Ecological Assessment in Compliance to IFC Performance Standard 6 for NH8 Toll Road from Bharatpur to Mahwa

I Squared Asia Advisors Pte Ltd

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1 BACKGROUND

I Squared Asia Advisors Pte Ltd (ISA) is evaluating an investment opportunity through a Special Purpose Vehicle (SPV) under the name of Madhucon Agra Jaipur Expressway Limited (MAJEL) that has been set up for the maintenance and operation of a 57 km stretch of National Highway-11 (Bharatpur- Mahwa stretch) near Bharatpur (herein referred to as project road). ERM India has been commissioned by ISA to undertake an Environmental and Social Due Diligence (ESDD) of MAJEL.

As a part of the ESDD, ERM carried out a rapid ecological survey along the 57 km highway stretch between Mawha and Bharatpur. The objective was to assess whether any habitats along this stretch had the potential to trigger critical habitats as per as per the International Finance Corporations (IFC) Performance Standard (PS6) (IFC 2012a, 2012b). This assessment was necessary as the Keoladeo Ghana National Park (KGNP) is close by. The KGNP was declared a National Park as per the Indian Wildlife (Protection) Act, 1972 in 1982, a RAMSAR site in 1981 as per the RAMSAR Convention for Conservation of Wetlands (1975) and a World Heritage Site in 1985, as per the UNESCO World Heritage Convention (1972).

As per the Ministry of Environment, Forests and Climate Change, Impact Assessment Guidance Manual for Highways (2010), any project activities related to highway building, widening or strengthening falling with 10 km radius of a protected area or within a designated Ecological Sensitive Area (Environmental Protection Act 2006 and subsequent notifications) will be treated as a Category A project requiring an Environmental Impact Assessment. Recognizing the close proximity of the 10 km stretch of the highway to an important biodiversity centre and that IFC is part of the joint venture and therefore IFC Performance Standards are required for assessing the project, it was agreed that an assessment be carried out as per IFC Performance Standard 6.

2 METHODOLOGY

The study was carried out on the 28th of August, 2015 between 1000 and 1600 hrs.

2.1 STUDY AREA

2.1.1 Keoladeo Ghana National park Bharatpur (KGNP).

One of the richest bird areas of the world, KGNP supports more than 350 bird species (Vijayan 1991). The site falls in Biome-12 representing the bird species of Indo-Gangetic Plains (Rodgers and Panwar 1988). Bird species of Biome-11 (Indo-Malayan Tropical Dry Zone, (Rodgers and Panwar 1988) are also found here.

The Park qualifies as an Important Bird Area[1] under A1 (Threatened Species), A4i (1% threshold population), and A4iii (20,000 waterbirds)[2] . During good monsoon years, it is not uncommon to see a hundred thousand birds. It is one of the major breeding centres of the Painted Stork *(Mycteria leucocephala)*, Asian Openbill (*Anastomus oscitans*), Darter (*Anhinga melanogaster*) and various egrets, herons, ibises and other storks. Many ducks, coot and rails occur much above their 1% threshold numbers. The most famous disappearance of any species is the Siberian Crane (*Grus leucogeranus*), which has declined from 200 birds in the 1960s to none in 2002.

