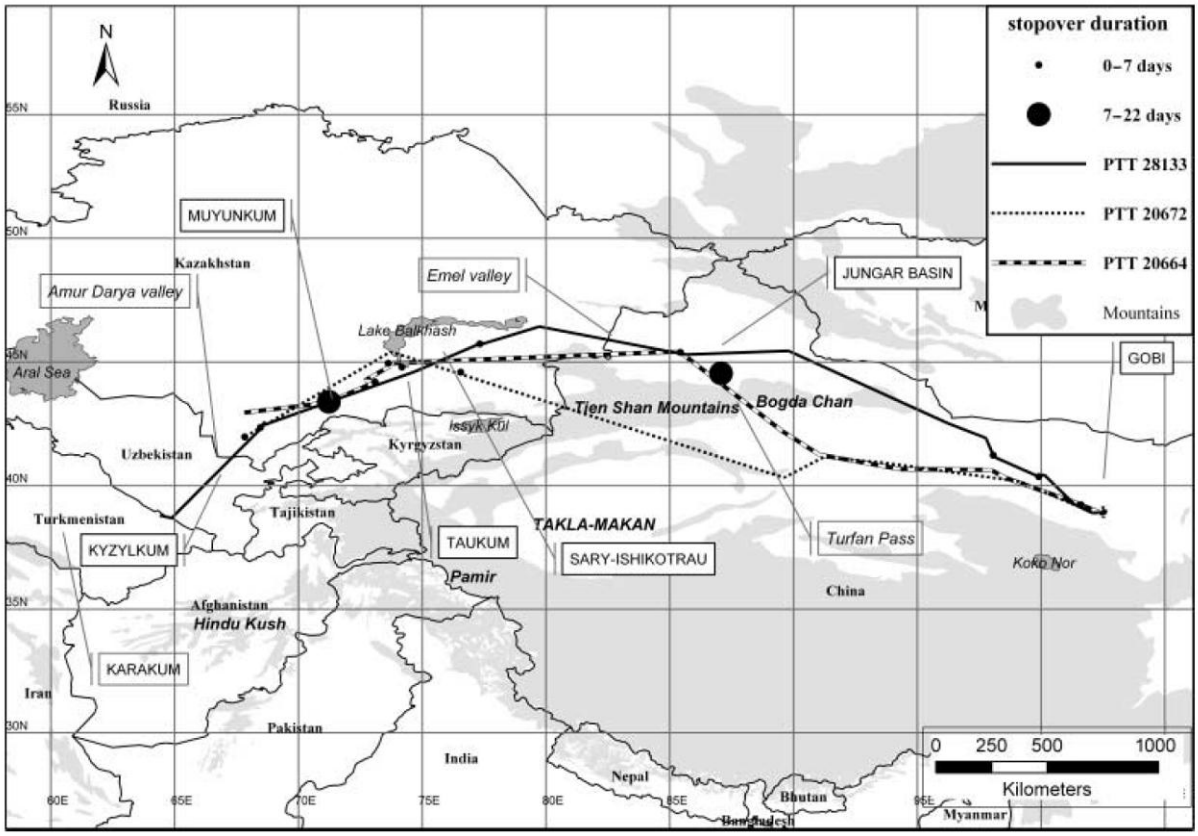

Figure 17: Migration routes of three male Houbara Bustards from the Gobi desert, China; altitude shaded (Judas et al. *2006)*

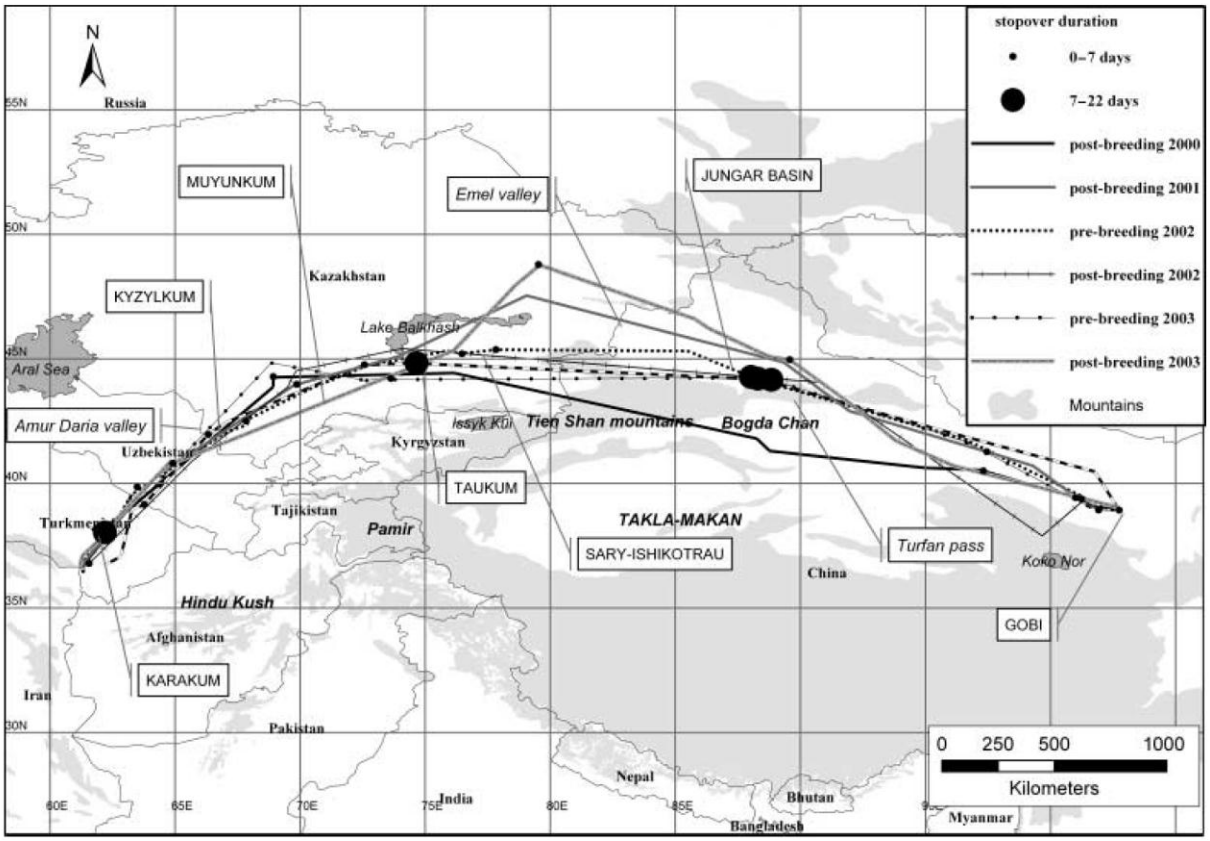

Figure 18: Migration routes of three male Houbara Bustards from the Gobi desert, China; altitude shaded (Judas et al. *2006)*

