Accelerating Transport and Trade Connectivity in Eastern South Asia (ACCESS) Project, Bhutan

Gelephu-Tareythang Road

PREPARED FOR

Department of Surface Transport (DoST), Ministry of Infrastructure and Transport, Royal Government of Bhutan

DATE
March 2025

Appendix -J: Critical Habitat Assessment

[Image on front page shows the Mau River in the project area]

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ACRONYMS USED IN THE TEXT

Acronym	Description
CR	Critically Endangered with extinction
CHA	Critical Habitat Assessment
EN	Endangered with extinction
FNCA	Forest and Nature Conservation Act (FNCA) 1995
FNCRR	Forest and Nature Conservation Rules and Regulation (FNCRR) 2017
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
LC	Least Concern
NE	Not Evaluated for threatened status
NT	Near Threatened
NWFP	Non-wood forest products
PWS	Phibsoo Wildlife Sanctuary
RMNP	Royal Manas National Park
VU	Vulnerable with extinction

1. INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS REPORT

This report presents the findings of the Natural Habitat and Critical Habitat Assessment undertaken by ERM as part of the ESIA. The ESIA addresses the potential impacts and mitigation of the proposed construction and operation of 10.2 km of new highway and 3.4 km of widening to the existing highway, from Gelephu Town to Tareythang, in Sarpang Dzongkhag, referred to here as "The Project".

This assessment report has been prepared in support of the Project's planning and alignment with the applicable on the Environmental and Social Framework (ESF), Environmental and Social Standards 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6) (2018).

The overall objectives of the assessment are:

- To identify, classify and delineate areas of natural and modified habitat within the Project Impact Area;
- To obtain an understanding of the set of "biodiversity values", if any, that potentially qualify the Project area and surrounding area as 'Critical Habitat' within Area of Analysis (AoA) as per the ESS6;
- To determine whether the Project Impact Area qualifies as Critical Habitat and the implications thereof for the Project; and
- Recommend next steps for the Project where additional actions may be required to achieve No Net Loss (NNL) for Natural Habitat and/or Net Gain (NG) for Critical Habitat (where appropriate) and outline next steps to achieving this.

1.2 PROJECT DESCRIPTION

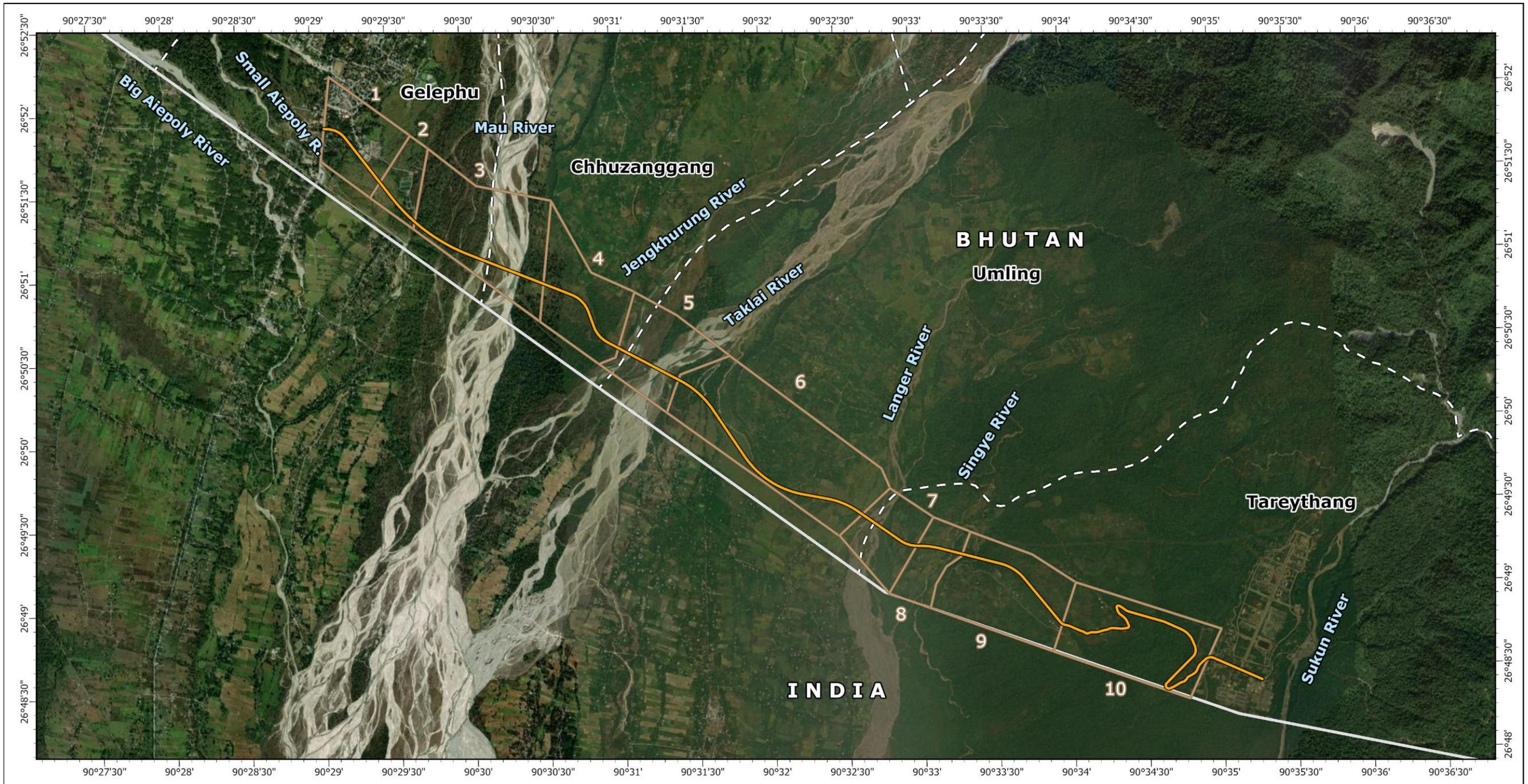
The GT Road would connect western part of Gelephu Town and the eastern part of area in Tareythang that was being developed as Tareythang Gyaksung. It passes through Gelephu Thromde and five (5) Gewogs: Gelephu Gewog, Umling Gewog, Chhuzanggang Gewog, and Tareythang Gewog.

The Project Area includes the proposed road and its Right of Way (ROW). About 3.8 km of the proposed road will be a dual 2-lane highway and 9.8 km will be single carriageway highway with one lane in each direction, with the suitable geometry to be classified as a Primary National Highway. The typical dual carriageway portions with 2 lanes in each direction will have a 40 m wide ROW. The typical single carriageway portions will have a 30 m wide ROW. Towards Tareythang, approximately 3.4 km of the existing road is proposed to be widened to comply with Primary National Highway standard. This will involve widening the existing carriageway from about 5.5 m wide to 7.5 m wide (Figure 1.1).

- The Right-of-Way (ROW) corridor will be wider than the civil works for the highway, to allow a buffer zone at both sides, with the potential for future expansion. The typical dual carriageway portions with 2 lanes in each direction will have a 40 m wide ROW. The typical single carriageway portions will have a 30 m wide ROW.
- **Bridges**: A total of approximately 2.6 km of bridge structures divided over four (4) major bridges namely Mau River Bridge, Jengkhurung River and Taklai River Bridge, Langer River Bridge and Singye River Bridge. Various culverts will be installed.

- **River Training Works:** To control erosion on the riverbanks and limit the extent of flooding, gabion basket walls are proposed upstream and downstream of the highway at the bridges crossing the Mau River, Jengkhurung and Taklai Rivers, and the Langer River.
- **Embankments (with Box Culverts):** used to transition from the at-grade road to the bridge structures. Box culverts will be introduced perpendicular to the highway at regular intervals along the embankment section to allow potential flood water to flow underneath the highway preventing flooding of the highway.
- **Retaining Structures**: Reinforce concrete retaining walls are adopted to minimize the extent of slope works and width of embankment construction as the height of the embankment increases, or the terrain is unfavorable for embankment construction i.e. steeply inclined.
- **Quarry Sites and Borrow Pits**: The construction materials, such as sand, stones, aggregates and fill material will be sourced from the existing government approved and licensed quarry/crushing plants located, which are abundant near Gelephu. The locations of these sites are given in the ESIA Project description (Section 2.5.1).
- **Work Areas**: Two sites, one on each end of the GT Road will be utilized for storage of materials, workshops and other construction support. Contractors will use the work areas for offices, supervision staff offices, equipment storage yard, machine storage and repair workshop. The storage yard will be used for machine storage and repair workshop. It is anticipated that there will be two work areas considering the geographical extent of the Project.
- **Worker camps**: Camps will be located at each of the work areas and developed in compliance with the minimum standards in the WBG ESS-2.

FIGURE 1.1 OVERALL PLAN OF PREFERRED ALIGNMENT



Legend

- Preferred Road Alignment
- Road Segment

Administrative Boundary

- Dzongkhag
- Gewog
- Country Boundary

0 0.5 1 2 km

N

Scale: 1:45,000

Coordinate System: WGS 1984 UTM Zone 45N

Service Credit: Service Credit: Maxar, Esri, © OpenStreetMap contributors, TomTom, Garmin, FAO, NOAA, USGS

Preferred Road Alignment Location

0737107 GMC ESIA Road and Bridges

Date: 25/11/2024

Drawn By: NS
Review By: AW

ERM

1.3 ECOLOGICAL CONTEXT OF THE PROJECT

This section presents a summary of the key biodiversity receptors identified through desk-based study and the baseline biodiversity field surveys undertaken to inform the Project development and ESIA.

A desk-based review of available information on the biodiversity features within the AoA (**Section 2.1.2**) and rapid baseline surveys were undertaken. The following are the key findings:

- The project footprint is predominantly covered by agriculture and forests, with other land-use types occupying much smaller portions, i.e., bare ground, built-up, successional rangeland, and riparian rangeland. While the forest vegetation has experienced minor disturbances, it likely continues to support a variety of species:
    - Dominating much of the northern part of the project area, sub-tropical forests are found at altitudes ranging from 150 to 398 meters. The sub-tropical forests have dense canopy covered with a rich diversity of evergreen and deciduous trees, shrubs, and thick undergrowth, including species such as *Chukrasia tabularis, Acrocarpus fraxinifolius, Ailanthus grandis, Bombax ceiba, Duabanga grandiflora, Shorea robusta, Tetrameles nudiflora*. These forests typically occur in warm, humid conditions and support a wide variety of wildlife, including insects, birds, mammals, and reptiles.
    - Interspersed within the forests and riverbanks, grasslands are composed primarily of tall grasses, such as *Miscanthus, Imperata and Saccharum* species, which are adapted to periodic disturbances like flooding, grazing, and fires. Grasslands are crucial habitats for herbivores as well as predators.
    - Warm broadleaf forests are composed of a mixture of deciduous and evergreen trees, such as *Alangium chinense, Alnus nepalensis, Betula alnoides, Bischofia javanica, Callicarpa arborea, Castanopsis indica, Cordia obliqua, Dendrocalamus hookeri, Dichroa febrifuga, Engelhardia spicata, Entada spp. Helicia nilagirica*. The canopy cover is moderately dense, allowing sufficient light for a diverse understory.
- The project requires developing crossings of the Mau River, Jenkhunrung River, Taklai River, Langer River, and Singye River. Sarpang district has recorded 28 fish species belonging to 11 families.[1] No available research reported the number of macroinvertebrates in Bhutan. There is currently no available research documenting the specific fish species or macroinvertebrates present in the sections of the Mau and Taklai rivers crossed by the project.
- There are 5 Protected Areas within 50 km radius of the project:
    - Ripu and Chirang Reserve Forests (2 km to the Project),
    - Royal Manas National Park (RMNP, <1 km to the Project),
    - Manas Wildlife Sanctuary, India (24 km to the Project),
    - Phibsoo Wildlife Sanctuary (PWS, 30 km to the Project), and
    - Biological Corridor 3 (9 km to the Project).
- There are 5 Key Biodiversity Areas within 50 km radius of the Project:

[1] Available at: Biodiversity Checklist of Sarpang district based on the secondary information 2022. (researchgate.net) Accessed date: Oct 17, 2024

  - Ripu and Chirang Reserve Forests (2 km to the Project),
  - RMNP Important Bird Area (<1 km to the Project),
  - Manas National Park Important Bird Area and Alliance for Zero Extinction (24 km to the Project),
  - PWS Important Bird Area (30 km to the Project), and
  - Sarpang-Gelephu Foothills Important Bird Area (3 km to the Project).
- The southern habitat of GMC, i.e., sub-tropical forests and warm broadleaf forests is contiguous with the RMNP.
- Data extraction using the Integrated Biodiversity Assessment Tool (IBAT) identified 1,687 species as occurring within 50 km of the project area. Of these, there were 17 Critically Endangered (CR), 42 Endangered (EN), 70 Vulnerable (VU), 77 Near Threatened (NT), 1402 Least Concerned (LC), and 79 Data Deficient (DD).
- Consultation with experts in July 2024 suggested that within the AoA there is a high probability of occurrence of 14 species of conservation concern (8 mammals, 2 reptiles, 1 bird, 1 fish, and 2 plants; **Annex G1**)**.**

The terrestrial (July 12 - August 29, 2024) and aquatic baseline (August 5 -8, 2024) surveys yielded the following findings:

- **Flora:** The flora survey found 127 species of trees and shrubs, 69 species of herbs, 59 species of regenerating plants, and 37 species of epiphytes. There are 2 species of conservation concern, i.e., Teak (*Tectona grandis*, IUCN EN) and *Aporosa cardiosperma* (IUCN VU). These 3 species were found in the plot 1 of the Quadrat survey towards Tareythang gewog of the preferred road alignment.[2] Nine (09) plants were identified as invasive species.
- **Birds:** The avifauna survey findings suggest that the study area is relatively diverse in terms of bird species, with a total of 158 bird species recorded. Among these, the presence of Great Hornbill (*Buceros bicornis*, FNCRR[3], IUCN VU, CITES I[4]), Wreathed Hornbill (Rhyticeros undulatus, IUCN VU), River Lapwing (*Vanellus duvaucelii*, FNCRR[5], IUCN NT) and Peregrine Falcon (*Falco peregrinus*, IUCN LC, CITE I[6]) was recorded.
- **Herpetofauna:** the presence of 12 amphibian species and 39 reptile species was recorded, though 4 amphibian species and 5 reptile species could not be identified to the species level. There were 3 species of conservation concern, i.e., Tricarinate Hill Turtle (*Melanochelys tricarinata*, IUCN EN, CITES I[7]), King Cobra (*Ophiophagus hannah*, IUCN VU, CITES II[8]), Burmese Python (*Python bivittatus*, IUCN VU).