2.1.2 The Bharatpur Mahwa Highway Stretch

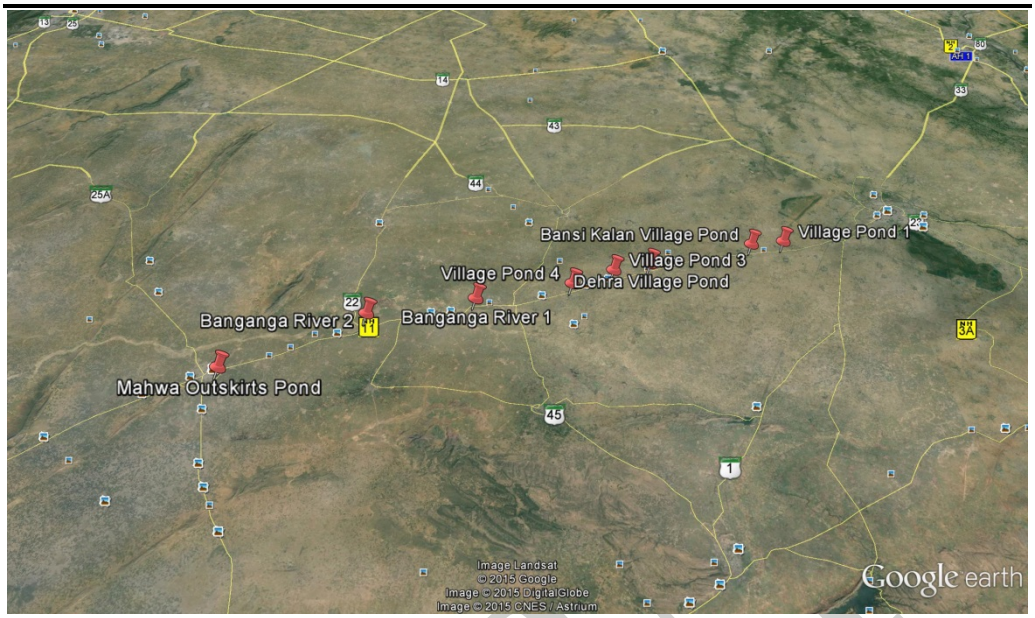
The Bharatpur-Mahwa road stretch of National Highway (NH) 11 connects Bharatpur to Mahwa to popular destinations such as Jaipur and Agra. The length of the project road is 57 km, from Km 62.295 to Km 119.600 (57.305 km) falling across the district of Bharatpur in the state of Rajasthan . The location of the project road has been presented in ***Fig 2.1.*** The road stretch was an undivided 2-lane throughout the corridor and has been widened and strengthened to a 4 lane highway. The total land that was required for the expansion of the Right of Way of the project was 88.41 hectares.

There is a likelihood that threatened species from the KGNP or any other habitats around the park may be dispersing for ecological needs such as foraging and breeding. Some of these species may use habitats close to the highway and thereby experience impacts from construction and enhanced traffic due to the highway widening. The ecological assessment described below is to assess this likelihood.

[1] http://www.birdlife.org/datazone/site

[2] http://www.birdlife.org/datazone/info/ibacritglob

Figure 2.1 Study Area along the 57 km Bharatpur to Mawha Highway



2.1.3 *Ecological Assessment*

It was assumed that impacts to ecological receptors, from road construction and operation, through particulate emissions, noise and vibration of machinery and labour, noise and emissions from enhanced traffic and felling of trees for widening the highway would be relevant along a 1 km width on either side of the highway. The following ecological receptors, specific to the objectives of this assessment against PS6, were considered in the impact assessment

- Aquatic bodies that may hold congregations of aquatic bird species;
- Trees that could offer nesting or roosting sites to both terrestrial and aquatic bird species;
- Terrestrial large mammals crossing the widened highway; and
- Terrestrial birds using the 1 km width on either side of the highway for feeding.

The entire 57 km stretch of the highway was assessed as indicated in Figure 2.1. While emphasis was placed on assessing water bodies such as village ponds and water courses, the other receptors given above were also assessed for impacts. For example the occurrence of nesting trees along the highway or risks posed to terrestrial fauna by traffic were assessed.

The assessments were carried out through

i. Visual observation and examination of receptors;
ii. Interviews with the Divisional Forest Officers of KGNP and Bharatpur Territorial Division;

iii. Interviews with local communities; and
iv. Review of secondary literature i.e. working/management plans of the national park and the territorial forest division in addition to scientific publications from the region.

3 SIGNIFICANT ASSESSMENT FINDINGS

The significant findings from the assessment are described in accordance to the receptors described in Section 2.1.3

3.1 AQUATIC BODIES

Table 3.1 Provides details of all village ponds and water courses examined

S. NO.	NAME	LAT	LONG	HABITAT	VEGETATION	DISTURBANCE
1	Village Pond 1 Bansi Kalan	27.16954	77.38249	Fallow fields		Construction along the edge
2	Village Pond	27.16627	77.35458	Village edge	Prosopis on bank	Cattle tied on the edge
3	Dehra Village Pond	27.14405	77.26589	Village edge	Prosopis on bank	Sheep and buffaloes being washed
4	Village Pond 3	27.1368	77.23511	Village edge	Pongamia pinnata	Crop residue stacked on bank
5	Village Pond 4	27.1224	77.20037	Village edge	Prosopis on bank	Sides of the pond were lined by bricks
6	Banganga River 1	27.10689	77.12279	Agriculture on banks	Tall grasses in riverbed	Sand mining
7	Banganga River 2	27.09191	77.03796	Agriculture on banks	Tall grasses in riverbed	Sand mining
8	Pond on Mahwa outskirts	27.04206	76.93539	Fallow fields	Prosopis on bank	

All water courses such as village ponds and river courses were carefully examined for the presence of fauna species, vegetation types and level and nature of disturbance. Boxes 3.1 to 3.3 indicate the vegetation types and status of each of the ponds. Box 3.4 indicates the status of each of the water courses surveyed.