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Annex D: RBA Appendix 5: Net Positive Impact forecast for the Oyu Tolgoi Project

the biodiversity consultancy

FAUNA & FLORA INTERNATIONAL

ESIA Appendix 5

Net Positive Impact forecast for the Oyu Tolgoi project

May 2012

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This report has been written by:
The Biodiversity Consultancy Ltd and Fauna & Flora International, Cambridge, UK,
with contributions from Oyu Tolgoi LLC and the Wildlife Conservation Society

Contents

Summary

This appendix forecasts the theoretical and technical feasibility of the Oyu Tolgoi project achieving a Net Positive Impact (NPI) or No Net Loss (NNL) on biodiversity. Residual losses, which are the losses remaining after the mitigation hierarchy of avoid, minimise and restore has been followed, were estimated for each priority biodiversity value. Biodiversity gains at offset sites were estimated for each priority biodiversity value based on a proposed set of possible offset areas and activities as outlined in Appendix IV Offset Strategy. This does not imply that these offset areas and activities will be undertaken, but does show the approximate area and type of offsets needed to achieve NPI/NNL. Losses and gains were estimated using a metric of Quality Hectares (QH). These methods derive a scientifically defensible offsets ratio based on the gains and losses per hectare, *for each biodiversity value*, a more rigorous and tailored approach than the subjective selection of an overall offset ratio taken by some regulators and companies.

Direct habitat loss was quantified by overlaying infrastructure maps with habitat maps. Indirect habitat loss was based on estimated 'avoidance distances' for species which were predicted to avoid roads and other infrastructure (for example due to disturbance and hunting pressure). These were converted into QH by multiplying the area (ha) by a vegetation quality percentage of 90%. The baseline quality for hunted species was taken as 50% quality and the indirect impacts of illegal hunting was estimated reduce that to 25% quality within 100 km of the mine site (31,000 km^2). It was estimated that mitigation actions might reduce that by 50%, leading to an overall quality of 62.5%, and a loss of 62.5-50% x 31,000 km^2 or 392,000 QH. It is noted that these quality coefficients are estimates based on expert opinion itself based on extremely limited empirical evidence, and therefore require significant refinement as monitoring data becomes available.

Mortality losses due to powerlines and potential gains to offset these impacts were calculated separately: the residual impact for direct mortality from powerline collisions and electrocution was not estimated directly but as a relative value per km (y birds / km). This was used to calculate a length of offset powerlines (outside the project area) over which best-practice mitigation is needed to offset the residual loss (0.6y birds 'gained' / km based on assumption that mitigation prevents 60% of collisions, where 60% is the lower estimates of relevant published studies summarised in Jenkins *et al*. 2010).

Gains were estimated for each priority biodiversity value in 2036 (25 years from now), in QH for the main offset actions of improved rangeland management and control of illegal hunting. Biodiversity gains from rangeland management will be difficult to achieve for social, political, ecological and economic reasons. Therefore calculations were highly conservative for this offset activity in terms of the both the area over which herders are fully supportive and the potential gains per unit area. Hence it was conservatively estimated that rangeland habitat degradation could perhaps be reduced

by half of the increase in plant biomass achieved by the GTZ project (15%; Hess *et al.* 2010), equating to a 7.5% improvement in habitat quality. A conservative estimate is that this might be achieved across a tenth of the total surface area of the landscape. This is equivalent to an overall quality percentage improvement of just 0.75% across the whole offsets landscape. It was estimated that illegal hunting could perhaps be reduced across the proposed Principal Offsets Landscape (28,245 km^2) by a similar level to that achieved by the WWF 'MAPU' project (which experts suggested as 50% reduction in hunting across 75% of landscape). This is equivalent to an overall quality percentage improvement of 18.75% (50%x50%x75%) or 530 QH across the Principal Offsets Landscape.

It is noted that the predicted gains from improved rangeland management are much less than from reduced illegal hunting. There are however essential to generate gains for species and other features which are not hunted.

These are very approximate estimates based on inadequate baseline and lack of comparable data, and should only be used for enabling an order-of-magnitude estimate of NPI feasibility. It is recommended that the Oyu Tolgoi project completes further research to refine these figures, then measures these losses and gains in its ongoing monitoring work, and is precautionary in initiating offset actions across much larger areas than these calculations suggest.

The estimated gain of 0.75% in the habitat quality percentage would equate to an 'offset ratio' of 120x (baseline habitat quality of 0.9/0.0075). The estimated gain of 18.75% in illegal hunting quality percentage would equate to an 'offset ratio' of 2.7x (baseline illegal hunting level of 0.5/0.1875). Another approach would be to compare the area of habitat lost (90 km^2 direct loss and up to 1550 km^2 direct and indirect loss) to the area of the Principal Offset Landscape 28,245 km^2), which gives 'offset ratios' of about 300x and 20x. These could be compared to typical 'offset ratios' in wetter environments (where greater gains per unit area are ecologically feasible) of <10x.

The net positions (gains minus losses) suggest that it is theoretically possible, based on the proposed offset sites and activities, to achieve NPI for the majority of priority biodiversity features (Table 1). The exceptions are the two bustard species, Great Bustard and Houbara Bustard. Consequently additional bustard offsets may be required, such as elsewhere in Mongolia or even on the migratory route outside Mongolia, where they are threatened by hunting. However, as noted in the 'Conclusions and Recommendations' section, there is considerable uncertainty around these figures; until refined through targeted monitoring, they should be treated with caution. Given this uncertainty, the Oyu Tolgoi project should incorporate significant contingency into its offset design.

Table 1. Projected net position (gains minus losses) in 2036 for priority biodiversity features addressed by the offsets strategy (Quality Hectares)

Name	Direct & indirect habitat loss (1000 ha)	Quality of habitat lost (0-1; 1 being highest)	Loss from increased hunting (1000 QH)	Residual loss (1000 QH)	Gain from hunting control (1000 QH)	Gain from rangeland manage-ment (1000 QH)	Predicted overall offset gain (1000 QH)	Net position (1000 QH)	NPI / NNL ?
Mongolian Chesney[1]	9	0.9		8	0	21	21	13	Yes
Asiatic Wild Ass	155	0.5	392	470	530	21	551	59	Yes
Argali	30	0.5	392	407	530	21	551	122	Yes
Goitered Gazelle	130	0.5	392	458	530	21	551	72	Yes
Mongolian Gazelle	76	0.5	392	431	530	21	551	99	Yes
Swan Goose	0								Yes[2]
Ferruginous Duck	0								Yes[2]
Short-toed Snake-eagle	9	0.9		8	0	21	21	13	Yes[2]
Saker Falcon	9	0.9		8	0	21	21	13	Yes[2]
Egyptian Vulture	9	0.9		8	0	21	21	13	Yes[2]
Great Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Houbara Bustard	71	0.9		64	0	21	21	-43	No[2,3]
Relict Gull	0								Yes[2]
Pallas' Sandgrouse	9	0.9		8	0	21	21	13	Yes[2]
Yellow-breasted Bunting	9	0.9		8	0	21	21	13	Yes
Mongolian Ground-Jay	9	0.9		8	0	21	21	13	Yes
Granite Outcrop Floral Communities[4]	0			0	0	0	0	0	Yes
Riverine Elm Trees	0					+[5]	+[5]	+[5]	Yes[6]
Tall Saxaul Forest	+	?	-	+	+	+	+	+	Yes[7]
Eastern Gobi desert-steppe	5.5	0.9		5	0	9	9	4	Yes
Alashan Plateau semi-desert	3.5	0.9		3	0	12	12	9	Yes