[2] The full detail is presented in the ESIA Chapter 7 Biodiversity Baseline.
[3] The Forest and Nature Conservation Rules and Regulations (FNCRR), 2017 of Bhutan
[4] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[5] The Forest and Nature Conservation Rules and Regulations (FNCRR), 2017 of Bhutan
[6] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[7] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[8] Appendix II: Includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

- **Terrestrial mammal:** The camera trap survey and transect survey recorded the presence of 13 mammal species with 6 species only encountered through the camera trap. Among the recorded species, species of conservation significance include:
  - Hog Deer (*Axis porcinus*, IUCN EN),
  - Dhole (Cuon alpinus, IUCN EN),
  - Asian Elephant (*Elephas maximus*, IUCN EN),
  - Bengal Tiger (*Panthera tigris ssp. Tigris*, EN),
  - Gee's Golden Langur (*Trachypithecus geei*, IUCN EN and endemic to Bhutan),
  - Gaur (*Bos gaurus*, IUCN VU),
  - Sambar (*Rusa unicolor*, IUCN VU), and
  - Smooth-coated Otter (*Lutrogale perspicillata*, IUCN VU).
- **Fish:** Fish diversity recorded a total of 32 species with 29 species in Mau river and 24 species in Taklai river. Two IUCN VU species were found, i.e., Reticulated Loach (*Schistura reticulofasciata*) and Mrigal Carp (*Cirrhinus cirrhosus*) but Mrigal Carp is considered invasive in Bhutan.
- **Macroinvertebrate:** A total of 11 families under 9 orders waere recorded. Among these, the presence of Mayfly fauna e.g., *Baetis spp.* indicated a clean freshwater condition.

2. APPROACH TO THE CRITICAL HABITAT ASSESSMENT

This Critical Habitat Assessment (CHA) has been conducted against the ESS6 critical habitat criteria. The five criteria are:

(a) Habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches.

(b) Habitat of significant importance to endemic or restricted range species;

(c) Habitat supporting globally or nationally significant concentrations of migratory or congregatory species;

(d) Highly threatened or unique ecosystems; and

(e) Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

The approach to CHA follows a method developed with the South Asia Region specifically for the above critical habitat criteria. The assessment is applied to a Terrestrial Area of Analysis (AoA) and an Aquatic AoA (see Section 2.1 of this Appendix H) that extend beyond the Project Area of Impact. 2.1The CHA approach comprises the following four steps:

1. Step 1. Generation of list of threatened, migratory, range-restricted and congregatory species using the International Biodiversity Assessment Tool (IBAT) and complemented by the field survey data, stakeholder engagement results and based on local/ national databases (Section 3.1 of this Appendix H).

2. Step 2: Screening of the species (identified in Step 1) based on their confirmed presence (as determined by field surveys, expert opinion and desktop research) and likelihood of occurrence (LoO) within the AoA. Species determined as "Out of Range (OOR)" or "Habitat Not Suitable (HNS)" were screened out (Annex G2 of this Appendix H).

3. Step 3: Evaluation of species (identified in Step 2) against the ESS6 criteria based on data on a species' population size, extent of occurrence and habitat requirements, as supplemented with data from field surveys, stakeholder engagements, national, global IUCN Red Lists and other academic journals (Annex G2 of this Appendix H). Six guidelines listed in the following box are used to assess each species against the five critical habitat criteria.

Guidelines for the Step 3 Assessment of each species/feature against the ESS6 Critical Habitat Criteria

i. Recognized areas of high biodiversity value (such as legally protected areas, KBA, IBA, Alliance for Zero Extinction (AZE) sites, Ramsar Wetlands of International Importance, World Heritage Natural Sites amongst others) and importantly the reasons for which they are designated can provide useful indicators of potential critical habitat.
ii. ESS6 Criterion (a) requires an assessment against both global (IUCN) and national red list ratings. ESS6 footnote 13 states that where the threatened status of a species is listed differently on the (global) IUCN Red List and national/regional lists, assessment of the impact of net reduction should be based on the national/regional population. This is interpreted as a requirement to follow a precautionary approach and to prioritize assessment of species reduction (project impact) to the smaller species population (i.e. the national assessment) over the global assessment.

iii. By definition, Critically Endangered (CR) species face an extremely high risk of extinction and their continued survival in the wild is in a critical state. Therefore, if a surviving population of a CR species is present in the critical habitat AoA, the habitat should be considered to have significant importance for the species under ESS6 Criterion (a).

iv. Where a significant proportion of the national, regional or global population of a species has a likely presence within the AoA, the habitat is considered to have significant importance for the species under ESS6 Criterion (a), (b) or (c). An understanding of habitat conditions is necessary as a basis to assess the likelihood of occurrence.

The measurement of a significant proportion of a population should be determined on a project-by-project basis and should be commensurate with the critical habitat AoA (i.e. projects with a very large footprint may apply a different measure of significance to projects with a small footprint). A ±1% threshold of the global or national population has been applied to this CHA.

v. ESS6 Criterion (b) can additionally be achieved for range-restricted species where the full extent of the critical habitat AoA overlaps a significant proportion (as above) of a species' distribution range.

vi. ESS6 Criteria (d) and (e) are to be assessed on a case-by-case basis using specialist input and reliable data sources with consideration given to the presence of conservation initiatives, legally protected areas and internationally or regionally recognized areas of high biodiversity value and the reasons for which they are designated.

4. Step 4: Assessment of relevance of and impacts to Critical Habitat features, including identification of requirements for Net Gain and associated strategy/ mitigation to feed into the design and embedded mitigation stage to align with the mitigation hierarchy for impact minimization (Section 10 of the ESIA).[9]

2.1 AREA OF ASSESSMENT

2.1.1 PROJECT IMPACT AREA

In addition to direct habitat loss and fragmentation from land clearing, habitat degradation and disturbance to terrestrial wildlife due to air emissions and noise may occur locally and extend beyond the immediate Project area. Although baseline surveys covered a larger landscape, the designated Impact Area for terrestrial species and habitats is confined to within 550 m of the road and bridge alignments. This distance is based on noise modeling results, which identified the primary zone of wildlife disturbance within a 550 m radius.

The main impacts on aquatic species and habitats can be associated with the bridge and road construction. These construction and operational activities can cause erosion, sedimentation, water quality degradation, and alterations in natural water flow. The designated Impact Area for aquatic species and habitats includes both upstream and downstream sections of the Project, as silt and contaminants are likely to travel downstream, and aquatic species are expected to migrate in both directions. This designation of the Impact Area considered the impact on hydrology and water quality.

2.1.2 AREA OF ANALYSIS (AOA)

As per ESS6*, the assessment undertaken by the Borrower will include identification of the types of habitats potentially affected and consideration of potential risks to and impacts on the*

[9] The Net Gain strategy shall be included and described within the Biodiversity Management Plan (Net Gain).

ecological function of the habitats. The Borrower's assessment will include characterization of baseline conditions to a degree that is proportional and specific to the anticipated risk and significance of impacts.[5] The following scientific approach was used to define the Project's Area of Analysis (AoA):

- Inclusion of areas where cumulative impacts to biodiversity are envisaged to be significant, typically beyond the Area of Impact (AoI).
- Commensurate with the scale of relevant practical conservation management activities
- Inclusion of wider distributions of potentially affected biodiversity features and the ecological patterns, processes, and functions that are necessary for maintaining them throughout this distribution.

2.1.2.1 TERRESTRIAL AOA

The terrestrial AoA (**Figure 2.1**) was defined to encompass the terrestrial area surrounding the Project's Impact Area, except where it was limited by natural and man-made barriers that restrict the movement of non-volant terrestrial species. Specifically, to the south and southeast, the AoA includes the subtropical forest, extending to the contiguous forests connected to the RMNP, and the Sarpang-Gelephu Foothills and Biological Corridor 3. The preferred habitat supporting potentially triggering Critical Habitat species, as identified in the Critical Habitat Screening (dated August 30, 2024), especially the Asian Elephant and Gee's Golden Langur, is examined during the terrestrial AoA delineation. While Asian Elephant is generalist, adaptable to a wide range of habitats, Gee's Golden Langur can be found in tropical forest or broad leaf forest with the dense canopy cover. An elevation of 500 meters[10] was used as a boundary for the terrestrial AoA, as certain species of conservation concern, i.e., Asian Elephant in the area are typically found at lower elevations up to 500m.[11] In the east, there is an existing road and hence, the proposed construction will leverage on the existing ROW, which will be widened to a double lane, which has also been considered in the AoA delineation. Further, it was understood from the visit and engagement with DoFPS that the development of the to the Tarethang Gaylsung centre has resulted in some fragmentation to the elephant movement and hence, the existing movement route has been altered to a pathway immediately north of the centre, which has been included in the AoA.

To the west, the Project's Impact Area covers agricultural land, rangeland, and subtropical forest. The terrestrial AoA was extended to this region to include connected habitats considering the movement of the Asian Elephant, a species of conservation value observed within the Project Area during the field survey (July - August 2024). Specifically, the tracked movements of the collared "Jetsun" elephant indicated that Asian Elephants travel to Umling Province, adjacent to Manas National Park, and as far west as PWS, traversing various land cover types.[12] Therefore, the western area, including agricultural land, rangeland, and subtropical forest, was included into the terrestrial AoA.

The south of the road alignment includes some barren land, riverbanks and agricultural land. Based on stakeholder engagements, it is understood that the elephants traverse these locations

[10] Palei, H. S., Jangid, A. K., Hanumant, D. D., Palei, N. C., & Mishra, A. K. (2024). On the elephant trails: habitat suitability and connectivity for Asian elephants in eastern Indian landscape. *PeerJ*, *12*, e16746.
[11] Sharma, P., Panthi, S., Yadav, S. K., Bhatta, M., Karki, A., Duncan, T., Poudel, M., & Acharya, K. P. (2020). Suitable habitat of wild Asian elephant in Western Terai of Nepal. *Ecology and Evolution*, *10*(12), 6112–6119. https://doi.org/10.1002/ece3.6356.
[12] Department of Forestry and Park Services. Bhutan Elephant Corridor Project.

in search of food. At time of writing, the AoA to the direction has been limited to a 1 km radius, accounting for potential impacts from the road development within the larger landscape context.

2.1.2.2 AQUATIC AOA

The aquatic AoA was delineated along both the Mau River and Taklai River, encompassing both upstream and downstream sections, including the areas before they merge with branches of other rivers (**Figure 2.2**). The main impact can be associated with the bridge and road construction and associated run off, erosion, siltation etc. During the seasons when the rivers have water e.g., during the monsoon, species such as Golden Mahseer migrate, and a siltation could impede its migration to spawning sites upstream at least temporarily. Therefore, the aquatic AoA includes the zone where siltation plumes are perhaps quite intense and any spawning and foraging sites within these plumes as well upstream of these where access could be impeded. Lower order streams are preferred spawning sites.[13] It is understood that during the dry season, the channel dries up considerably, with limited water flow. The delineation of the AoA has also taken into consideration the different habitat niches along the water body which may be utilized by the local fish, such as:

- Smaller hill streams/ riverbeds, most preferred spawning sites;
- Deep waters;
- Run habitats;
- Backwater pools;
- Secondary channels;
- Areas with large boulders, pebbles and gravel.