Box 3.1: Village ponds 1 and 3 (from left to right)

Box 3.2 ***Village pond 4 and pond on outskirts of Mahwa town***

Box 3.3 ***Dehra and Bansi Kalan ponds.***

Box 3.4 ***Two views of dry course of the Banganga river***

As can be seen from the pictures and Table 3.1, all ponds are small and except for the pond on the outskirts of Mahwa town and village pond 4, were highly disturbed by human activity. Furthermore all ponds experienced high levels of eutrophication probably as a consequence of sewage or other waste effluent into the ponds. Aquatic birds (as per Table 3.2) were only seen in village pond 4 (little grebe) and the pond on the outskirt of Mahwa town (common moorhen, cattle egret and lesser whistling duck). While these ponds may

attract some species of birds found in KGNP and surrounding habitats, they are unlikely to offer important habitats for threatened species.

Furthermore as indicated in Box 3.4, the Bangaga river was dry during the survey and according to local sources has been dry since 1996. The dry river course is highly disturbed by sand mining and is therefore unlikely to offer habitats for birds also found in the KGNP and surrounding habitats.

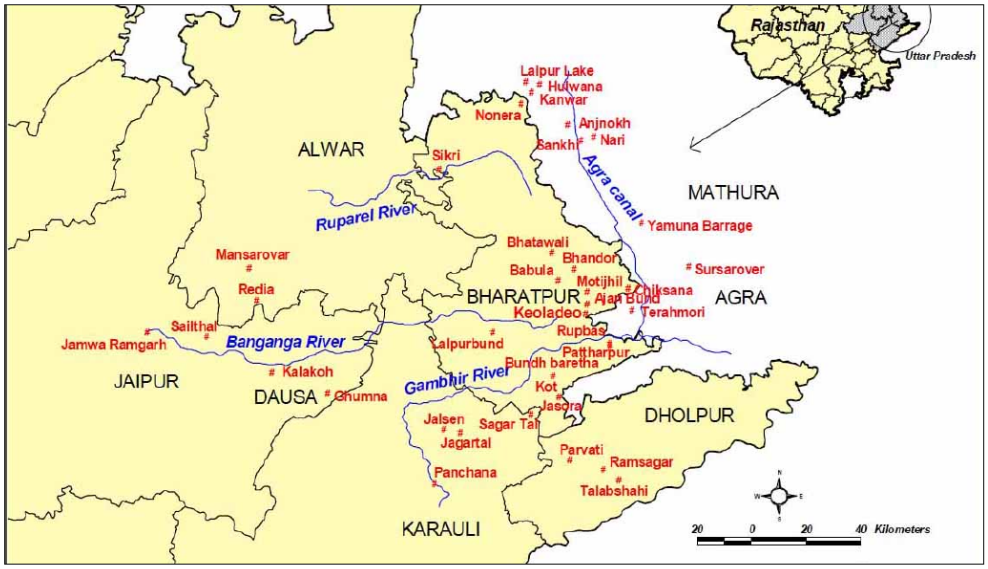
Table 3.2 ***Provides bird species observed in the above water bodies***

Common Name	Scientific Name	Family	Migratory Status	Habitats	IUCN (2015 v 2.0)	WPA ,1972
Baya Weaver	Ploceus philippinus	Ploceidae	R	T	LC	IV
Black winged Stilt	Himantopus himantopus	Recurvirostridae	R	A	LC	IV
Cattle Egret	Bubulcus ibis	Ardeidae	R	A	LC	IV
Common Myna	Acridotheres tristis	Sturnidae	R	T	LC	IV
Common Moorhen	Gallinula chloropus	Rallidae	R	A	LC	IV
Eurasian Collared Dove	Streptopelia decaocto	Columbidae	R	T	LC	IV
Indian Pond Heron	Ardeola grayii	Ardeidae	R	A	LC	IV
Indian Roller	Coracias benghalensis	Coraciidae	R	T	LC	IV
Laughing Dove	Spilopelia senegalensis	Columbidae	R	T	LC	IV
Little Egret	Egretta garzetta	Ardeidae	R	A	LC	IV
Little Grebe	Tachybaptus ruficollis	Podicipedidae	R	A	LC	IV
Red wattled Lapwing	Vanellus indicus	Charadriidae	R	A	LC	IV
Rock Pigeon	Columba livia	Columbidae	R	T	LC	IV
House Crow	Corvus splendens	Corvidae	R	T	LC	V
Lesser Whistling Duck	Dendrocygna javanica	Anatidae	R	A	LC	IV
Asian Pied Starling	Sturnus contra	Sturnidae	R	T	LC	IV