[1] Assumed here to represent all 18 'very rare' plants known or predicted from the project area

[2] Assuming mitigation is put in place on all OT powerlines plus an additional >64km of non-OT powerlines

[3] Yes if there is an appropriate additional offset

[4] Even though these are not predicted to be impacted, they are included here since they are a Critical Habitat-qualifying biodiversity value in the area

[5] Offset gains in no. individuals rather than QH; offset gains depend on specific offset site

[6] Yes if the three translocated trees survive; offset gains depend on specific offset site

[7] Yes assuming adequate control of illegal collecting (not quantified)

What is an NPI forecast?

An NPI forecast is a projection of potential biodiversity losses and gains over a period of time in the future (25 years in this case, i.e. 2011-2036), based on current knowledge regarding Oyu Tolgoi project impacts, potential offset activities, characteristics of priority biodiversity features, and background rates of biodiversity loss and threat in the region.

The main purpose of this NPI forecast is to provide an order-of-magnitude answer to the question: '***is it theoretically feasible to achieve a net positive impact on biodiversity, and to meet the requirements of IFC PS6/EBRD PR6 Critical Habitat clauses, at Oyu Tolgoi?'*** In addition, it aims to:

- Provide information to assist with the selection of offset sites and activities, and to determine the appropriate scale of such activities
- Identify data gaps, and outline the additional information needed to be able to carry out a more precise forecast

This is the first attempt to carry out an NPI forecast for Oyu Tolgoi, and several important caveats should be kept in mind. First – this is a *forecast* – it attempts to predict what will happen over the coming years and decades, but it does not guarantee that these things will happen. Importantly it outlines what is theoretically possible; as yet no political consultation on feasibility has been undertaken with Mongolian experts, government and other stakeholders. Second, the calculations presented here are based on a number of assumptions and on supporting information of variable, and often inadequate, quality and quantity. There is very significant uncertainty around a number of key parameters – these are noted in the 'Methods' section (and related Appendices). Third, and perhaps most importantly, although this NPI forecast quantifies Oyu Tolgoi project impacts (including direct, indirect and induced impacts) in a fairly comprehensive way, it does not include (e.g. formally quantify) cumulative impacts from the number of other developments proposed and underway in the region, although some of these are considered in a qualitative way in the 'Results' and 'Conclusions and Recommendations' sections.

Which biodiversity features are included?

Priority biodiversity features included in the NPI forecast include (1) all priority species and ecosystems (i.e., not ecosystem services) for which the area qualifies as Critical Habitat under IFC PS6/EBRD PR6, as well as (2) species and habitats defined as appropriate for inclusion in NPI accounting by Rio Tinto internal guidance. These priority biodiversity features are listed in Table 2, and more details regarding the criteria by which they were selected can be found Appendix 2 Critical Habitat assessment.

Table 2: Biodiversity features included in NPI accounting.

Taxonomic group	Biodiversity feature	Scientific name	Critical Habitat	IUCN Red List status	National Red List status	Status in unit of analysis
Plant (herb)	Mongolian Chesney[1]	*Chesneya/Chesniella mongolica*	Tier 2	-	EN?	Patchily distributed throughout
Mammal (ungulate)	Asiatic Wild Ass	*Equus hemionus*	Tier 1	EN	EN	Nomadic 'resident'
Mammal (ungulate)	Argali	*Ovis ammon*	Tier 2	NT	EN	Localised resident
Mammal (ungulate)	Goitered Gazelle	*Gazella subgutturosa*	Tier 2	VU	VU	Migratory 'resident'
Mammal (ungulate)	Mongolian Gazelle	*Procapra gutturosa*	-	LC	EN	Rare visitor from the east
Migratory Bird	Swan Goose	*Anser cygnoides*	-	VU	NT	Likely a regular migrant over the area
Migratory Bird	Ferruginous Duck	*Aythya nyroca*	-	LC	VU	Likely a regular migrant over the area
Bird	Short-toed Snake-eagle	*Circaetus gallicus*	Tier 2	LC	EN	Breeds
Bird	Saker Falcon	*Falco cherrug*	-	VU	VU	Breeds
Bird	Egyptian Vulture	*Neophron percnopterus*	-	EN	LC	Probably breeds
Migratory Bird	Great Bustard	*Otis tarda*	-	VU	VU	Regular migrant (stops over in the area)
Bird	Houbara Bustard	*Chlamydotis undulata*	-	VU	VU	Breeds
Migratory Bird	Relict Gull	*Larus relictus*	-	VU	EN	Likely a rare migrant over the area
Bird	Pallas' Sandgrouse	*Syrrhaptes paradoxus*	-	LC	LC	Breeds
Bird	Mongolian Ground-jay	*Podoces hendersoni*	-	LC	VU	Breeds
Migratory Bird	Yellow-breasted Bunting	*Emberiza aureola*	-	VU	NT	Likely a regular migrant
Habitat	Granite Outcrop Floral Communities	n/a	-	n/a	n/a	Near Khanbogd
Habitat	Riverine Elm Trees	n/a	-	n/a	n/a	Mostly in Undai riverbed
Habitat	Tall Saxaul Forest	n/a	-	n/a	n/a	Mostly in borefield and depressions
Habitat	Eastern Gobi desert-steppe	n/a	-	n/a	n/a	Major habitat type in the region - widespread
Habitat	Alashan Plateau semi-desert	n/a	-	n/a	n/a	Major habitat type in the region - widespread

CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; NE = Not Evaluated

A number of species believed by expert opinion to not occur in the relevant units of analysis have been excluded. Additionally, species and ecosystems that occur marginally in the units of analysis and are not believed to be impacted by the project (Ephemeral Lakes and Pools, Snow Leopard, Long-eared Jerboa and Mongolian Accentor) have been excluded. 'Granite outcrop floral communities' are not predicted to be impacted, but are a Critical Habitat-qualifying feature and – owing to stakeholder concerns – are thus

[1] An umbrella species for 18 poorly known possibly threatened plants which may possibly occur in the project area. These are all considered, on present knowledge, to have similar impacts and mitigation/offset measures and so are represented here by this one species.

precautionarily included in the offsets strategy. Other plants listed as Very Rare in the national *Law on Natural Plants* may occur in the Oyu Tolgoi project area, but are considered to be sufficiently represented here by Mongolian Chesney (cf. discussion in Appendix 3 *Biodiversity Impacts and Mitigation Actions* 3.3).