[13] Shahi, et al., 2014. Golden mahseer, *Tor putitora* - a possible candidate species for hill aquaculture. Research and Farming Techniques Volume XIX No. 2, April-June 2014 [Available at: https://enaca.org/publications/magazine/2014/aquaculture-asia-magazine-april-june-2014.pdf#page=23]

FIGURE 2.1 TERRESTRIAL AREA OF ANALYSIS

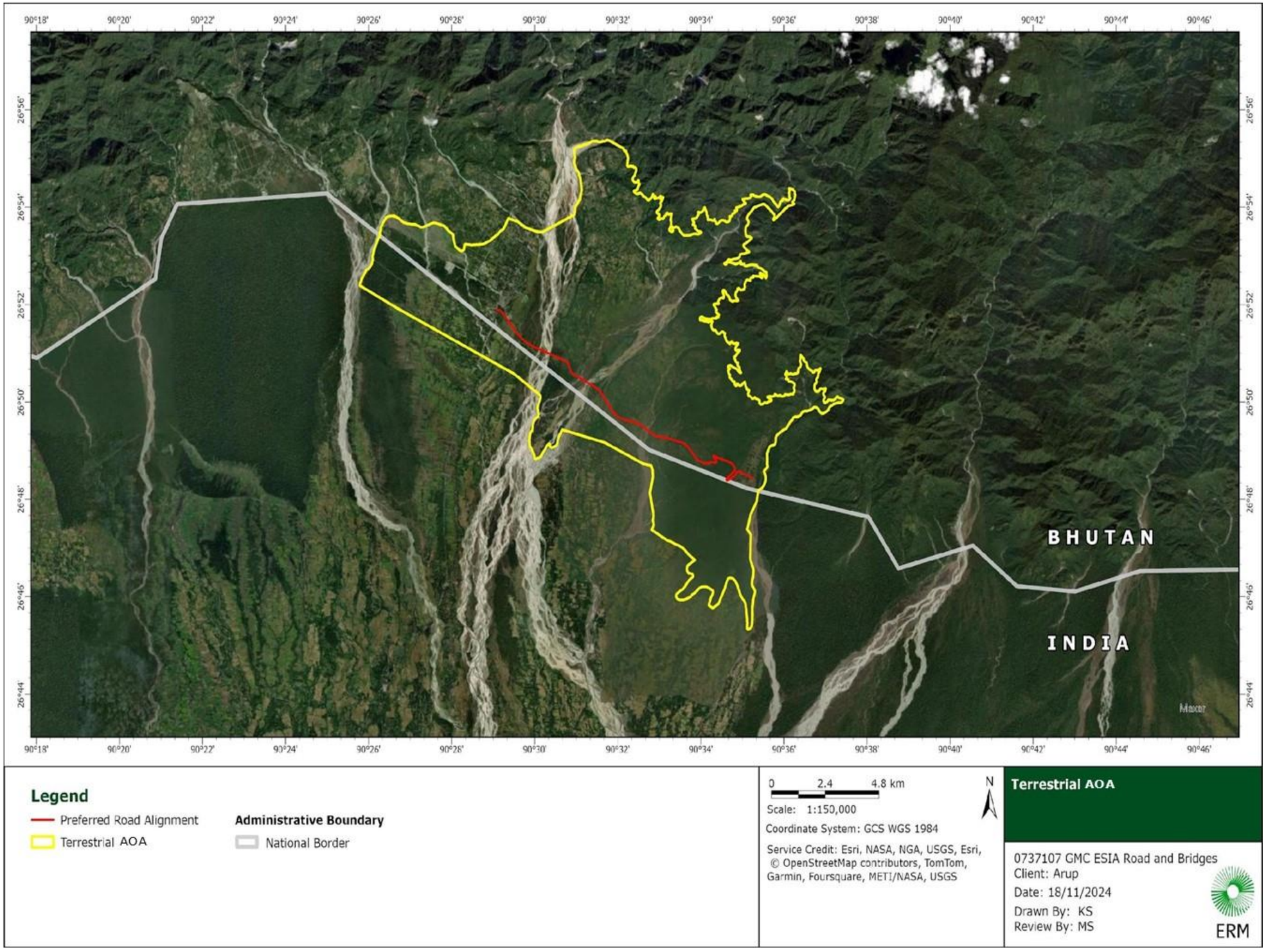
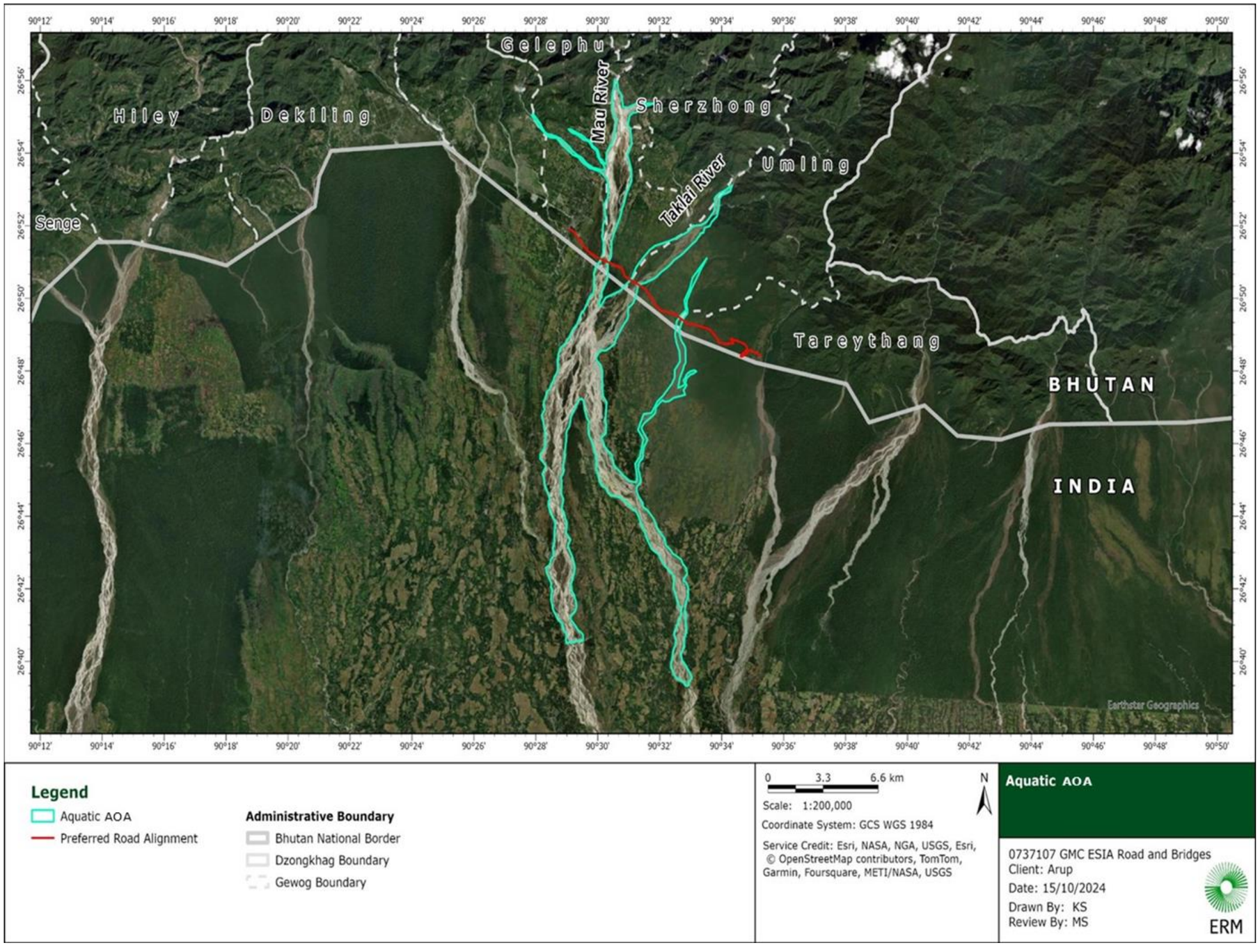


FIGURE 2.2 AQUATIC AREA OF ANALYSIS



2.2 KEY DATA REVIEW AND ANALYSIS

A desk-based review of available information on the biodiversity features within the AOAs was undertaken to inform the CHA. This included a review of global biodiversity datasets, project-specific biodiversity information, and published and publicly available information (as needed).

A list of biodiversity features (i.e. species, KBAs, and PAs), potentially present in the AOAs was compiled from a spatial analysis of global datasets available through the Integrated Biodiversity Assessment Tool (IBAT), which draws from the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, KBAs, and the World Database on Protected Areas (covering nationally and internationally recognized sites, including IUCN management categories I-VI, Ramsar Wetlands of International Importance and World Heritage sites). This was supplemented by a review of the Bhutanese biodiversity databases and frameworks such as the Forest and Nature Conservation Act 2023, Forest and Nature Conservation Rules and Regulations of Bhutan 2023 and Biodiversity Act of Bhutan 2022.

Project biodiversity information was also reviewed to support the identification of biodiversity that may qualify the area as critical habitat and/ or natural habitat. This included the following sources of information:

- Expert consultation (July 2024),
- Terrestrial flora and fauna survey (July 12 - August 29, 2024), and
- Aquatic fauna survey (August 5 -8, 2024).

The terrestrial and aquatic baseline field surveys were used to verify the presence, distribution and/or abundance of the potential high priority species that were initially screened based on desk-based information and professional knowledge. The field surveys were designed to target the potential high priority species in order to validate findings from desk-based analysis and identify any additional biodiversity features likely to qualify areas as critical habitat.

2.3 HABITATS WITHIN THE AOAS

Table 2.1 summarizes the extent of habitat types within the AOAs and the Project boundary in 2023, and Figure 2.3, Figure 2.4 and Figure 2.5 displays the extent and distribution of habitats within the Project Impact Area and the Project AOAs.

The Project footprint, Project's Impact Area and the terrestrial AoA are predominantly covered by agriculture and forests, with other land-use types occupying much smaller portions, i.e., bare ground, built-up, successional rangeland, and riparian rangeland. Anthropogenic impacts in the region are considered pervasive, in the form of urbanization. This has led to extreme fragmentation of the land, with agriculture and human settlements interspersed with areas of rangeland.

The western forest contiguous with PWS and southern forest contiguous with RMNP have experienced disturbances but continue to support a variety of species. In the western forest of GMC, there were records of Gee's Gloden Langur and Asian Elephant. Species of conservation concern found in the southern forest of the Project includes King Cobra, Great Hornbill, Wreathed Hornbill, Gee's Golden Langur, Southern Red Muntjac, Leopard, Tiger, and Asian Elephant (**ESIA Section 7 - Biodiversity Baseline**). In addition, other species of conservation concern were observed including Dhole, and Asian Elephant which are generalist, adapting to various types of habitats including modified habitat within the AOAs.

TABLE 2.1 LAND COVER AND NATURAL/ MODIFIED HABITAT CALCULATION

	Land Cover	Project footprint (carriageway) (km^2)	Camp Area (km^2)	Work Area (km^2)	Project Impact Area (550 m from the GMC) (km^2)	Terrestrial AoA (km^2)	Aquatic AoA (km^2)
1	Agriculture	0.06	-	-	4.28	27.42	Not applicable
2	Bare Ground	0.01	-	-	0.53	4.86	Not applicable
3	Built-up	0.02	0.03	0.04	1.89	12.99	Not applicable
4	Successional Rangeland	0.03	0.01	0.02	2.08	7.53	Not applicable
5	Forest	0.06	-	-	5.77	70.24	Not applicable
6	Riparian Rangeland	0.01	-	-	0.82	6.56	Not applicable as partially counted in the terrestrial AoA
7	Water	Not applicable	-	-	0.15	Not applicable	71.4
Total		**0.19**	**0.04**	**0.06**	**15.53**	**129.60**	**71.4**