T=Terrestrial A=Aquatic LC=Least concern

We also assessed the possibility of other major water bodies close to the highway stretch attracting birds from the KGNP and surrounding areas. Interviews with the Assistant Conservator of Forests, KGNP indicated that a major wetland, the Bundh Bareta Tal, is the only significant wetland attracting several species of aquatic birds. As can be seen from the map in Box 3.5 no major wetlands attracting aquatic birds , are found close to the assessed highway stretch indicating that the ponds assessed are unlikely to offer major habitats for threatened species .

Box 3.5 ***Location of major wetlands around Keoladeo Ghana National Park (Bhadouria et al (2012)).***



3.2 *NESTING AND SITES ROOSTING FOR TERRESTRIAL AND AQUATIC BIRD SPECIES*

The highway stretch was examined for the presence of large trees that could offer nesting or roosting sites for terrestrial or aquatic species (e.g. heronries). The bases of such trees were examined for the presence of large amounts of bird dropping and fallen nesting material. No such trees were found along the stretch.

3.3 *CROSSING POINTS FOR TERRESTRIAL LARGE MAMMALS*

In addition to the possibility of collision with vehicles along un-barricaded sections of the highway, we identified a cutting in the road, which could pose a higher risk to large mammals crossing, especially when trapped within (Box 3.6). Mammals could have access to this cutting due to the absence of barricades.

Box 3.6

3.4 *FEEDING SITES*

While birds may feed sporadically anywhere along the highway there were no specific locations identified as specific feeding sites e.g. garbage dumps attracting scavengers such as vultures or feeding sites maintained by villagers traditionally feeding migratory birds, such as Demoiselle's crane (*Grus virgo*)

4 DISCUSSION AND CRITICAL HABITAT ASSESSMENT

4.1 IMPLICATION OF THE ASSESSMENT FINDINGS

Section 3 indicates that habitats along the 57 km highway stretch do not offer good potential for threatened species and therefore the proposed widening and strengthening of the highway are unlikely to impact threatened species.

Bhadouria et al (2012) state that the KGNP, a world heritage site, is now facing water shortages. Therefore, many species of migratory birds have been moving to nearby wetlands for foraging. In light of this, a survey was carried out during 2009-10 to understand the status of birds and their use of these wetlands. A total of 27 wetlands have been identified within 100 km radius of the Keoladeo National Park (as mentioned above largely to the north, south and east of KGNP) and within them 75 species of water birds were recorded. Of these species ~ 25 are migratory.

As the present assessment was carried out in August 2015 corresponding to the monsoon, migratory birds may still use the ponds surveyed. It is therefore recommended that the assessment be repeated in November 2015 to rule out the unlikely possibility of threatened migratory species or any large congregations using the water bodies assessed.

Due to this assessment carried out in the non-migratory season and its short duration, we still consider threatened species that, despite having prime habitats in the KGNP and surrounding wetlands, could use the water bodies assessed. This is to establish unequivocally whether these species are present and could potentially experience any impacts from the operation of the highway. Section 4.2 derives a list of bird and mammal threatened species that may use the area in the immediate proximity of the highway and thereby provides the basis for a critical habitat assessment as per IFC PS6.

4.2 THREATENED SPECIES POTENTIALLY USING THE 57 KM HIGHWAY STRETCH.

Birds

Birdlife International in its data-zone for IBAs (http://www.birdlife.org/datazone/sitefactsheet.php?id=18351) has listed 14 species that trigger IBA criteria A1 due to their IUCN 2015 v 2.0 threatened status (Table 4.1). Other references provide additional threatened species such as the Greater Adjutant (*Leptoptilos dubius*) which have not been included in this. However we consider the above source as the most credible due to its strict rigour and timeliness in species status assessments and updating bird lists from the IBA. Table 4.1 also provides a column where we assess the possibility of species using the habitats along the highway stretch (highlighted rows indicate possible species along highway stretch).