Which impacts are included?

Impacts were included in the NPI forecast calculations if they were considered significant and certain or relatively likely to occur. The main impact types included were:

- Direct habitat loss
- Indirect habitat loss (due to avoidance of infrastructure by animals)
- Direct mortality (from collision with vehicles and from collision with, and electrocution by, power lines)
- Indirect mortality (from increased hunting and collecting facilitated by increased numbers of people in the area and by increased access)

Losses resulting from all of these impact types were quantified. However, the project also has a number of possible impacts that are understood to be of low likelihood but potentially very high consequence to biodiversity. These include hydrological risks such as those outlined in Appendix 3 Biodiversity Impacts. These low likelihood/high consequence risks are considered in a qualitative way in the 'Results' and 'Conclusions and Recommendations' sections but are not formally included in the NPI forecast calculations.

A detailed consideration of project risks and impacts on the priority biodiversity features can be found in Appendix 3 Biodiversity Impacts.

Which offset sites are considered for the purposes of this NPI forecast?

The Oyu Tolgoi project is in the process of selecting appropriate offset sites; further details of the site screening process are given in Appendix 4 Offsets Strategy. However, for the purposes of carrying out this NPI forecast it was necessary to select a particular set of sites in order to calculate the magnitude of potential biodiversity gains, and to determine whether or not NPI is theoretically achievable based on offsets of the scale currently being considered. It should be noted that this does not imply that this particular set of sites is recommended over any other site or combination of sites, nor that any stakeholder discussion has yet taken place on the feasibility or appropriateness of these sites. Recommendations on site selection and the criteria upon which this should be based are given in Appendix 4 Offsets Strategy.

Calculations of gains were carried out based on the assumption that the following sites would be taken forward as offsets:

- Bayan-Ovoo soum (excluding the SPA)
- Khatanbulag soum (excluding the SPA)
- Khuvsgul soum

The Small Gobi (A and B) SPAs were excluded from offset gain calculations because many stakeholders consider that existing protected areas cannot be considered as offsets because they do not meet additionality criteria (although this is not a universally held view). Nonetheless, it is noted that the Oyu Tolgoi project is committed to carrying out conservation actions in the Small Gobi SPA (most of which are likely to be similar to those outlined for offsets here) and that to some extent this provides a 'contingency' for offsets.

Main offset activities to achieve NPI

The main offset actions that could be employed to achieve a Net Positive Impact on priority biodiversity features are:

- Control of illegal hunting and collecting
- Improved rangeland management
- Infrastructure mitigation

These offset actions cover most of the threats to priority biodiversity features. Sheehy *et al*. (2010) note that Asiatic Wild Ass (and presumably other priority biodiversity features) are also threatened by habitat change, which is driven largely by climate change and is impracticable to address at a local level. The residual impacts and key actions for each feature are summarised in Table 3. Further details of these offset activities are given in Appendix 4 Offsets Strategy.

Table 3: Residual impacts and key actions required for each relevant priority biodiversity value

Priority biodiversity feature	Key residual impacts	Key offset actions
Eastern Gobi desert-steppe	Habitat loss	Improve rangeland management
Alashan Plateau semi-desert	Habitat loss	Improve rangeland management
Mongolian Chesney	Habitat loss	Improve rangeland management
Asiatic Wild Ass	Increased mortality from hunting; habitat loss	Control illegal hunting; infrastructure mitigation; rangeland management
Argali	Increased mortality from hunting; habitat loss	Control illegal hunting; rangeland management
Goitered Gazelle	Increased mortality from hunting; habitat loss	Control illegal hunting; infrastructure mitigation; rangeland management
Mongolian Gazelle	Increased mortality from hunting; habitat loss	Control illegal hunting; infrastructure mitigation; rangeland management
Swan Goose	Increased mortality from collisions	Infrastructure mitigation
Ferruginous Duck	Increased mortality from collisions	Infrastructure mitigation
Short-toed Snake-eagle	Habitat loss; increased mortality from electrocutions	Rangeland management; infrastructure mitigation
Saker Falcon	Increased mortality from collecting and electrocutions; habitat loss	Control illegal hunting; infrastructure mitigation; rangeland management
Egyptian Vulture	Habitat loss; increased mortality from electrocutions	Rangeland management; infrastructure mitigation
Great Bustard	Increased mortality from hunting and collisions; habitat loss	Rangeland management; control illegal hunting; infrastructure mitigation
Houbara Bustard	Habitat loss; increased mortality from hunting and collisions	Rangeland management; control illegal hunting; infrastructure mitigation
Relict Gull	Increased mortality from collisions	Infrastructure mitigation
Pallas' Sandgrouse	Habitat loss; increased mortality from collisions	Infrastructure mitigation
Mongolian Ground-Jay	Habitat loss	Rangeland management
Yellow-breasted Bunting	Habitat loss	Rangeland management
Granite Outcrop Floral Communities	None	n/a
Riverine Elm Trees	Habitat loss; increased collecting	Rangeland management; collecting control
Tall Saxaul Forest	Habitat loss; increased collecting	Rangeland management; collecting control

Methods

1.1 General methods

The Net Positive Impact forecast for biodiversity at Oyu Tolgoi was carried out according to the following steps, as recommended in Rio Tinto's internal guidance on biodiversity accounting:

1. Select which biodiversity features to include in NPI accounting
2. Select a metric or metrics
3. Decide over which time period to measure losses and gains
4. Quantify residual losses once the mitigation hierarchy has been followed
5. Quantify gains generated through offsets
6. Determine whether Net Positive Impact may be achieved

1. Select which biodiversity to include in NPI accounting

- Biodiversity is complex - it is not possible to quantify all of its aspects.
- Consequently it is necessary to select which biodiversity features to measure. This should be done based on clear and consistent criteria, with stakeholder input where necessary.
- The selected features should be good 'surrogates' - they should capture a wide range of the biodiversity values at a site, including any biodiversity regarded as a conservation priority.
- Typically it is appropriate to measures losses and gains in *habitats* and *priority species*, using globally-accepted methods (e.g. IUCN Red List) to determine priority.

2. Select a metric or metrics

- There is no single globally-accepted metric for measuring losses and gains in biodiversity, in contrast to carbon offsetting, where Carbon Dioxide Equivalents (CDE) provide a globally consistent metric. This presents a challenge for measuring Net Positive Impact.
- The best choice of metric will depend in part on the biodiversity features selected in Step 1. For example, losses and gains of habitat may be measured in hectares, losses and gains of a priority species may be measured in number of individuals.
- The most commonly-used metrics globally are based on *extent and condition (or quality) of habitat*. Rio Tinto's Quality Hectares metric follows this model.
- Condition (or quality) can be measured in many different ways; the appropriate choice depends on the context. There are a number of well-established methods for measuring condition.