FIGURE 2.3 HABITAT TYPES WITHIN THE PROJECT IMPACT AREA

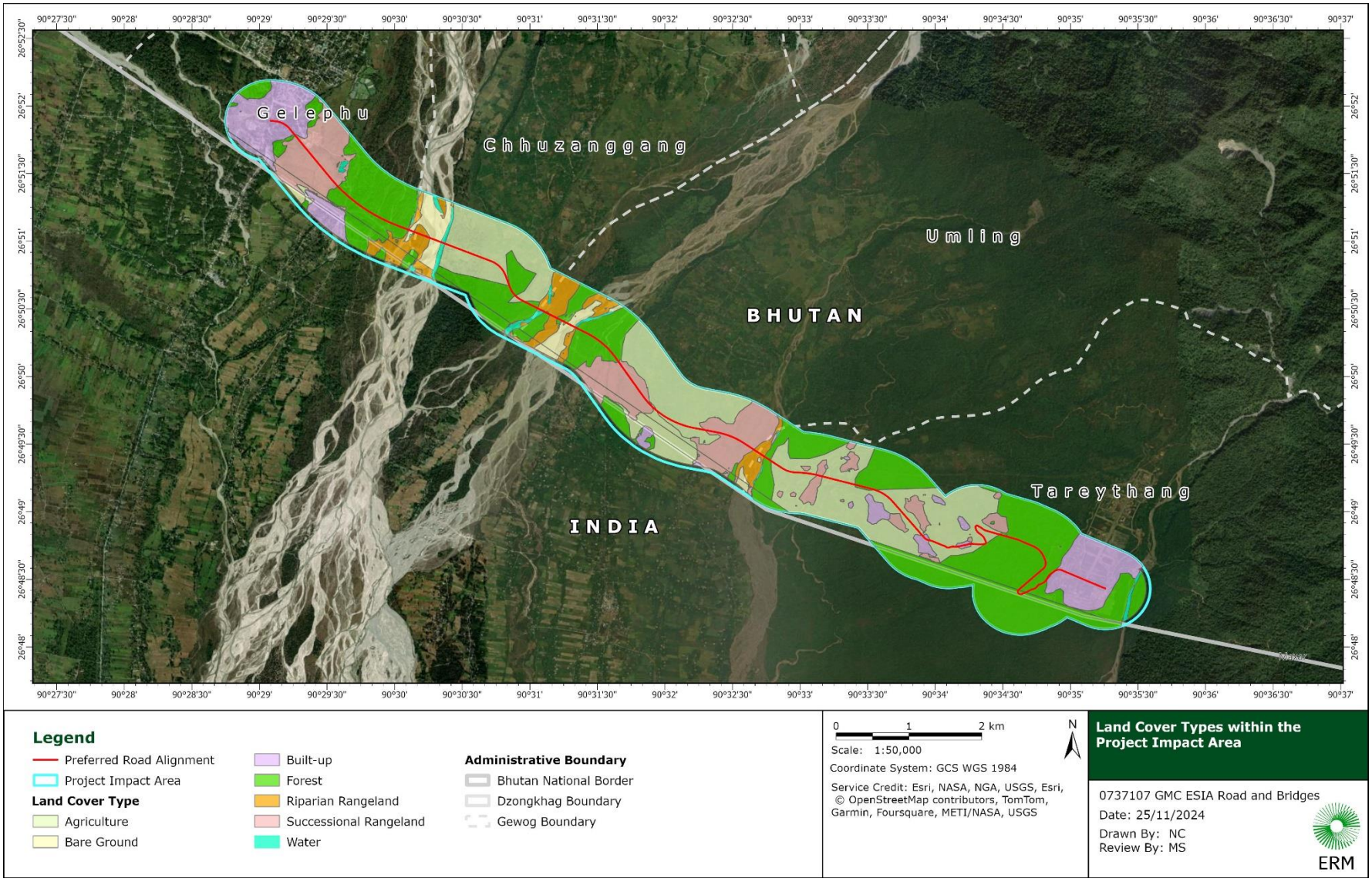


FIGURE 2.4 LAND COVER WITHIN THE TERRESTRIAL AOA

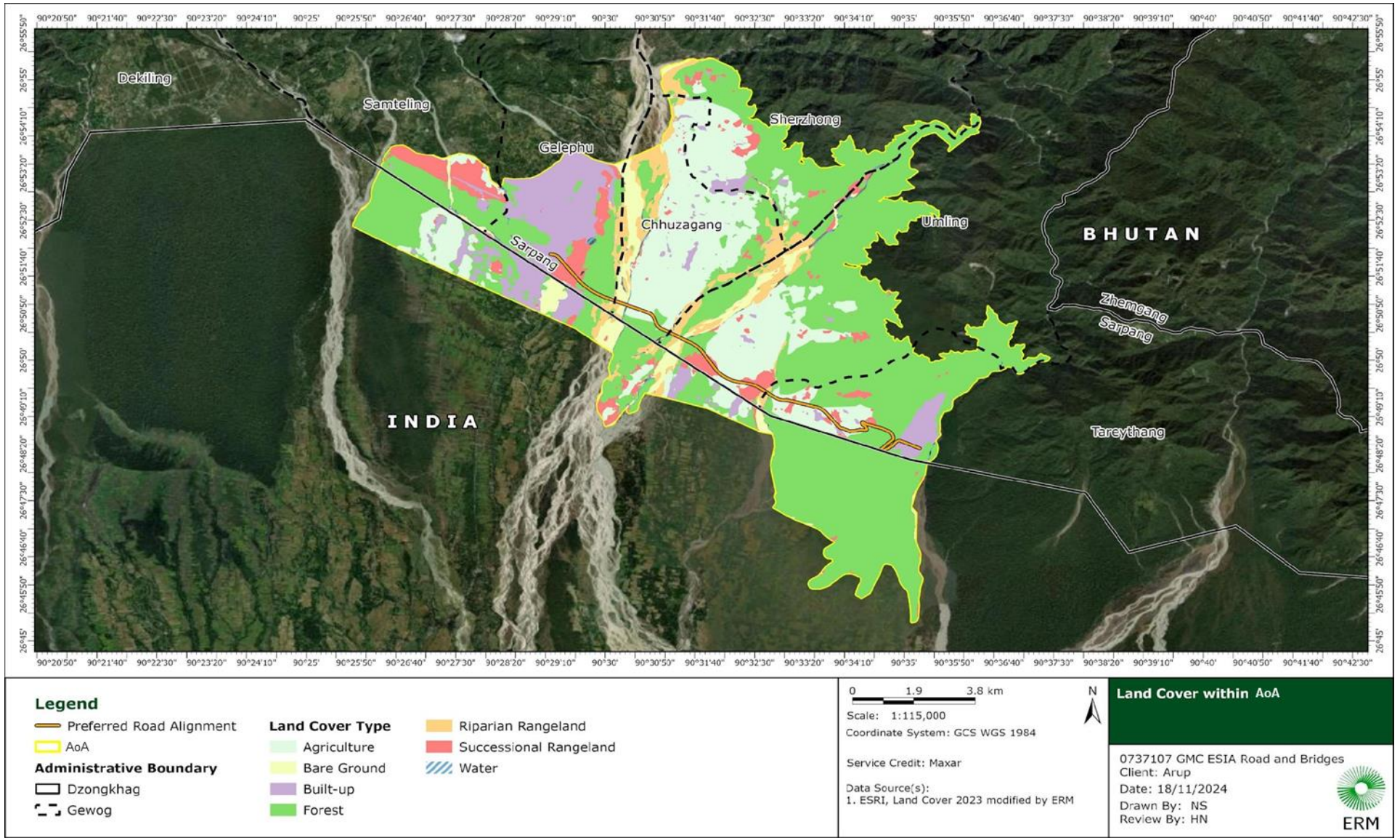
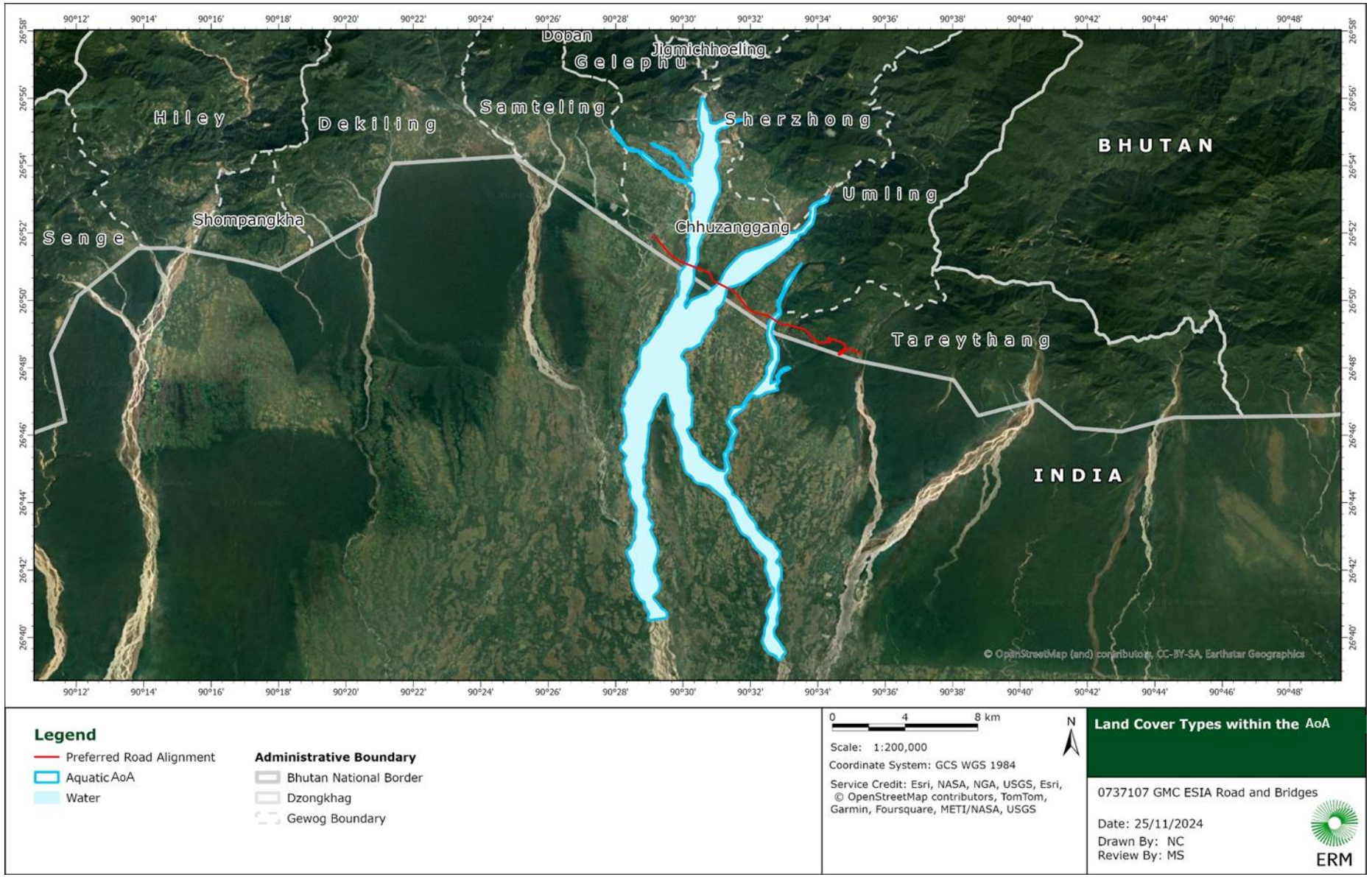


FIGURE 2.5 LAND COVER WITHIN THE AQUATIC AOA



3. FINDINGS OF THE CRITICAL HABITAT ASSESSMENT

3.1 STEP 1: IDENTIFICATION OF SPECIES

The IBAT[14] database was used to identify potential Critical Habitat species within the AoA (as per ESS6 criteria (a), (b), and (c) listed in Section 2). IBAT presents a list of species potentially occurring within a 50 km radius from the six phases of the GMC.

Additionally, a total of 160 species found during the terrestrial flora and fauna (July 12 - August 29, 2024) and aquatic fauna (August 5 -8, 2024) surveys but not included in the IBAT screening, were taken into consideration. Table 3.1 shows the number of species considered for the CHA arranged by taxa.

TABLE 3.1 SUMMARY OF IBAT RESULTS

Feature			Number of Species
Total Number of Species			1,816
a	Plants		343
b	Fungi		2
c	Fauna		
	1	Birds	720
	2	Ray-finned fish	100
	3	Reptiles	138
	4	Mammals	155
	5	Insects	140
	6	Snails and slugs	77
	7	Amphibians	22
	8	Crustaceans	29
	9	Spiders, scorpions, and mites	3
	10	Bivalves	47

The initial screening indicates a large number of candidate critical habitat species that are CR, EN species and/ or national conservation concern and/ or endemic / restricted-range species and/ or migratory species.

3.2 STEP 2: SPECIES AND HABITAT SCREENING

Based on the species list, a screening was conducted to identify the likelihood of occurrence (LoO) of these species based on an understanding of habitat requirements and distribution range, which also accounts for findings from the baseline survey and expert consultations.

To trigger Critical Habitat, the Project AoA must contain habitat supporting/ sustaining significant populations of species of conservation significance, endemic, restricted range, congregatory or

[14] IBAT PS6 & ESS6 Report. Generated under licence 35468-63735 from the Integrated Biodiversity Assessment Tool on 09 May 2024 (GMT). www.ibat-alliance.org

migratory (**Error! Reference source not found.**). Given this requirement, the following species were also excluded from further consideration:

- IUCN Near Threatened (NT) and Least Concern (LC) under Criterion (a) as these species are normally widespread with large populations; thus, it is highly unlikely that the Project AoA contains significant populations when comparing their extensive Extent of Occurrence (EoO) to the relatively small size of the project's AoA.
- IUCN Least Concern (LC) under Criterion (c) as these species typically have large global populations and wide geographic distributions. When comparing their extensive Extent of Occurrence (EoO) to the relatively small size of the project's AoA, it is highly unlikely that the area could support significant global population of any migratory or congregatory LC species at any stage of their lifecycle.

The results are summarized in Table 3.2 and further described in **Annex G2**, based on the following LoO categories:

- **Present:** Species recorded during field surveys or reported present by informed stakeholders
- **Possible LoO:** Species that are within range and habitats within the critical habitat AoA have the potential (or future potential) to support the species
- **Unlikely LoO:** Species that is out of range or dominant features of the habitats within the critical habitat AoA render the area not suitable to support the species
- **Not Present:** Species that is far out of range and/or habitats are not suitable to support the species.

TABLE 3.2 LIKELIHOOD OF OCCURRENCE OF SPECIES

LoO Category	No. of Species							
	Mammals	Amphibians	Birds	Reptiles	Flora	Fish	Crustaceans	Insects
Present	9	0	2	3	3	2	0	0
Possible LoO	19	6	22	11	11	5	1	1
Unlikely LoO	8	2	2	9	9	14	2	2
Not Present	0	3	1	2	3	0	1	0

3.3 STEP 3: CRITICAL HABITAT STATUS

3.3.1 ESS6 CRITERIA (A), (B) AND (C)

Based on the CHA method, the species under LoO categories of "Present" and "Possible LoO" were assessed further to determine if these meet the Critical Habitat criteria. The justifications are described in **Annex G2** and the Project AoA is considered to contain Critical Habitat for four (4) species:

- Asian Elephant (*Elephas maximus* IUCN EN).
- Gee's Golden Langur (*Trachypithecus geei*, IUCN EN).
- Bengal Tiger (*Panthera tigris*, IUCN EN)

- *Hoya bhutanica* (IUCN EN)

Various other Endangered species occur (such as Dhole, Hog Deer, and Tricarnate Hill Turtle) but the AoA is not considered a habitat of significant importance for these species. Additional information from monitoring and future surveys may refine this assessment and potentially lead to a trigger or non-trigger status for these species.