Table 4.1 List as per the KGNP IBA database and species likely to use the habitat close to the highway stretch (highlighted).

S. No.	Species	Season	Period	Population estimate	Quality of estimate	IBA Criteria	IUCN Category	Likelihood of using stretch and rationale
1.	Baer's Pochard (*Aythya baeri*)	winter	2004	present	-	A1	Critically Endangered	Not possible. Individuals seen here are likely stragglers as the bird over winters in northeast India
2.	Lesser Adjutant (*Leptoptilos javanicus*)	resident	2004	present	-	A1	Vulnerable	Possible. Could use the pond for fishing.
3.	Dalmatian Pelican (*Pelecanus crispus*)	winter	2004	present	-	A1	Vulnerable	Possible. Could use the pond for fishing
5.	Pallas's Fish-eagle (*Haliaeetus leucoryphus*)	resident	2004	present	-	A1	Vulnerable	Not possible. Bird is rarely seen in KGNP today.
6.	White-rumped Vulture (*Gyps bengalensis*)	non-breeding	2004	present	-	A1	Critically Endangered	Possible . Could use highway stretch for scavenging
7.	Greater Spotted Eagle (*Clanga clanga*)	winter	2004	present	-	A1	Vulnerable	Not possible. No ecological reason for using the highway stretch.
8.	Eastern Imperial Eagle (*Aquila heliacal)*	winter	2004	present	-	A1	Vulnerable	Not possible No ecological reason for using the highway stretch.
9.	Indian Vulture (*Gyps indicus*)	non-breeding	2004	present	-	A1	Critically Endangered	Possible. Could use highway stretch for scavenging.
10.	Siberian Crane (*Leucogeranus leucogeranus*)	winter	2004	present	-	A1	Critically Endangered	Not possible. Species has not come to KGNP since 2002
11.	Sarus Crane (*Antigone antigone*)	resident	2004	present	-	A1	Vulnerable	Possible; Could use the highway stretch for feeding and breeding
12.	Sociable Lapwing (*Vanellus gregarious*)	winter	2004	present	-	A1	Critically Endangered	Possible; May use habitats of other lapwing species
13.	Indian	breeding	2004	present	-	A1	Vulnerable	Not possible . No

S. No.	Species	Season	Period	Population estimate	Quality of estimate	IBA Criteria	IUCN Category	Likelihood of using stretch and rationale
	Skimmer (*Rynchops albicollis*)							habitat on highway stretch as species prefers larger rivers and wetlands.
14.	White-browed Bushchat (*Saxicola macrorhynchus*)	resident	2004	present	-	A1	Vulnerable	Not possible. No habitat on highway stretch as species prefers desert habitats

Mammals

Important herbivores of KGNP include the Cheetal (*Axis axis*), Sambar (*Cervus unicolor*), Nilgai (*Boselaphus tragocamelus*) and Wild Boar (*Sus scrofa*), whereas the commonly sighted predators include Golden Jackal (*Canis aureus),* Jungle Cat (*Felis chaus*) and Fishing Cat (*Prionailurus viverrina*). Striped Hyena (*Hyaena hyaena*), and Smooth Indian Otter (*Lutra perspicillata*) are also found in small numbers. Blackbuck (*Antelope cervicapra*) has become extinct in recent years, mainly due to habitat changes.

Among the above mammals, threatened species include sambar (VU: IUCN 2015 v 2.0) smooth Indian otter (VU; IUCN 2015 v 2.0) and fishing cat (EN; IUCN 2015 v 2.0). We consider only the sambar relevant for any impacts caused by the highway construction and operation. The fishing cat has been extirpated from the Bharatpur areas (Shomita Mukherjee, Jamal Khan pers. comms. 2007) and the smooth Indian otter inhabits wetland areas which are not contiguous with those along the highway stretch. There is a small likelihood for on occasional sambar individual attempting to cross the road and risking collision from vehicles

4.3 SCREENING OF LIST OF HABITATS AND SPECIES POTENTIALLY TRIGGERING CRITICAL HABITATS.

Due to the high level of human activity within a km buffer of the 57 km highway stretch, we classify ***all habitats as modified***. There are **no natural habitats** along this stretch.