3. Decide which time period over which to measure losses and gains

- *Retrospective no net loss analysis* - measuring losses and gains from a point in the past (e.g. date of establishment of a company, site or project) to the present date, to determine whether no net loss has been achieved.
- *No net loss forecast* - forecasting losses and gains from the present date to a point in the future (e.g. project closure, or a stakeholder- or regulator-imposed deadline), for example to determine whether planned mitigation and offset measures are sufficient to deliver no net loss.

4. Quantify residual losses once the mitigation hierarchy has been followed

- Following the mitigation hierarchy means that a company ahould first avoid and minimise impacts wherever possible. Post-impact, biodiversity should be rehabilitated and restored. Offsets should be used to compensate for the residual impacts.
- In practice, because restoration and rehabilitation often happens many years in the future whereas offsets need to be implemented immediately, it is necessary to forecast the gains that can reasonable be achieved through restoration and rehabilitation in order to determine the size of offset required.
- To measure the full impact of a project, indirect/secondary impacts should be considered as well as direct impacts. However, these are often difficult to quantify.

5. Quantify gains generated through offsets

- Measurable gains can be generated by improving the *quality* of biodiversity and / or by increasing the *quantity* of biodiversity in relative or absolute terms (e.g. stopping deforestation in an area where there would otherwise have been rapid loss, or creating a species-rich wetland on intensive arable farmland).

6. Determine whether no net loss has been achieved

- No net loss is achieved when gains from offsets outweigh residual losses (after the mitigation hierarchy has been followed).
- Third-party verification (e.g. through an appropriate stakeholder process) is desirable.

As discussed in Section 2 above, biodiversity features included in the NPI forecast include (1) all priority species and ecosystems for which the area qualifies as Critical Habitat under IFC PS6/EBRD PR6, as well as (2) species and habitats defined as appropriate for inclusion in NPI accounting by Rio Tinto internal guidance, and are listed in Table 2. The main metric used was Quality Hectares (QH)[2]. Additionally, for certain features, losses and gains were quantified in number of individuals, or in the case of mortality from electrocution/collision with powerlines, using a bespoke method that is described fully in the sections below. The time period selected was 25 years, i.e. 2011-2036. Rio Tinto business units located in 'Very High' or 'High' biodiversity value contexts should at a minimum meet Net Positive Impact by closure, and should aim to be NPI positive as early in mine life as possible and ideally throughout operations (Rio Tinto unpubl. memo. 2011). Consequently 25 years was seen as an appropriate time period for NPI forecasting, as Oyu Tolgoi is a long-term project, and offset planning should take a long-term perspective, but forecasting losses and gains over periods longer than a few decades involves very significant uncertainty. Steps 4, 5 and 6 (quantify losses and gains and determine whether or not NPI may be achieved) are described below.

1.2 Estimating biodiversity losses

Losses resulting from the following impact types were quantified following the approach described below:

- Direct habitat loss
- Indirect habitat loss (due to avoidance of infrastructure by animals)
- Direct mortality (from collision with, and electrocution by, power lines)
- Indirect mortality (from increased hunting facilitated by increased numbers of people in the area and by increased access)

Direct habitat loss was quantified for all priority biodiversity features by overlaying infrastructure maps (e.g. mine site, road, airport, borefield/pipeline) with habitat maps. For most priority species, impacts due to direct habitat loss were initially calculated in hectares assuming that the species occurs at even densities throughout the habitat type(s) from which it is known. A next step would be to adjust these losses (and gains) based on distribution maps from national red list assessments. One feature for which this assumption may be particularly problematic is the Mongolian Chesney (and other threatened plants) – very little is known about the ecology and distribution of this species within the study area, and it is possible that this species is patchily distributed

[2] Quality Hectares are Rio Tinto's standard metric for tracking progress towards the NPI target at the global and site level. A wide range of biodiversity values, including threatened species, rare habitats or non-timber forest products, may be expressed in terms of their quantity and quality. This is expressed as an "Area x Quality" metric, referred to here as Quality Hectares (QH). For example, 100 hectares of forest in pristine condition would count as 100 Quality Hectares (100 ha x 100% quality = 100 QH), whereas 100 hectares of fairly degraded forest at 40% 'optimum quality' would be expressed as 40 Quality Hectares (100 ha x 40% quality = 40 QH).

and over-represented in the areas of direct impact (cf Appendix 3 Biodiversity Impacts). For one priority feature, Riverine Elm Trees, losses were calculated in terms of number of individuals.

Indirect habitat loss was estimated for a subset of the priority features (i.e. large mammals and certain bird species that exhibit behaviour of avoiding roads and other infrastructure, owing to the fact that they are hunted by humans). Avoidance distances were derived from the literature and from expert consultation[3].

The residual impact and offset requirement for direct mortality from powerline collisions and electrocution was estimated as follows: On a precautionary basis, it was assumed that if best-practice mitigation is implemented, bird strikes can be reduced by 60% (lower estimates of relevant published studies summarised in Jenkins *et al*. 2010). Given impacts of 'y' per km, and a 95 km-long transmission line, this means residual impacts are reduced to 95*0.4*y = 38y. To offset these impacts requires similar mitigation to be put in place over another, previously unmitigated, length of power line of 'z' km in the range of these priority biodiversity features such that z*0.6*y=38y, i.e. z=38/0.6[4], thus mitigation over an additional 64 km.

To convert losses calculated in hectares into Quality Hectares, two different methods were used, depending on what the key determinant of habitat quality was for the particular biodiversity feature in question. For the majority of priority features (e.g. habitat types, birds, reptiles, plants), habitat quality was estimated based on vegetation condition, i.e. degree of degradation (mainly caused by grazing pressure). Vegetation condition was assessed in five categories (very good, good, moderate, poor, very poor) based on Oyu Tolgoi reports and other literature, and 'quality percentages' were derived as shown in Table 4. Vegetation in areas selected was precautionarily assessed to currently be in very good condition; there is relatively little information available, and that which is available is conflicting, so it was most appropriate to take a precautionary approach.