3.3.2 ESS6 CRITERION (D)

The Project AoA includes PWS, Biodiversity Corridor #3 and RMNP, these protected areas located in the west, north and east of AoA, respectively. PWS is classified as an IUCN Management Category IV and Biodiversity Corridor 3 is classified as an IUCN Management Category VI.

RMNP is classified as an IUCN Management Category II, which is defined as *large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities*.[15]

The habitats within these protected areas are similar to those found in other parts of the Brahmaputra Valley Semi-Evergreen Forests Ecoregion, particularly on the northern bank of the Brahmaputra River, and are not considered to qualify against critical habitat criterion (d).

3.3.3 ESS6 CRITERION (E)

The ESS6 describes this Criterion (e) as Ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d). The existing habitat within the AoA help retain functional, southern terrestrial ecological connections between PWS and RMNP as well as habitats immediately south of the Bhutanese-India border (especially India's Manas National Park). Functional terrestrial ecological connection between PWS and RMNP is also to lesser extent, supported by habitats in the northern project along the Bhutanese Himalayan foothills that includes the formally recognized "Northern Biodiversity Corridor" (Corridor 3) that roughly parallels the elevation contours from 329–2,647 masl.[16] Species of conservation concern found within the Project area and its proximity are generalists, e.g., Dhole, Tiger, Hog deer, Gaur, Leopard, Samba, and Tricarinate Hill Turtle that can use Corridor 3 alternative for its movement. Species less inclined to use steep, higher elevation terrain associated with Biological Corridor 3 (e.g., Asian Elephant) may be more adversely affected by the loss of connectivity. Additionally, the Mau and Taklai Rivers serve as natural barriers to species movement on either side of the rivers, except between October and May when the rivers dry up. In conclusion, the GMC and its surrounding areas do not provide critical ecological functions that support the movement of Asian elephants, thereby triggering the designation of Critical Habitat.

3.4 STEP 4: IDENTIFICATION OF CRITICAL HABITATS RELEVANT TO THE PROJECT

Based on the Critical Habitat status identified in Step 3, the four (4) species were assessed further to determine relevance to the Project (Table 3.3). This analysis revealed that only Asian Elephant and Gee's Golden Langur are likely to be significantly impacted and require Net Gain measures to be considered. Impacts to these species associated with the road can be mitigated

[15] Dudley, N. (Ed.). (2008). Guidelines for applying protected area management categories. IUCN.
[16] Bhutan Biodiversity Portal. Available at: Biological Corridor 3 (biodiversity.bt) Accessed date: Oct 10, 2024

through provision of wildlife crossings, and alignment to ESS6 requirements is feasible. Application of mitigation measures and the achievement of net gain outcomes is addressed in the Project BMP.

TABLE 3.3 PROJECT RELEVANCE OF FOUR ENDANGERED SPECIES

Species and Relevance
Asian Elephant (*Elephas maximus*) During the transect survey, there were 2 direct sightings, the first encountered a herd of 12 elephants with 6 females, 3 males and 3 juveniles; and the second encountered a herd of 25 elephants with 16 females, 3 males and 6 juveniles. In addition to direct sightings, evidence of Asian Elephants' occurrence such as droppings, feeding signs, tracks, and scrapes suggested the species' presence in different types of habitats within the GMC, i.e., farmland, grassland, and sub-tropical. DoFPS estimate over 100 elephant are present in the Project area. The Project supports the habitat of at least 6.12% of the National population, which is significant and the Project AoA qualifies as a critical habitat for Asian Elephants. A desktop review of movement data for two elephants, "Jetsun" and "Dema" indicated that the GMC area is utilized as elephant corridors. As such, the loss of GMC and its vicinity can result in elephants to alter their movement routes. See Section 3.4.1.1.
Gee's Golden Langur (*Trachypithecus geei*). During the transect survey, Gee's Golden Langur were recorded in the sub-tropical region within the GMC. It is estimated that at least 23 - 93 individuals of Golden Langur were found within the AoA, accounting for (i) 0.35% - 1.55% of the global population and (ii) 1.7% of the National population. The Project AoA supports significant population of this Endangered and restricted-range species. Genetic diversity and structural issues among isolated populations of the Gee's Golden Langur in Assam, India have been recorded, indicating that gene isolation can be the most extreme consequence among population fragments, which leads to local extinction. Habita fragmentation as a result of the project development can exacerbate gene isolation effects. See Section 3.4.1.2.
Bengal Tiger (*Panthera tigris*) The 2021 – 2022 National Tiger Survey for Bhutan estimated 131 tigers nationwide, with an estimated 90 adult tigers (60 females) and a mean density of 0.23 adult tigers per 100 km² in the mountainous terrain of Bhutan. The RMNP supports a Bengal Tiger population, and these cats are known to regularly occur in the nearby Biological Corridor #3. Field transect surveys recorded evidence of a tiger towards the southeast end of the GT Road close to the RMNP, but DoFPS camera trapping surveys did not detect tigers in the area. DoFPS staff have stated that tigers currently do not present a concern for human wildlife conflict in Gelephu and surrounding gewogs. Expert consultations and previous research conducted by the Ugyen Wangchuk Institute for Conservation and Environment Research (UWICER) of Bhutan, reveals tigers in Bhutan are typically found in higher elevations. Also the future presence of tigers is considered incompatible with development of the GMC. Based on this Step 4 assessment, Bengal tigers are not likely to be significantly impacted net gain measures are not necessary for alignment to ESS6 requirements.
Hoya bhutanica The potential presence of *Hoya bhutanica* was identified as part of the desktop assessment (as per the Bhutan Endemic Flowering Plants Workshop and IUCN database) and expert consultation. However, the following were noted: • It was not recorded during the baseline survey which covered the road alignment and a 750m buffer zone. • It was previously reported in (i) Gelephu (Sarpang district) and (ii) Mondokha, Dungna-Metakha (tri-junction), Gedu (Chukha district). • The previous record within Gelephu was reported approximately 1.65 km north of the Project RoW, which is beyond the Project Impact Area, as well as the identified lands to be cleared as part of the Project development. There is no evidence that this plant will be significantly impacted and net gain measures are not necessary for alignment to ESS6 requirements. As a precautionary approach, the BMP has included mitigation to confirm no species of conservation significance are present within the working areas.

Species and Relevance
If any are present, these shall be translocated to a suitable area. Hence, it is not envisaged that the project activities will result in adverse impacts to the species.

3.4.1.1 ASIAN ELEPHANT

Asian Elephant (*Elephas maximus*, FNCA[17], FNCRR, IUCN EN, CITES I[18]) is distributed in 13 countries across South Asia and South East Asia spread over an area of 486,800 km^2.[19,20] Asian Elephant are generalists and feed on a variety of plants, which vary depending upon the habitat and season.[21] Estimated populations is about 48,323–51,680 in the wild and 15,000 in captivity.[22]

Under the Forest and Nature Conservation Act of 1995 of Bhutan, the species is classified as a "totally protected species," meaning any harm to elephants is subject to severe penalties, including imprisonment and fines.[23] The legal framework in Bhutan also supports the conservation of elephant habitats through the establishment of protected areas and wildlife corridors, which are critical for maintaining the ecological connectivity essential for the survival of the species.

Movement

Role of the AoA in promoting dispersal across the Asian Elephant is distributed throughout the southern belt of Bhutan along the border with India (Samtse, Chhukha, Dagana, PWS, Sarpang, RMNP, Samdrup Jongkhar, Jomotshangkha Wildlife Sanctuary, Chirang Ripu RF, and the Manas National Park); elevation ranging between 100 m to above 2000 m (Nature Conservation Division, 2018).[24] Site visits and expert consultations suggest that elephants are attracted to the foothills of Gelephu City due to the presence of salt licks and bamboo shoots. Asian Elephants utilize the Project area and its proximity for its movement between PWS and Manas National Park (Figure 3.3). Elephants migrate primarily to access seasonal resources such as food and water, avoid human conflict, and maintain traditional social and ecological behaviors. The dispersal of male elephant is critical for its reproduction.[25] Specifically, this helps in avoiding inbreeding and is critical for gene flow through the population.

[17] Royal Government of Bhutan. Forest and Nature Conservation Act 1995. Available at: https://faolex.fao.org/docs/pdf/bhu7101.pdf
[18] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[19] Menon, V., & Tiwari, S. K. (2019). Population status of Asian elephants Elephas maximus and key threats. *International Zoo Yearbook*, *53*(1), 17-30.
[20] TANDIN, T., LETRO, L. & ZAM, T. (2019): Elephant conservation action plan for Bhutan, 2018–2028. Thimphu: Nature Conservation Division, Department of Forests & Park Services
[21] Williams, C., Tiwari, S.K., Goswami, V.R., de Silva, S., Kumar, A., Baskaran, N., Yoganand, K. & Menon, V. 2020. *Elephas maximus*. *The IUCN Red List of Threatened Species* 2020: e.T7140A45818198. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T7140A45818198.en. Accessed on 30 September 2024.
[22] Menon, V., & Tiwari, S. K. (2019). Population status of Asian elephants Elephas maximus and key threats. *International Zoo Yearbook*, *53*(1), 17-30.
[23] Royal Government of Bhutan. Forest and Nature Conservation Act 1995. Available at: https://faolex.fao.org/docs/pdf/bhu7101.pdf
[24] Pla-Ard, M., Sukmasuang, R., & Srinopawan, K. (2019). Population characteristics and habitat suitability of Asian elephants (Elephas maximus Linnaeus, 1758) in the Khao Yai National Park, Thailand. *European Journal of Ecology*, *5*(2), 62-71.
[25] Convention on Migratory Species. Available at: cms_cop13_doc.27.1.1_proposal-inclusion-asian-elephant_india_e.pdf Accessed date Oct 28, 2024

A desktop review of available data on the movements of two individual elephants, "Jetsun" and "Dema,"[26] revealed that they utilized different geographic areas and did not share the same locations, even across different months. For this assessment, 'Jetsun' movements were assessed as her movements included the GMC and its surrounding areas. 'Jetsun' was observed reaching the boundary of Umling province, adjacent to Manas National Park (Figure 3.1, Figure 3.2), and travelling as far west as PWS. The elephant visited this sanctuary in the first half of 2015 and again in the second quarter of 2016, indicating that she consistently remained in forested or shrubland areas. The loss of GMC and its vicinity can result in elephants to alter their movement routes. There are no records of elephants using "Northern Biodiversity Corridor" or Biological Corridor 3 (329–2,647 masl). Additionally, the research shows a negative correlation between elephant abundance and elevation,[27] thus the elephant may be hindered using Biological Corridor 3 as an alternative.

At the time of this report, it is planned that the area to the north of the Project within the AoA will be maintained as an elephant corridor to support adequate dispersals of elephants (Figure 3.3). Therefore, the AoA is important for maintaining habitat connectivity across the landscape spanning the western forest areas in India and Bhutan with the eastern forest areas largely comprising of the Royal Manas and Manas National Park.