We use IFC PS6 Criteria1 alone for the assessing critical habitats. As there is virtually no possibility of finding endemic or restricted range species we do not use Criteria 2. Furthermore the habitats do not hold significant populations of migratory or congregatory species and therefore we do not use Criteria 3. Table 4.2 provides details of the criteria used for the critical habitat assessment.

Table 4.3 provides the species wise critical habitat screening assessment based on Table 4.1

Table 4.2 Criteria used for assessing critical habitats (IFC PS 6 2012a,b)

Criteria	Tier 1[(1)]	Tier 2[(1)]
Criteria 1: Critically Endangered(CR) /Endangered (EN) Species	Habitat required to sustain ≥ 10 percent of the global population of an IUCN Red-listed CR or EN species where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species. Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.	Habitat that supports the regular occurrence of a single individual of an IUCN Red-listed CR species and/or habitat containing regionally-important concentrations of an IUCN Red-listed EN species where that habitat could be considered a discrete management unit for that species. Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species. As appropriate, habitat containing nationally/regionally-important concentrations of an EN, CR or equivalent national/regional listing.
Criterion 2: Endemic and Restricted-range Species	An endemic species is defined as one that has ≥ 95 percent of its global range inside the country or region of analysis.	Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.
Criterion 3: Migratory and Congregatory Species	Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle where that habitat could be considered a discrete management unit for that species.	Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' life-cycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment. For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance. For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both

Criteria	Tier 1[1]	Tier 2[1]
		terrestrial and marine species. Source sites that contribute ≥ 1 percent of the global population of recruits.
Criterion 4: Highly Threatened and/or Unique Ecosystems	No Tiered system is prescribed that are at risk of significantly decreasing in area or quality; with a small spatial extent; and/or containing unique assemblages of species including assemblages or concentrations of biome-restricted species. Highly threatened or unique ecosystems are defined by a combination of factors which may include long term trend, rarity, ecological condition, and threat	
Criterion 5: Key Evolutionary Processes	The criteria is defined by Isolated areas (e.g., islands, mountaintops, lakes) are associated with populations that are phylogenetically distinct. Areas of high endemism often contain flora and/or fauna with unique evolutionary histories (note overlap with Criterion 2, endemic and restricted-range species). Landscapes with high spatial heterogeneity are a driving force in speciation as species are naturally selected on their ability to adapt and diversify. Environmental gradients, also known as ecotones, produce transitional habitat which has been associated with the process of speciation and high species and genetic diversity. Edaphic interfaces are specific juxtapositions of soil types (e.g., serpentine outcrops, limestone and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism. Connectivity between habitats (e.g., biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from "crest to coast." Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.	

Table 4.3 Threatened species with the potential of triggering critical habitats

Species Name	Common Name	Criteria 1 CR or EN Species	Criteria 2 Endemic / Restricted Range Species	Criteria 3 Migratory / Congregatory Species	Critical Habitat Tier 1	Critical Habitat Tier 2	Rationale	Information[1]
Birds								
Gyps bengalensis Gyps indicus	White-rumped Vulture Indian vulture	*				*	Tier 2e: Highly significant population declines were first noticed in the KGNP and it is likely that the population's recovery is still rudimentary. The mortality of individual(s) through any development could have an impact on breeding rates and hence population recovery. .	Since the mid-1990s, the species has suffered a catastrophic decline (over 99%) across the Indian Subcontinent (the majority of its historic range), first noticed in Keoladeo National Park, India (Prakash et al. 2003), Extensive research has identified the non-steroidal anti-inflammatory drug (NSAID), diclofenac, to be the cause behind this rapid population collapse This drug, used to treat domestic livestock, is ingested by vultures feeding on their carcasses leading to renal failure and causing visceral gout (Oaks et al. 2004a, 2004b; Swan et al. 2005, Gilbert et al. 2006). A similar situation prevails for the Indian vulture.
Vanellus gregarius	Sociable	*				*	Tier 2e: KGNP is one of the	The species breeds in

[1] http://www.birdlife.org/datazone/species/factsheet/22695194, http://www.birdlife.org/datazone/species/factsheet/22694053

Species Name	Common Name	Criteria 1 CR or EN Species	Criteria 2 Endemic / Restricted Range Species	Criteria 3 Migratory / Congregatory Species	Critical Habitat Tier 1	Critical Habitat Tier 2	Rationale	Information[1]
	Lapwing						few sites receiving migrating flocks and is therefore of substantial national significance.	northern and central Kazakhstan and south-central Russia and migrates to key wintering sites in Israel, Eritrea, Sudan and north-west India (e.g. 45 birds in the Little Rann of Kutch in November 2007 and 30 at Great Rann of Kutch in November 2008). The species has suffered a very rapid decline and range contraction

Impact assessment of critical habitats

Table 4.6 and 4.7 assess impacts on modified habitats (land of 1 km width on either side of the highway stretch) and species identified in Table 4.1 with the potential of triggering critical habitats. The assessments are as per the habitat and species impact assessment criteria given in Table 4.4 and 4.5.