Table 4: Quality multipliers for vegetation condition

[3] Many priority biodiversity features are predicted to avoid areas close to project infrastructure and activities. Such avoidance is not complete and total: for example, avoidance may be 100% within several metres of a road, 50% within 500 m, 25% within 1 km, etc. Avoidance distances depend on factors such as noise, dust, local topography and vegetation, and hunting pressure. At the Oyu Tolgoi project site, background hunting pressure is the strongest driver of avoidance, especially for Asiatic Wild Ass and other ungulates avoiding vehicles and people. Avoidance distances are likely to be higher during construction, when noise and dust pollution will be greatest, and animals have not yet habituated to the infrastructure. Some data on avoidance distances may be possible to obtain empirically (e.g. by aerial surveys) and monitoring. For example, Asiatic Wild Ass in the southern Gobi region are estimated to avoid areas within 5 km of vehicles (P. Kaczensky *in litt.* 2011). However, given likely habituation to static infrastructure, it has been necessary to infer and extrapolate avoidance distances. For example, impacts have been demonstrated up to 1,600 m for Great Bustard (Lane *et al.* 2001; López-Jamar 2010; Raab 2011) and Reindeer have shown reduced population effects up to 17 km from similar infrastructure where historically hunted (Benítez-López *et al.* 2009). Provisional estimates of avoidance distances are given in Appendix 3 Biodiversity Impacts section II.2.

[4] Rounded up to the nearest km.

Vegetation condition	% of 'optimal quality'	Quality Percentage
Very good	80-100%	90%
Good	60-80%	70%
Moderate	40-60%	50%
Poor	20-40%	30%
Very poor	0-20%	10%

For large mammals, the key determinant of habitat condition is hunting pressure[5]. In a similar way, this was estimated in five categories (Very High, High, Medium, Low, Negligible) and quality percentages were derived. Current habitat quality for large mammals was estimated to be moderate (quality percentage of 50%); this is based on scant data and better information is needed.

Indirect mortality from increased hunting facilitated by increased numbers of people in the area and by increased access was estimated as follows: It was estimated that the unmitigated impact of a project of the scale of Oyu Tolgoi would be that the hunting rate doubles within a 100 km radius of growth pole (equivalent to a reduction in habitat quality from 50% to 25%, assuming a linear relationship between hunting pressure and the quality percentage across 31,000 km^2). The resulting loss would be c.785,000 QH for each of the priority hunted mammals. It was further assumed that the project would put best-practice mitigation in place to minimise secondary impacts such as increased hunting, but that this would only be partially successful (it was estimated that mitigation would be 50% successful, hence a quality percentage of 25% + 50%x75% = 62.5%). Consequently the loss from indirect mortality from increased hunting was estimated at c.392,500 QH (62.5%-50% x31,000 km^2). This estimate is essentially based on expert opinion and educated guesswork rather than empirical evidence - better information from field studies is needed to provide a more secure estimate in future. This is particularly necessary given that these kind of impacts are potentially the largest in magnitude of all the project's impacts on priority mammal species.

1.3 Counter-factual situation

To be precautionary, losses and offsets gains were estimated against a static baseline, meaning that there is assumed to be no acceleration in development in the southern Gobi region and concomitant increased impacts on biodiversity. An alternative counterfactual situation of greatly accelerated growth related to additional mines (although acknowledged by the project to be more realistic) was not used as this would be difficult to quantify, assume ineffective mitigation and be non-precautionary. Furthermore, there is experience that stakeholders are unlikely to accept large background rates of loss as the baseline against which losses and gains are measured (Temple *et al.* 2011). An estimate of predicted future growth could be factored into the NPI forecast based on the best opinion of regional planning experts. The project's success in addressing cumulative regional impacts would need to be factored into this estimate. The current assumption of no accelerated impacts is therefore precautionary but subject to revision.

[5] And disturbance (increased avoidance of humans and infrastructure), which is a problem because of hunting pressure.

1.4 Projecting possible biodiversity gains

The main offset actions that would be employed to achieve a Net Positive Impact on priority biodiversity features include the following:

- Control of illegal hunting
- Improved rangeland management
- Infrastructure mitigation (reducing collision with, and electrocution by, power lines)

The predicted offset gains need to be estimated in order to make a forecast for achieving Net Positive Impact. Gains are measured in the same units as losses, and are largely a product of offset area and incremental improvement in quality (hunting, rangeland and infrastructure).

The key parameters enabling quantification of quality improvements are:

- By what percentage can the Oyu Tolgoi project decrease the rate of illegal hunting?
- By what percentage can the Oyu Tolgoi project reduce the degree of habitat degradation?

As indicated in the previous sections on offset actions, these parameters are very poorly-known and require much more research. However, it is important to indicate their likely scale in order to assess the feasibility of achieving Net Positive Impact. The overall rate of illegal hunting could perhaps be reduced by a similar level to that achieved by the WWF 'MAPU' project. The impact of this project on the baseline rate of hunting has not been quantified but the reviewers concluded that "illegal hunting has strongly declined" (Breitenmoser *et al.* 2006). For the purpose of enabling an order-of-magnitude estimate of Net Positive Impact feasibility, this report solicited expert opinion and precautionarily suggests that an appropriate offset action could achieve a 50% improvement in illegal hunting over 75% of the area in which it worked (i.e. hunting would be reduced to 50% x 75% of 2011 levels). In practice, a 'strong decline' might turn out to be greater in magnitude than this precautionary estimate, but for the purposes of offset planning it is appropriate to be cautious. An alternative guesstimate is that effective control of illegal hunting would allow the populations of Asiatic Wild Ass and similar species to increase by c.10% / year (D. Sheehy *in litt.* 2011).

Quantified reviews are unavailable for any projects that have aimed to improve rangeland management, except for the GTZ project which had a primary aim of improving herder income but also included improvement of rangeland management as an action. This achieved c.15% relative increase in plant biomass (Hess *et al.* 2010). However, herders in the offset areas may be less interested in participating in a project whose primary aim is wild animal conservation. Offset actions could be undertaken over a relatively small area at a similarly intense rate to the GTZ project, or over similar areas to the control of illegal hunting but at a lesser intensity than the GTZ project. For the purpose of enabling an order-of-magnitude estimate of Net Positive Impact feasibility, this report suggests that an appropriate offset action could achieve a 15% improvement in plant biomass, which might equate to a 7.5% improvement in habitat quality.

These figures are very approximate estimates based on very inadequate baseline and comparable data, and should not be used as anything other than the purpose of enabling an order-of-magnitude estimate of Net Positive Impact feasibility. Further research into improving the accuracy of these estimates is needed. It is also recommended that the project is precautionary in initiating actions across much larger areas than calculations may suggest, and invests in accurate measurements of baselines and offset gains which will enable much more accurate estimates. It is also noted that the final outcome should be measured in gains in population size of priority biodiversity features, in addition to the rate of illegal hunting or rangeland improvement.

1.4.1 Gains from the control of illegal hunting

Potential gains from the control of illegal hunting were projected for the priority large mammal species, assuming that offset actions would be implemented throughout the offset area[6]. As detailed above, it was assumed that the hunting rate could be reduced to 50% of 2011 levels across 75% of the landscape; assuming a linear relationship between hunting rate and quality percentage this would be equivalent to an improvement in habitat quality from 50% to 68.75% (= no change (50% quality) in 25% area + doubled quality (75%) in 75% area) or an overall gain of 18.75% (50% gain x50% quality x75% area) Details of the kind of activities that would need to be put in place to achieve this are given in Appendix 4 Offset Strategy.