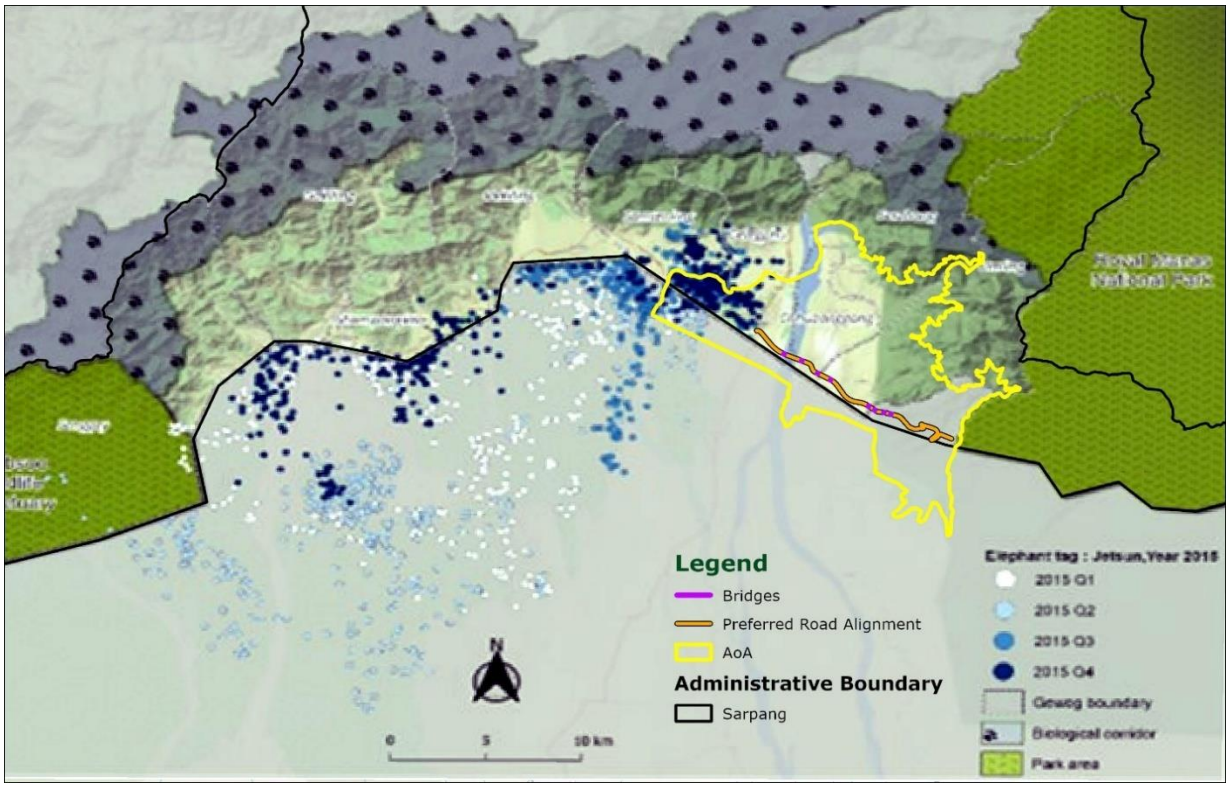


FIGURE 3.1 HOURLY DATA-POINTS FOR RADIO-COLLARED ADULT FEMALE ASIAN ELEPHANT "JETSUN" PER QUARTER IN 2015

[26] Department of Forestry and Park Services.
[27] National Elephant Survey Report (2018). Bhutan Trust Fund. Available at: 1705405524National-Elephant-Survey-Report-DoFPS.pdf (bhutantrustfund.bt) Accessed date: Oct 1, 2024

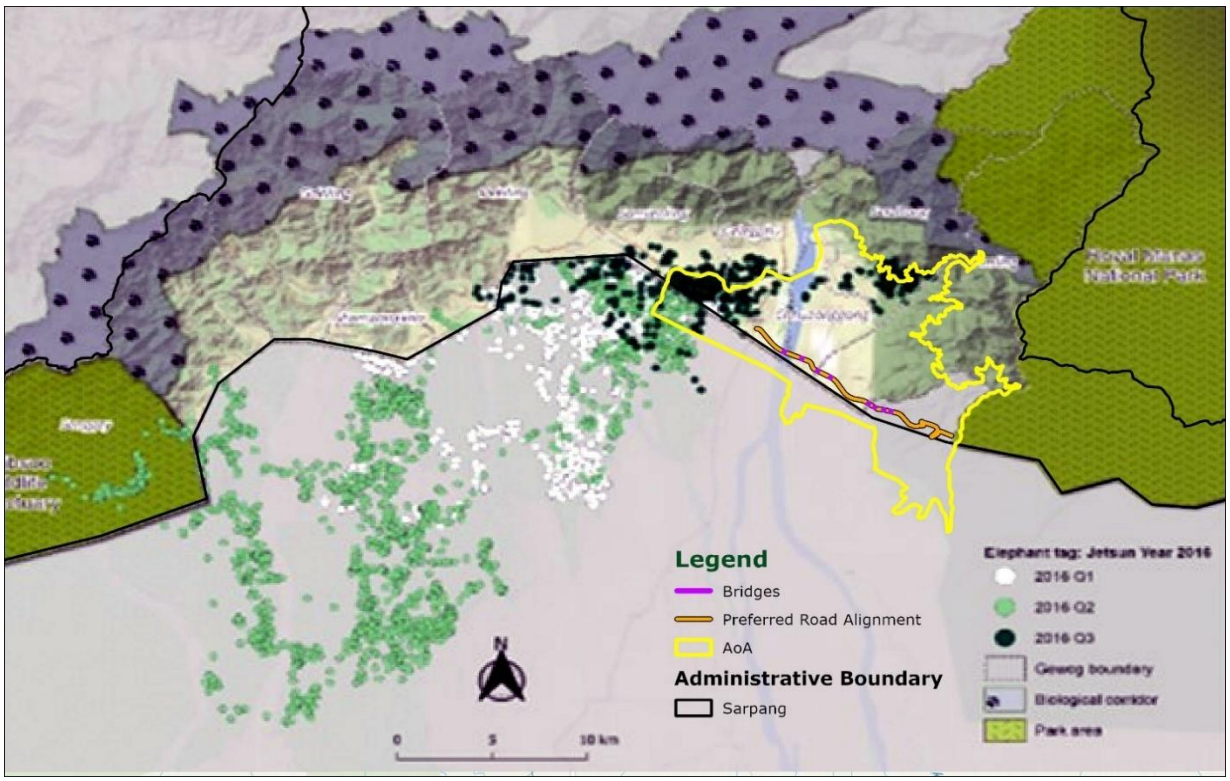


FIGURE 3.2 HOURLY DATA-POINTS FOR RADIO-COLLARED ADULT FEMALE ASIAN ELEPHANT "JETSUN" PER QUARTER FROM JAN TO SEPT 2016

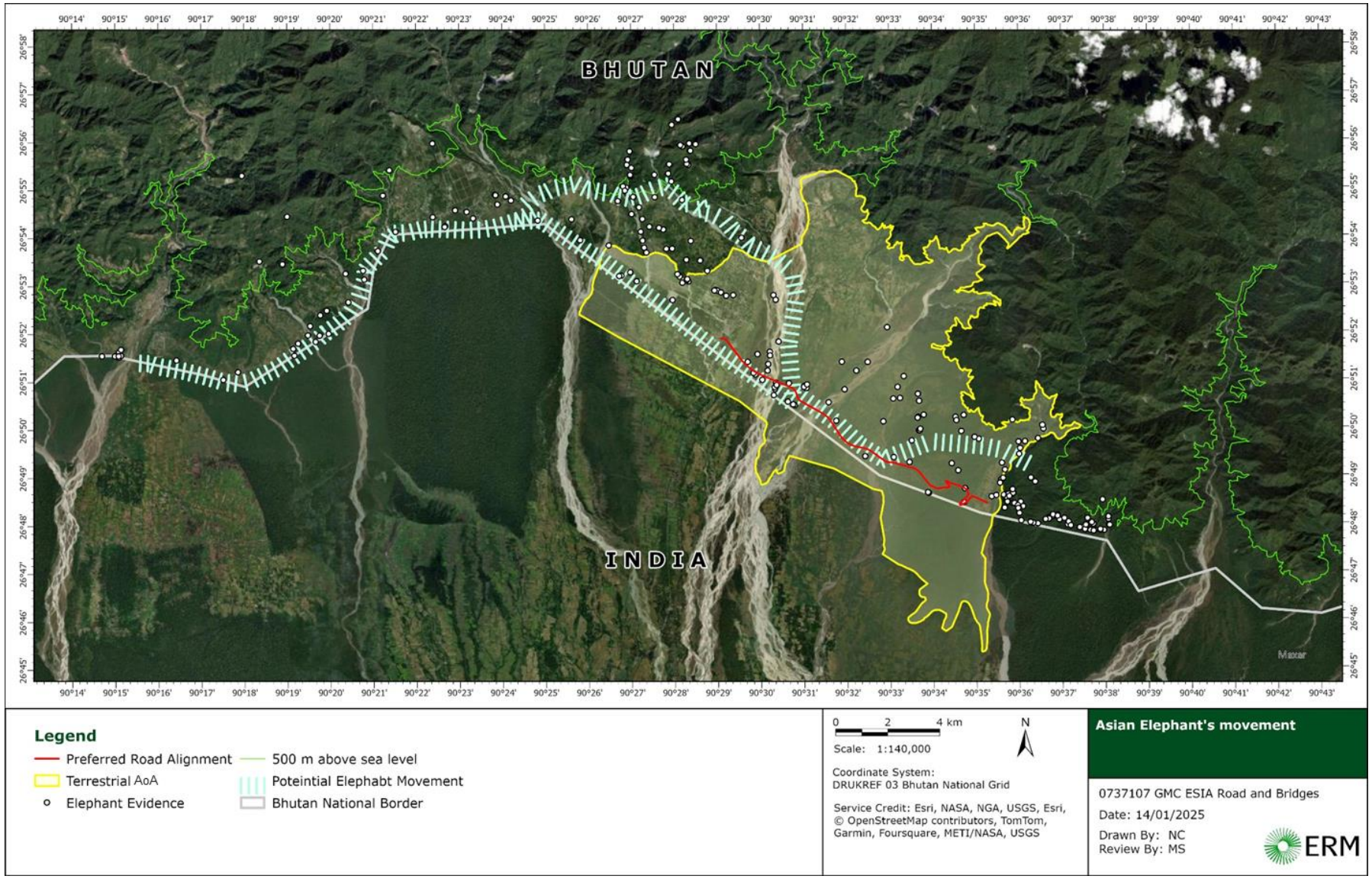


FIGURE 3.3 ELEPHANT SIGHTING LOCATIONS (DESKTOP SCREENING)

Population

It is estimated that approximately 605-761 individuals of wild population and 9 individuals of captive population exist in Bhutan.[28] The National Elephant Survey Report indicated elephant density mean is estimated at 0.297 individuals per 100 km^2 (95% CI: 0.26 – 0.33).[29] The research indicated that elephant abundance was positively associated with forest cover while negatively with elevation.[30]

The camera trap and transect survey recorded the presence of Asian Elephant. During the transect survey, there were 2 direct sightings, the first encountered a herd of 12 elephants with 6 females, 3 males and 3 juveniles; and the second encountered a herd of 25 elephants with 16 females, 3 males and 6 juveniles. In addition to direct sightings, evidence of Asian Elephants' occurrence such as droppings, feeding signs, tracks, and scrapes suggested the species' presence in different types of habitats within the GMC, i.e., farmland, grassland, and sub-tropical. The camera trap captured Asian Elephants on multiple days in 26 days during the period of 13 July - 29 August 2024 (Figure 3.4). It suggests the frequent occurrence of Asian elephants within the GMC. Based on the current data regarding the presence of Asian elephants within the Project area, it is likely that there are two herds consisting of 37 individuals. The first herd, which includes 6 females, 3 males, and 3 juveniles, likely represents 3 reproductive units, as 3 adult females are potentially the mothers of the 3 juveniles. The second herd, consisting of 16 females, 3 males, and 6 juveniles, likely represents 6 reproductive units, with 6 adult females possibly being the mothers of the 6 juveniles. The Project supports the habitat of 4.86% - 6.12% of the National population (37/761 X 100% = 4.86%; 37/605 X 100% = 6.12%).

In conclusion, the Project AoA contains critical habitat for Asian Elephants that support significant national important concentrations of this species.

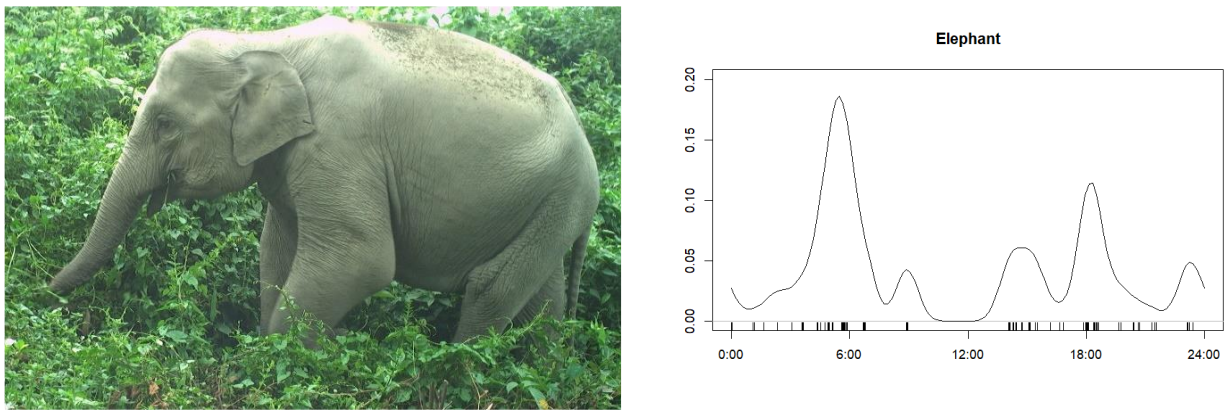


FIGURE 3.4 ASIAN ELEPHANT AND THEIR ACTIVITY PATTER

[28] Williams, C., Tiwari, S.K., Goswami, V.R., de Silva, S., Kumar, A., Baskaran, N., Yoganand, K. & Menon, V. 2020. *Elephas maximus*. *The IUCN Red List of Threatened Species* 2020: e.T7140A45818198. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T7140A45818198.en. Accessed on 30 September 2024.
[29] National Elephant Survey Report (2018). Bhutan Trust Fund. Available at: 1705405524National-Elephant-Survey-Report-DoFPS.pdf (bhutantrustfund.bt) Accessed date: Oct 1, 2024
[30] National Elephant Survey Report (2018). Bhutan Trust Fund. Available at: 1705405524National-Elephant-Survey-Report-DoFPS.pdf (bhutantrustfund.bt) Accessed date: Oct 1, 2024