Table 4.4 Habitat impact assessment criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	**Small**	**Medium**	**Large**
		Effect is within the normal range of natural variation	*Affects only a small area of habitat, such that there is no loss of viability / function of the habitat*	*Affects part of the habitat, but does not threaten the long-term viability / function of the habitat.*	*Affects the entire habitat, or a significant proportion of it, and the long-term viability / function of the habitat is threatened.*
Negligible	Habitats with negligible interest for biodiversity.	**Not significant**	**Not significant**	**Not significant**	**Not significant**
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	**Not significant**	**Not significant**	**Minor**	**Moderate**
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.	**Not significant**	**Minor**	**Moderate**	**Major**

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	**Not significant**	**Moderate**	**Major**	**Critical**

Table 4.5 Species impact assessment criteria

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	**Small**	**Medium**	**Large**
		Effect is within the normal range of variation for the population of the species.	*Effect does not cause a substantial change in the population of the species, or other species dependent on it.*	*Effect causes a substantial change in abundance and / or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability / function of that population, or any population dependent on it.*	*Affects entire population, or a significant part of it causing a substantial decline in abundance and / or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).*
Negligible	Species with no specific value or importance attached to them.	**Not significant**	**Not significant**	**Not significant**	**Not significant**
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.	**Not significant**	**Not significant**	**Minor**	**Moderate**
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	**Not significant**	**Minor**	**Moderate**	**Major**

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (ie plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km2), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	**Not significant**	**Moderate**	**Major**	**Critical**

Table 4.6 Habitat Impact Assessment

Habitat Description	Associated Species	Impact Description	Sensitivity	Magnitude of Effect	Significance
Modified. Strip of land of 1 km width on either side of highway containing water bodies, agricultural and fallow land, settlements	As listed and highlighted in Table 4.1	Impacts of road construction and operation, such as particulate emissions from dust, run offs and erosion after heavy rains, noise and vibration from labour force, construction machinery and vehicles, illegal hunting by work force	While there may be some passage of endangered species the habitat is not recognized and is common and widespread within the region with low conservation interest. Negligible	Impacts affect only a small area of habitat, (along the highway stretch) such that there is no loss of viability / function of the habitat. Several impacts are also temporary: Small	Not significant

Table 4.7 Species impact assessment

Species	Impact Description	Sensitivity	Magnitude of Effect	Significance
Birds				
Sociable Lapwing (*Vanellus gregarious*)	The species may associate with other lapwing species (such as the red-wattled and yellow wattled lapwing) and may be found along the highway stretch. There is a small chance of collision risk with vehicles on the highway, especially if the species is startled by vehicle or human noise.	**High:** As species is CR	**Negligible:** Due to very low probability that the species is found outside KGNP in the modified habitat and individuals may collide with vehicles we consider the magnitude as negligible. There is therefore unlikely to be an impact on the population within the region.	**Not significant**
White-rumped Vulture (*Gyps bengalensis*) and Indian vulture (*Gyps indicus*)	The species may scavenge along the highway side and thereby may face collision risks from vehicles if flying low across the highway	**High:** As species is CR	**Small:** Due to the very low density of the species and noted absence of any specific sites for dumping of garbage, offal etc along the highway, there is a small chance of collision. There is therefore unlike to be an impact on the population within the region	**Moderate**
Lesser Adjutant (*Leptoptilos javanicus*)	Water bodies along the highway may attract a few individuals of the species for feeding. Water quality of these bodies may be impacted due to construction activities e.g. run-off and erosion. Furthermore the species may fly low over the highway and may face a collision risk.	**Medium:** Species is VU	**Negligible:** Due to the size and quality of the water bodies it is very unlikely that the species visits these water bodies. For feeding. Therefore any impacts on these water bodies is likely to be insignificant and the chances of the species flying across the highway highly improbable.	**Not significant**
Dalmatian Pelican (*Pelecanus crispus*)	Water bodies along the highway may attract a few individuals of the species for feeding. Water quality of these bodies may be impacted due to construction activities e.g. run-off and erosion. Furthermore the species may fly low over the highway and may face a collision risk.	**Medium:** Species is VU	**Small:** Due to the size and quality of the water bodies it is very unlikely that the species visits these water bodies for feeding. Therefore any impacts on these water bodies is likely to be insignificant and the chances of the species flying across the highway highly improbable.	**Not significant**
Sarus Crane (*Antigone antigone)*	Fields along the highway may attract the species for foraging or courtship/breeding and may face a collision risk when flying low across the highway.	**Medium:** Species is VU	**Small:** There is a small chance that the species faces a collision risk when flying low across the highway. However this is unlikely to impact the population. Furthermore if the species experiences	**Minor**