1.4.2 Gains from improved rangeland management

Potential gains from improved rangeland management were projected for all non-mammal priority features (with the exception of Riverine Elm Trees, Granite Outcrop Floral Communities and Tall Saxaul Forest, to which this management is not specifically targeted, though it may have some benefits). It was assumed that an improvement of quality of 7.5% could be achieved in the areas of focused management intervention (assumed to be 10% of the total offset area for the purposes of these calculations[7]; this is a precautionary assumption made on the grounds that the total offset area considered for the purposes of this NPI forecast is very large and it may not be feasible to successfully implement improved rangeland management across this whole very large area rangeland). Details of the kind of activities that would need to be put in place to achieve this are given in Appendix 4 Offset Strategy. It should be noted that measuring and monitoring success will be challenging in the non-equilibrium ecosystems found in the project area and offset sites.

1.4.3 Gains from infrastructure mitigation

The method for calculating residual impact and offset requirement for direct mortality from powerline collisions and electrocution was given in the previous section. Details of

[6] Calculated here based on the area of Bayan-Ovoo soum (excluding the SPA), Khatanbulag soum (excluding the SPA) and Khuvsgul soum; this does not imply that these areas have been selected as offset sites, the purpose of the calculation is simply to determine whether offsets of sufficient scale and appropriate type are available to be able to potentially meet NPI.

[7] Calculated here based on the area of Bayan-Ovoo soum (excluding the SPA), Khatanbulag soum (excluding the SPA) and Khuvsgul soum; this does not imply that these areas have been selected as offset sites, the purpose of the calculation is simply to determine whether offsets of sufficient scale and appropriate type are available to be able to potentially meet NPI.

the kind of activities that would need to be put in place are given in Appendix 4 Offset Strategy.

Feature-specific actions may be necessary for some priority features such as Riverine Elm Trees. Three individuals were under the project's direct footprint and have been translocated; the NPI forecast assumes that this translocation is successful and, if not, that any residual loss is compensated for by propagating trees in the OT nursery and planting them out with appropriate medium-term care to ensure successful establishment. Details of other gains from feature-specific activities are given in the Appendices.

Results

The results of the NPI forecast suggest that, based on an offset programme including the sites and activities detailed above and in Appendix 4 Offsets Stratgey, it may be theoretically possible to achieve NPI on the majority of priority biodiversity features (Table 5). The exceptions are Great Bustard and Houbara Bustard. Consequently additional bustard offsets may be required outside Mongolia (e.g. on migratory route, where the species are threatened by hunting). However, as noted in the 'Conclusions and Recommendations' section, there is considerable uncertainty around these figures, and they should be treated with caution. For example, it is possible that the net impact would be negative rather than positive, even if all of the offset measures recommended in 'Potential offset sites and actions for the Oyu Tolgoi project' are implemented.

Table 5. Projected net position (i.e. losses plus gains) in 2036 for relevant priority biodiversity features

Name	Net position (QH) excluding secondary impacts (increased hunting)	Net position (QH) for priority mammals including secondary impacts (increased hunting)	Is NPI forecast to be achieved for this feature?
Mongolian Chesney	13,000		Yes
Asiatic Wild Ass	452,000	59,000	Yes
Argali	515,000	122,000	Yes
Goitered Gazelle	465,000	72,000	Yes
Mongolian Gazelle	491,000	99,000	Yes
Swan Goose			Yes[1]
Ferruginous Duck			Yes[1]
Short-toed Snake-eagle	13,000		Yes[1]
Saker Falcon	13,000		Yes[1]
Egyptian Vulture	13,000		Yes[1]
Great Bustard	-43,000		No[1,2]
Houbara Bustard	-43,000		No[1,2]
Relict Gull			Yes[1]
Pallas' Sandgrouse	13,000		Yes[1]
Yellow-breasted Bunting	13,000		Yes
Mongolian Ground-Jay	13,000		Yes
Riverine Elm Trees			Yes
Granite Outcrop Floral Communities	0		Yes (NNL)
Tall Saxaul Forest	0		Yes
Eastern Gobi desert-steppe	4,000		Yes
Alashan Plateau semi-desert	9,000		Yes

[1] Assuming mitigation is put in place on all OT powerlines plus an additional >64km of non-OT powerlines

[2] Yes if there is an appropriate additional offset

Detailed results are presented in the Appendices. Note that there will be a time lag during which the project is NPI negative because losses will occur immediately (indeed some significant impacts have already occurred) whereas gains in a number of features may take some years to accrue. Consequently offset actions should be implemented as soon as possible in order to minimise this period of temporal loss, which may be significant for the viability of some priority features (e.g. threatened species).

Conclusions and recommendations

This section starts by setting out a number of key caveats that should be born in mind when interpreting this NPI forecast.

First, this NPI forecast quantifies Oyu Tolgoi project impacts (including direct, indirect and induced impacts) in a fairly comprehensive way, but it does not include (e.g. formally quantify) cumulative impacts from the number of other developments proposed and underway in the region. This approach is in line with the requirements of Rio Tinto's biodiversity policy and IFC/EBRD, which require operations to offset their own impacts, keeping in mind the broader regional context (including cumulative impacts) when considering offset viability. However, particularly in the case of the southern Gobi region, there is a significant risk that even if the Oyu Tolgoi project does the 'right thing', following the mitigation hierarchy and implementing mitigation and offset activities of a type and scale commensurate with project impacts, Net Positive Impact may not be achieved. In other words, there is a significant risk that mitigation and offset activities may fail owing to the actions of others that are outside Oyu Tolgoi's control. This presents a reputational risk to OT, Rio Tinto, and its lenders. A resultant recommendation is that Oyu Tolgoi and its lenders should consider how they can use their influence to drive improved biodiversity performance for other non-Rio businesses (and across all sectors, including both private and public) in the region.

Second, the project has a number of uncertainties that are understood to be of low likelihood but potentially very high consequence to biodiversity, including hydrological impacts such as those outlined in the summary and full Biodiversity Management Plans. These low likelihood/high consequence risks are not appropriate for inclusion in the NPI forecast calculations. Moreover, little information is available to be able to quantify the potential impacts that might occur. All that can be said is that impacts (and hence additional offset requirements) would potentially be large, and consequently these low likelihood/high consequence risks should be further investigated and monitored as recommended in Appendix 3 Biodiversity Impacts.

Third, as is clear from the 'Methods' section, the results of the NPI forecast are critically dependent upon a number of different technical assumptions and input parameters, many of which have been estimated based on minimal evidence (typically because little or no information is available), and which consequently are associated with a high level of uncertainty. Further research needs to be done as part of the ongoing monitoring, and the NPI forecast can be iteratively improved and refined as better information becomes available.