3.4.1.2 GEE'S GOLDEN LANGUR

Gee's Golden Langur (*Trachypithecus geei*, IUCN EN, FNCA[31], FNCRR, IUCN EN, CITES I[32]) (Figure 3.5) is a restricted-range species with the Estimated Extent of Occurrence (EoO) of about 9,235–30,000 km². This species occurs only in Bhutan and northeastern India (Assam).[33] The Bhutan population occurs within an area of about 3,136 km² and the Indian population in an area of about 1,255 km².[34] This species is found in moist evergreen, dipterocarp forests, riverine, and moist deciduous forests, temperate and subalpine forests and occasionally in degraded habitats with secondary growth and broad leaf forest, sal forest, sub-tropical forest.[35]The global population is approximately 6,000-6,500 mature individuals.[36]

The activity pattern exhibited a bimodal diurnal feeding behavior, with peaks observed in the morning and evening hours. [37] Golden Langur is threatened by habitat fragmentation.[38] Five habitat threats in Bhutan include (1) hydropower development, (2) road development, (3) housing development, (4) resource extraction, and (5) agricultural expansion.[39]

In Bhutan, the langur is distributed from the subtropical forests of Western Assam to the broadleaf forests of Bhutan.[40] IUCN Red List report suggested an estimation of 6,600 total individuals of this species in Bhutan.[41] However, a comprehensive research regarding the population abundance and distribution of Gee's Golden Langur in Bhutan in 2019 documented a total of 2439 langurs in 222 groups.[42] In which, there was a total of 468 adult males (19%), 924 adult females (38%), 649 juveniles (27%), and 398 infants (16%).[43]

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[31] Royal Government of Bhutan. Forest and Nature Conservation Act 1995. Available at: https://faolex.fao.org/docs/pdf/bhu7101.pdf
[32] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[33] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.
[34] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.
[35] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 01 October 2024.
[36] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.
[37] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.
[38] Roy, Debahutee, and Rajarathinavelu Nagarajan. "Biology, ecology, and conservation of golden langur, Trachypithecus geei." *Indian Hotspots: Vertebrate Faunal Diversity, Conservation and Management Volume 1* (2018): 251-283.
[39] Thinley, Phuntsho, Tshewang Norbu, Rajanathan Rajaratnam, Karl Vernes, Phub Dhendup, Jigme Tenzin, Karma Choki et al. "Conservation threats to the endangered golden langur (Trachypithecus geei, Khajuria 1956) in Bhutan." *Primates* 61, no. 2 (2020): 257-266.
[40] Roy, D., & Nagarajan, R. (2018). Biology, ecology, and conservation of golden langur, Trachypithecus geei. *Indian Hotspots: Vertebrate Faunal Diversity, Conservation and Management Volume 1*, 251-283.
[41] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.
[42] Thinley, Phuntsho, Tshewang Norbu, Rajanathan Rajaratnam, Karl Vernes, Kezang Wangchuk, Karma Choki, Jigme Tenzin et al. "Population abundance and distribution of the endangered golden langur (Trachypithecus geei, Khajuria 1956) in Bhutan." *Primates* 60, no. 5 (2019): 437-448.
[43] Thinley, Phuntsho, Tshewang Norbu, Rajanathan Rajaratnam, Karl Vernes, Kezang Wangchuk, Karma Choki, Jigme Tenzin et al. "Population abundance and distribution of the endangered golden langur (Trachypithecus geei, Khajuria 1956) in Bhutan." *Primates* 60, no. 5 (2019): 437-448.

Its Extent of Occurrence (EoO) overlaps the Project AoA.[44] During the transect survey, Gee's Golden Langur individuals were recorded in the sub-tropical region within the GMC. During the survey, the presence of Gee's Golden Langur was directly observed across multiple dates in July (13th, 16th, 20th, and 29th) in the sub-tropical forest, with varying group sizes recorded:

- July 13: 17 individuals in Grid_43, and 23 individuals in Grid_41;
- July 16: 9 individuals in Grid_29, 11 individuals in Grid_27, and 13 individuals in Grid_23;
- July 20: 7 individuals in Grid_21; and
- July 29: 13 individuals in Survey_000047 grid.

Therefore, it is estimated that a total of approximately 23 - 93 individuals of Golden Langur were found within the Project Area. It accounted for (i) 0.35% - 1.55% of the global population (23/6500*100%= 0.35%; 93/6000*100% = 1.55%) and (ii) 1.7% of the National population (42/6500*100%= 0.65%). In conclusion, considering the Project AoA supports significant population of this restricted-range species, the Critical Habitat supporting Golden Langur is triggered.

FIGURE 3.5 A TROOP OF GOLDEN LANGUR SITTING ON TERMINALIA CHEBULA TREE FOUND IN "PEACOCK ISLAND", INDIA[45]

[44] Das, J., Chetry, D., Medhi, R. & Choudhury, A. 2020. *Trachypithecus geei*. *The IUCN Red List of Threatened Species* 2020: e.T22037A17960997. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22037A17960997.en. Accessed on 30 September 2024.

[45] Roy, D., & Nagarajan, R. (2018). Biology, ecology, and conservation of golden langur, Trachypithecus geei. *Indian Hotspots: Vertebrate Faunal Diversity, Conservation and Management Volume 1*, 251-283.

4. CONCLUSION

Natural habitats, comprising forest, riparian rangeland will be impacted by development of the various project components. No Net Loss or preferable net gain where feasible will need to be demonstrated for the project to meet ESS6 requirements. A habitat enrichment program is presented within the Project Biodiversity Management Plan (BMP) together with an assessment of achievement net gain for natural habitats.

For critical habitat assessment, IBAT screening resulted in a total of 1,687 species occurring within the GMC and its 50 km radius. After screening out the widespread species, a list of 155 potential candidate species was developed. These species have either confirmed occurrences within the GMC and its adjacent areas or are considered to have potential presence based on expert consultation.

The presence of Tricarinate Hill Turtle (*Melanochelys tricarinata*, IUCN CR), Hog Deer (*Axis porcinus*, IUCN EN), and other IUCN VU species was confirmed, but the habitat is not considered to have significant importance for these species, and they are not currently considered to qualify for Critical Habitat designations. However, additional information from future surveys may refine this assessment and potentially lead to a trigger or non-trigger status for these species.

Only the following four species are confirmed to trigger Critical Habitat designations against the ESS6 criteria:

- Asian Elephant (*Elephas maximus*, EN),
- Gee's Golden Langur (*Trachypithecus geei*, EN),
- Bengal Tiger (*Panthera tigris*, EN),
- *Hoya Bhutanica* (EN).

The additional Step 4 analysis reveals that only Asian Elephant and Gee's Golden Langur are likely to be significantly impacted and require Net Gain measures to be considered. Impacts to these species associated with the road can be mitigated through provision of wildlife crossings, and alignment to ESS6 requirements is feasible. Application of mitigation measures and the achievement of net gain outcomes is addressed in the Project BMP.

The Project AoA includes important ecological corridors and protected areas, which play an important role in maintaining biodiversity and supporting the movement of species like the Asian Elephant. The area serves critical ecological functions, reinforcing the need for continued monitoring and conservation efforts.

ANNEX G1 - FINDINGS FROM THE EXPERT CONSULTATION

Common Name	Scientific Name	IUCN status	Preferred habitat	Potential distribution
Mammals				
Chinese Pangolin	*Manis pentadactyla*	CR	This species can occupy modified habitat adjacent to forest habitat. This species is frequently recorded in Bhutan. Sarpang is one of three dzongkhags with record of Chinese Pangolin.	Forest, Shrubland, Grassland
Tiger	*Panthera tigris*	EN	Southern Bhutan is the important area of species population in the region. The species population has been estimated to be 2,608 – 3,905 individuals, while the Bhutan may support the species population in 131 individuals based on the recent survey in 2021 and 2022.[46]	Forest, Savanna, Shrubland, Grassland, Wetlands (inland), Marine Coastal/Supratidal, Artificial/Terrestrial
Gee's Golden Langur	*Trachypithecus geei*	EN	Species recorded mostly in Bhutan including area around Gelephu. The global species population has been estimated to be 6,000 – 6,500 individuals, while Bhutan may support a species population of 4,000 individuals based on the IUCN Red List assessment.	Forest, Artificial/Terrestrial
Red Panda	*Ailurus fulgens*	EN	The species known to occur in Eastern Himalayan Broadleaf and Conifer Ecoregion.[47] It depends on a bamboo diet and dwells in bamboo understories in temperate pine forests adjacent to broadleaf forests.[48]	High elevation sub-tropical forest and pine forest.
Hispid Hare	*Caprolagus hispidus*	EN	The species is strongly relying on the large, tall grass habitat.[49]	Low land grassland
Pygmy Hog	*Porcula salvania*	EN	This species occupies a highly restricted range of the sub-tropical	Low land grassland

[46] Alison Henry. (2023). In an astounding achievement, Bhutan tiger numbers grow by 27%. Accessed on 15 July 2024, from https://www.worldwildlife.org/stories/in-an-astounding-achievement-bhutan-tiger-numbers-grow-by-27.
[47] Williams, B. H. (2003). Red panda in eastern Nepal: how do they fit into ecoregional conservation of the eastern Himalaya. Conservation Biology in Asia, 16, 236-250.
[48] Yonzon, P. B., & Hunter Jr, M. L. (1991). Conservation of the red panda Ailurus fulgens. Biological conservation, 57(1), 1-11.
[49] Aryal, A., Brunton, D., Ji, W., Yadav, H. K., Adhikari, B., & Raubenheimer, D. (2012). Diet and habitat use of hispid hare Caprolagus hispidus in Shuklaphanta Wildlife Reserve, Nepal. Mammal Study, 37(2), 147-154.

Common Name	Scientific Name	IUCN status	Preferred habitat	Potential distribution
			grasslands of Assam, especially tall grass habitat.[50]	
Bengal Slow Loris	*Nycticebus bengalensis*	EN	This species is arboreal species that occupy dense forest canopy.[51] However, tropical plantation and modified forest can support species population as well.[52]	Dry dipterocarp forest, man-made plantation and sub-tropical forest
Asian Elephant	*Elephas maximus*	EN	They are generalists and feed on a variety of plants, which vary depending upon the habitat and season.	Low land grassland, agricultural land, man-made plantation, sub-tropical forest
Reptiles				
Tricarinate Hill Turtle	*Melanochelys tricarinata*	EN	Core distribution area is associated with the Himalayan foothills. The global population of this species has not been estimated.	
Elongated Tortoise	*Indotestudo elongata*	CR	The species normally occurs in open deciduous forest patches, including Sal (*Shorea robusta*), as well as evergreen forest habitats, dry thorn forests and savannah grasslands.[53]	Dry dipterocarp forest and agricultural land
Birds				
White-bellied Heron	*Ardea insignis*	CR	Prefer deep forest stream but could occur in GMC AoA. Southern Bhutan is its core distribution area, in particular the Punatsangchhu basin. The global population of this species has been estimated as 50 – 249 individuals, and consultation with the Royal Society For Protection of Nature (23 July 2024) suggested that the population in Bhutan may be 25 to 30 individuals.	
Fish				

[50] de Visser, M., Liu, L., & Bosse, M. (2021). Pygmy hogs. Current Biology, 31(8), R366-R368.
[51] Al-Razi, H., Hasan, S., Ahmed, T., & Muzaffar, S. B. (2020). Home range, activity budgets and habitat use in the Bengal slow loris (Nycticebus bengalensis) in Bangladesh. Evolution, Ecology and Conservation of Lorises and Pottos, 193-203.
[52] Barlow, J., Gardner, T. A., Araújo, I. S., Ávila-Pires, T. C., Bonaldo, A. B., Costa, J. E., ... & Peres, C. A. (2007). Quantifying the biodiversity value of tropical primary, secondary, and plantation forests. Proceedings of the National Academy of Sciences, 104(47), 18555-18560.
[53] Das, I. (2015). Field guide to the reptiles of South-East Asia. Bloomsbury Publishing.

Common Name	Scientific Name	IUCN status	Preferred habitat	Potential distribution
Golden Mahseer	*Tor putitora*	EN	Based consultations with local experts, it can be found in Mau River and other river in protected areas. The species population has not been estimated yet, but the IUCN red List states that several populations exist inside terrestrial protected areas where their populations are increasing or stable.[54]	
Flora				
	Hoya bhutanica	EN	This species is endemic to Sarpang, Bhutan and have a record in Gelephu. The species population has not been estimated yet.	
	Cheirostylis sherriffii	CR	This species is endemic to Bhutan. Occur in the montane habitat at 2,000 above sea level.[55]	High elevation sub-tropical forest.

[54] Jha, B.R., Rayamajhi, A., Dahanukar, N., Harrison, A. & Pinder, A. 2018. Tor putitora. The IUCN Red List of Threatened Species 2018: e.T126319882A126322226. http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T126319882A126322226.en

[55] Pearce, N., & Cribb, P. (1999). Notes relating to the flora of Bhutan: XXXVII. New species and records of Orchidaceae from Bhutan and India (Sikkim). Edinburgh Journal of Botany, 56(2), 273-284.