Species	Impact Description	Sensitivity	Magnitude of Effect	Significance
Birds				
			constant levels of disturbance it is likely to avoid the highway stretch	
Mammals				
Sambar (*Cervus unicolor)*	The species may attempt to cross the highway for feeding in the fields at night. The species faces some collision risk from vehicles.	**Medium:** Species is VU	**Negligible:** There is no contiguous habitat from the KGNP traversing the highway. The species is also very shy and is unlikely to leave the confines of the KGNP**.**	**Not significant**

From the impact assessment above only two species, the White-rumped vulture and the Sarus crane, appear to face some impacts from the highway construction and operation. Both species face risks from collision with vehicles which could be deemed a more generic risk across most highways within their habitats. However the proximity of the highway to the KGNP incrementally elevates this risk, due to the availability of good habitat in the park and the chance of these species dispersing beyond the park for foraging and breeding.

We are however clear that no critical habitats have been triggered.

4.4 MITIGATION OF IMPACTS

In Tables 4.8 we discuss mitigation of impacts on the two species listed in Table 4.7. As impacts on the modified habitat along the highway were found negligible we do not discuss mitigation of impacts on this habitat. We also do not discuss impacts on species for which impacts were determined negligible.

Table 4.8 Mitigation of assessed impacts

Species	Significance Ranking	Mitigation (Description)
Birds: White-rumped vulture (Gyps bengalensis) and Indian vulture (Gyps indicus)	Moderate	Strict control on garbage or carcass dumping along this highway stretch enforced by highway patrols and police with local panchayat participation
Sarus crane (Grus Antigone)	Minor	A survey (in collaboration with local communities, panchayats, schools) needs to be carried out, of breeding pairs using the habitat and sites close to the road. If there is any specificity for these locations over extended durations, signage needs to be erected, cautioning traffic of their possible presence/crossing and enforcing a lower speed limit.

Subsequent to the mitigations suggested above we carry out an assessment of residual impacts to evaluate whether any additional mitigation is required.

Table 4.9 Mitigation of residual impacts

Species	Pre-mitigation Impact Assessment	Description of value lost	Residual Impact
White-rumped vulture (Gyps bengalensis) and Indian vulture (Gyps indicus)	Moderate	Individual killed through collisions with vehicles could deplete the pool of a CR species and raise undue concerns about the impacts of the highways	Negligible

Species	Pre-mitigation Impact Assessment	Description of value lost	Residual Impact
Sarus crane (Grus Antigone)	Minor	A very charismatic species and very much part of local culture and folklore. Mortality of individuals is likely to create negative sentiment about the highway.	Negligible

We therefore anticipate that the mitigation methods when implemented through participatory action and commitment, will reduce residual impacts to negligible levels, thereby not requiring further mitigation options.

Bhumesh, S.B., Mathur, V.B. and K. Sivakumar (2012) *A Survey of Avifaunal Diversity in Wetlands Around Keoladeo National Park, Bharatpur,Rajasthan, India*, Bird Populations, 11:1-6

IFC (2012a) Performance Standard 6: *Biodiversity Conservation and Sustainable Management of Living Natural Resources*

IFC (2012b) Guidance Note 6: *Biodiversity Conservation and Sustainable Management of Living Natural Resources*

Rodgers, W.A. and Panwar, H.S. (1988). *Planning a Wildlife Protected Area Network in India*. 2 vols. Project FO: IND/82/003. FAO, Dehra Dun. 339, 267 pp.

Vijayan, V. S. (1991) *Keoladeo National Park Ecology Study (1980-1990)* - An Overview. Bombay Natural History Society, Bombay.

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