Finally, the ambitious nature of such a novel approach in Mongolia should be stressed. Based on the findings of this NPI forecast, offset activities on a very large scale would be required to give reasonable confidence of achieving a net positive impact on biodiversity. The political feasibility of implementing such measures has yet to be ascertained. Political consultation on the feasibility of the offset actions required to theoretically achieve NPI is the next step required.

The following recommendations can be made:

- Additional bustard offsets may be required outside Mongolia (e.g. on wintering grounds and migratory route, where the species are threatened by hunting)
- Oyu Tolgoi and its lenders should consider how they can use their influence to drive improved biodiversity performance for other non-Rio businesses (and across all sectors, including both private and public) in the region, in order to manage cumulative impacts
- Low likelihood/high consequence risks (e.g. hydrology) should be further investigated and monitored, and offsets for these should be implemented if monitoring indicates that impacts are occurring. Further research is needed to determine whether offsets would be feasible.
- Some of the information upon which this NPI forecast is based is very weak, and additional research would need to be done to provide a forecast with higher confidence and less uncertainty

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11 Appendices

Appendix 1. Currencies used for measuring biodiversity losses and gains

Name of biodiversity feature	Currency / currencies	Currency notes
Mongolian Chesney	QH	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Asiatic Wild Ass	QH	Quality estimated in terms of hunting pressure
Argali	QH	Quality estimated in terms of hunting pressure
Goitered Gazelle	QH	Quality estimated in terms of hunting pressure
Mongolian Gazelle	QH	Quality estimated in terms of hunting pressure
Swan Goose	Bespoke collision metric	Not affected by habitat loss
Ferruginous Duck	Bespoke collision metric	Not affected by habitat loss
Short-toed Snake-eagle	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Saker Falcon	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Egyptian Vulture	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Great Bustard	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Houbara Bustard	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Relict Gull	Bespoke collision metric	Not affected by habitat loss
Pallas' Sandgrouse	QH, bespoke collision metric	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Yellow-breasted Bunting	QH	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Mongolian Ground-Jay	QH	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Riverine Elm Trees	Number of individuals	Total population within study area is 3-5,000
Granite Outcrop Floral Communities	QH	
Tall Saxaul Forest	QH	
Eastern Gobi desert-steppe	QH	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)
Alashan Plateau semi-desert	QH	Quality estimated in terms of degree of degradation (mainly caused by grazing pressure)

Appendix 2. Residual losses to relevant priority biodiversity features

Name	Direct habitat loss (1000 ha)	Direct & indirect habitat loss (1000 ha)	Secondary impact of increased hunting from increased human population in the region (1000 QH)	Quality of habitat lost (0-1; 1 being highest)	Quality notes
Mongolian Chesney	9	9		0.9	Habitat is currently in very good condition. Using a 5-category scale, habitat would be in top category (0.8-1; mid-point 0.9)
Asiatic Wild Ass		1555	392	0.5	Habitat is of moderate quality for mammals (main determinant of quality for mammals is hunting pressure). Using a 5-category scale, judged to be in middle category e.g. Range 0.4-0.6, mid-point = 0.5
Argali		301	392	0.5	
Goitered Gazelle		1302	392	0.5	
Mongolian Gazelle		763	392	0.5	
Swan Goose					n/a
Ferruginous Duck					n/a
Short-toed Snake-eagle	9	9		0.9	Habitat is currently in very good condition. Using a 5-category scale, habitat would be in top category (0.8-1; mid-point 0.9)
Saker Falcon	9	9		0.9	
Egyptian Vulture	9	9		0.9	
Great Bustard		713		0.9	
Houbara Bustard		713		0.9	
Relict Gull					n/a
Pallas' Sandgrouse	9	9		0.9	Habitat is currently in very good condition. Using a 5-category scale, habitat would be in top category (0.8-1; mid-point 0.9)
Yellow-breasted Bunting	9	9		0.9	
Mongolian Ground-Jay	9	9		0.9	
Riverine Elm Trees					n/a
Granite Outcrop Floral Communities	0	0			n/a
Tall Saxaul Forest		+		?	

Eastern Gobi desert-steppe	5.5	5.5		0.9	Habitat is currently in very good condition. Using a 5-category scale, habitat would be in top category (0.8-1; mid-point 0.9)
Alashan Plateau semi-desert	3.5	3.5		0.9	

Appendix 3. Potential offset gains by 2036

Name	How will gains be achieved?	Offset area (km^2)	Offset gain (1000 QH)	Notes on calculation of gains
Mongolian Chesney	Improved habitat quality is likely to benefit threatened plants	28,245	21	Assumes improvement of quality by 7.5% over 25 years in area of intensive intervention (which is 10% of total offset area).
Asiatic Wild Ass	Reduce hunting rates at the offset sites	28,245	551	Assumes that hunting rate can be improved by 18.75%; combined with habitat gains (2100 QH)
Argali	Reduce hunting rates at the offset sites	28,245	551	
Goitered Gazelle	Reduce hunting rates at the offset sites	28,245	551	
Mongolian Gazelle	Reduce hunting rates at the offset sites	28,245	551	
Swan Goose	Collision mitigation on non-OT power lines			
Ferruginous Duck	Collision mitigation on non-OT power lines			
Short-toed Snake-eagle	Improve habitat quality, collision mitigation on non-OT powerlines	28,245	21	Assumes improvement of quality by 7.5% over 25 years in area of intensive intervention (which is 10% of total offset area).
Saker Falcon	Improve habitat quality, collision mitigation on non-OT powerlines	28,245	21	
Egyptian Vulture	Improve habitat quality, collision mitigation on non-OT powerlines	28,245	21	
Great Bustard	Improve habitat quality, collision mitigation on non-OT powerlines	28,245	21	
Houbara Bustard	Improve habitat quality, collision mitigation on non-OT powerlines	28,245	21	
Relict Gull	Collision mitigation on non-OT power lines			
Pallas' Sandgrouse	Improve habitat quality	28,245	21	Assumes improvement of quality by 7.5% over 25 years in area of intensive intervention (which is 10% of total offset area).
Yellow-breasted Bunting	Improve habitat quality	28,245	21	
Mongolian Ground-Jay	Improve habitat quality	28,245	21	
Riverine Elm Trees	3 trees translocated		+	Assumes translocation is successful; offset gains depend on specific offset site
Granite Outcrop Floral Communities	No certain losses to offset		0	Offset gains depend on specific offset site
Tall Saxaul Forest	No certain losses to offset		+	Assumes adequate control of illegal collecting (not quantified)
Eastern Gobi desert-steppe	Improve habitat quality through improved rangeland management	12,179	9	Assumes improvement of quality by 7.5% over 25 years in area of intensive intervention (which is 10% of total offset area).
Alashan Plateau semi-desert	Improve habitat quality through improved rangeland management	16,066	12	