ANNEX G2 – SPECIES DETAILS FOR ANALYSIS OF STEP 3

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Mammals								
	Manis pentadactyla	Chinese Pangolin	CR			Criteria (a)	Possible LoO	No	Its wide distribution includes Bangladesh, China, Hong Kong, India, Lao People's Democratic Republic, Myanmar, Nepal, Taiwan, Province of China, Thailand, Viet Nam, and Bhutan.[56] No estimated global population is available. This species can occupy the modified habitat adjacent to forest habitat. Sarpang is one of three dzongkhags with records of Chinese Pangolin. Although the global population of this species has not been estimated, most population studies have been conducted in China. One study suggested that only 10,000 individuals remain in China.[57] The species was not recorded during transect surveys and camera trap. iNaturalist recorded the species' occurrence within GMC or its proximity. In comparison with the wide distribution of the species, the small Project AoA is unlikely to support significant global population. Therefore, Critical Habitat is not triggered.
	Ailurus fulgens	Red Panda	EN	FNCA, FNCRR	I	Criteria (a), (c)	Possible LoO	No	The species is known to occur in Eastern Himalayan Broadleaf and Conifer Ecoregion.58 It relies on a bamboo diet and dwells in bamboo understories in temperate pine forests adjacent to broadleaf forests.[59] The global population is less than 10,000.[60] The EoO of the species contains the forest that are contiguous with those within the AoA. Expert consultation in July 2024 suggested the possible presence of this species within the Project AoA. However, the terrestrial flora survey did not record the presence of any bamboo species in the forest habitat. It is unlikely that the species occurs within the AoA with significant number of individuals to trigger CH.
	Platanista gangetica	Ganges River Dolphin	EN			Criteria (a), (c)	Unlikely LoO	No	The EoO of the species does not overlap the AoA.[61] Additionally, its presence is still uncertain in Bhutan. Thus, it is unlikely that the species occurs within the AoA with enough number of individuals to trigger Critical Habitat.
	Bubalus arnee	Wild Water Buffalo	EN	FNCA, FNCRR	III	Criteria (a)	Possible LoO	No	The EoO overlaps the AoA. The global population is approximately 2,500 mature individuals.[62] Wild Water Buffalo is very dependent on the availability of water and historically its preferred habitats were low-lying alluvial grasslands.[63] In Bhutan, it occurs in alluvial grasslands along the Manas and Brahmaputra rivers to the south of the Project. There is no record regarding the presence of the species near the Mau and Taklai River. Thus, though the species may occur within the AoA, it is unlikely that the species occurs within the AoA with enough individuals to trigger CH.
	Caprolagus hispidus	Hispid Hare	EN	FNCRR		Criteria (a)	Possible LoO	No	The EoO overlaps the AoA.[64] The global population is approximately 300 individuals. The species is strongly relying on the low-elevation grassland (1). Its recent occurrence was in RMNP (Bhutan),[65] which is around 1 km from the AoA. Expert consultation suggested the possible presence of the species within the AoA. Though the species may occur within the AoA, it is unlikely that the species occurs within the AoA with enough individuals to trigger CH.

[56] Challender, D., Wu, S., Kaspal, P., Khatiwada, A., Ghose, A., Ching-Min Sun, N., Mohapatra, R.K. & Laxmi Suwal, T. 2019. *Manis pentadactyla* (errata version published in 2020). *The IUCN Red List of Threatened Species* 2019: e.T12764A168392151. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T12764A168392151.en. Accessed on 03 October 2024.
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[65] Aryal, A., Brunton, D., Ji, W., Yadav, H. K., Adhikari, B., & Raubenheimer, D. (2012). Diet and habitat use of hispid hare Caprolagus hispidus in Shuklaphanta Wildlife Reserve, Nepal. Mammal Study, 37(2), 147-154.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Cuon alpinus	Dhole (Asiatic wild dog)	EN		II	Criteria (a)	Present	No	Dhole is a habitat generalist that occurs in a wide variety of vegetation types, including primary, secondary and degraded forms of tropical dry and moist deciduous forests; evergreen and semi-evergreen forests; temperate deciduous forests; boreal forests; dry thorn forests; grassland–scrub–forest mosaics; temperate steppe; and alpine steppe.[66,67] The global population is approximately 4,500-10,500, of which 949-2,215 are estimated to be mature individuals.[68] The spatial capture-recapture models used a combination of genotype-based individual identification and indirect signs, and the estimated density ranged from 12 to 14.2 Dholes per 100 km^2 in protected areas in India.[69] Dholes are also estimated to require five times more land area than other large-bodied carnivores, mainly because of the social structure of populations living in exclusive territories.[70] Its EoO overlaps the Project AoA.[71] The camera trap G_10_C1 confirmed the occurrence of the species in the sub-tropical forest in the southern GMC. While only one individual was captured in the camera trap, it is suspected that there should be more individuals as Dhole is a highly social animal (2). Dholes live in packs ranging from 5 – 12,[72] other documents mentioned 3-20 individuals.[73] Dhole has the widest distribution amongst large carnivores in Bhutan with records in all 20 districts.[74] In Bhutan, no Dhole-specific species conservation plan is available, thus no current population estimate exists. Dholes prey on Wild Pig, which is considered a national pest causing significant crop damage.[75] As a result of the nationwide poisoning campaigns in the 1970s and 80s aimed at controlling wild pig populations, Dhole populations were also negatively impacted.[76, 77] However, since then, the species has shown signs of recovery.[78] The densities are far lower in the Himalayan Foothills of India and Nepal as compared to Central and Southern India. In Nepal, sightings have been very sporadic as has been observed in the terai of India. However, in comparison to North India and Nepal, Bhutan does have a higher abundance of Dhole, but this would still be less significant than in Central or Southern India, where densities are even higher than Thailand. The abundance in the high-altitude area of northern Bhutan is probably due to the presence of the subspecies *Cuon alpinus laniger* rather than the lowland subspecies *Cuon alpinus dukhanensis* which as mentioned earlier occurs at very low abundance in the Himalayan foothills.[79]. Therefore, Project AoA is considered to not contain Critical Habitat for Dhole.
	Elephas maximus	Asian Elephant	EN	FNAC, FNCRR	I	Criteria (a)	Present	Yes	Refer to Section 3.4.1.1
	Trachypithecus geei	Gee's Golden Langur	EN	FNCA, FNCR	I	Criteria (a)	Present	Yes	Refer to Section 3.4.1.2

[66] Kamler, J.F., Songsasen, N., Jenks, K., Srivathsa, A., Sheng, L. & Kunkel, K. 2015. Cuon alpinus. The IUCN Red List of Threatened Species 2015: e.T5953A72477893. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T5953A72477893.en. Accessed on 30 September 2024.
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[68] Kamler, J.F., Songsasen, N., Jenks, K., Srivathsa, A., Sheng, L. & Kunkel, K. 2015. Cuon alpinus. The IUCN Red List of Threatened Species 2015: e.T5953A72477893. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T5953A72477893.en. Accessed on 30 September 2024.
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[71] Kamler, J.F., Songsasen, N., Jenks, K., Srivathsa, A., Sheng, L. & Kunkel, K. 2015. Cuon alpinus. The IUCN Red List of Threatened Species 2015: e.T5953A72477893. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T5953A72477893.en. Accessed on 30 September 2024.
[72] Cohen, J. A. (1978). Cuon alpinus. Mammalian species, (100), 1-3.
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[75] Thinley, P., Rajaratnam, R., Kamler, J. F., & Wangmo, C. (2021). Conserving an endangered canid: assessing distribution, habitat protection, and connectivity for the dhole (Cuon alpinus) in Bhutan. *Frontiers in Conservation Science*, *2*, 654976.
[76] Thinley, P., Rajaratnam, R., Kamler, J. F., & Wangmo, C. (2021). Conserving an endangered canid: assessing distribution, habitat protection, and connectivity for the dhole (Cuon alpinus) in Bhutan. *Frontiers in Conservation Science*, *2*, 654976.
[77] Kamler, J.F., Songsasen, N., Jenks, K., Srivathsa, A., Sheng, L. & Kunkel, K. 2015. *Cuon alpinus*. *The IUCN Red List of Threatened Species* 2015: e.T5953A72477893. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T5953A72477893.en. Accessed on 30 September 2024.
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No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Axis porcinus	Hog Deer	EN		I, III	Criteria (a)	Present	No	Hog Deer (*Axis porcinus*, IUCN EN, CITES I[80], III[81]) is a medium-sized deer species native to Bangladesh, Cambodia, India, Nepal, Pakistan, and Bhutan.[82] Hog Deer is usually reported from habitat consisting of wet or moist tall grasslands, often associated with medium- to large-sized rivers. Global population is unknown.[83] The Bhutan subpopulation is found mostly along the southern foothills and small plains along the rivers. [84] Animals have been observed in three protected areas along its border with Assam India, these are PWS, RMNP and Khaling. [85] The number of individuals in RMNP (<1 km from GMC) could be greater than 150, with the grassland around the Gabhorukunda river as the main stronghold. Its EoO overlaps the Project AoA.[86] Six camera traps captured the presence of Hog Deer in the southern GMC, within grasslands, warm broadleaf forests, and subtropical forests. Hog Deer were recorded over 11 days between 13 July and 29 August 2024, suggesting a frequent presence of the species within GMC. Additionally, iNaturalist data reported occurrences of Hog Deer in the Indian forest contiguous with RMNP (<1 km from GMC) and nearby Manas National Park (24 km from GMC). GBIF also recorded occurrences of this species within Ripu and Chirang Reserve Forests (2 km from GMC) and the Indian forest adjacent to RMNP, where the species is associated with rivers. If the individuals recorded by the six camera traps are different, this would indicate 6 Hog Deer in the GMC, accounting for approximately 4% of Bhutan's population. Hog Deer are generally solitary or found in pairs, often consisting of a mother and offspring. Groups are usually small families, while temporary aggregations of 20-80 individuals are observed in rich pastures. [87] Therefore, it is suspected that a larger population of Hog Deer may be scattered in small groups within the southern GMC, connected with RMNP rather than concentrated in the GMC itself. In comparison to the larger EoO of this species, the AoA is unlikely to support significant global population, and it does not contain critical habitat for Hog Deer.
	Panthera tigris	Tiger	EN	FNCA, FNCR	I	Criteria (a)	Present	Yes	Tiger is native to South and Southeast Asia but has been indicated as extinct in many places. Tigers are habitat generalists and have adapted to diverse habitats inclusive of equatorial rainforests and mangroves in India and Sumatra, semi-arid habitats of western India, Himalayan deciduous and evergreen forests up to elevations of about 4,500 m and temperate forests in northeast Russia and China.[88] The global population is estimated 2,608 – 3,905 mature individuals, with the best estimate is approximately 3,140 mature individuals.[89] Bhutan may have 131 individuals based on the recent survey in 2021 and 2022.[90] It is estimated 90 individual tigers (60 females) and a mean density of 0.23 adult tigers per 100 km^2 in the mountainous terrain of Bhutan.[91] The Project AoA overlaps the species' EoO. Expert consultation suggested the potential occurrence of Tiger within the GMC and its adjacent area. The transect survey recorded the species evidence of Tiger. iNaturalist

[80] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[81] Appendix III: Includes species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.
[82] Timmins, R., Duckworth, J.W., Samba Kumar, N., Anwarul Islam, M., Sagar Baral, H., Long, B. & Maxwell, A. 2015. *Axis porcinus*. *The IUCN Red List of Threatened Species* 2015: e.T41784A22157664. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41784A22157664.en. Accessed on 01 October 2024.
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[87] GBIF. Available at: Axis porcinus (Zimmermann, 1780) (gbif.org) Accessed date: Oct 1, 2024
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[90] Alison Henry. (2023). In an astounding achievement, Bhutan tiger numbers grow by 27%. Accessed on 15 July 2024, from https://www.worldwildlife.org/stories/in-an-astounding-achievement-bhutan-tiger-numbers-grow-by-27
[91] Tempa, T., Hebblewhite, M., Goldberg, J. F., Norbu, N., Wangchuk, T. R., Xiao, W., & Mills, L. S. (2019). The spatial distribution and population density of tigers in mountainous terrain of Bhutan. *Biological Conservation*, *238*, 108192.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									recorded the presence of Tiger in Manas National Park but not the GMC. Surrounding the GMC, Tiger is recorded in PWS[92], RMNP[93,94], Biological Corridor 3[95,96], Manas National Park[97,98] , and Ripu Reserve Forest[99,100]. Given the relatively small population size in Bhutan of 131 individuals, the presence of 1 individual detected during the survey indicates an approximate proportion of 1% of national population within the AoA. Hence, critical habitat likely is triggered.
	Porcula salvania	Pygmy Hog	EN			Criteria (a), (b)	Possible LoO	No	This species is dependent on early successional riverine communities, typically comprising dense tall grasslands, commonly referred to as 'thatch land', but which, in its pristine state, is intermixed with a wide variety of herbaceous plants and early colonizing shrubs and young trees.[101] Global population is estimated 100-250 mature individuals.[102] Species' core distribution is Grassland in Kaziranga National Park (approx. 200 km Southeast of the Project AoA). The habitat near the rivers within the GMC can support this species. Expert consultation suggested the potential occurrence of this species within the GMC and its proximity However, transect survey and camera trap did not record this species. iNaturalist and GBIF did not record the species' occurrence within the GMC or its vicinity. The AoA may not be expected to regularly hold significant global population. Thus, the Project AoA does not contain habitat for this species.
	Nycticebus bengalensis	Bengal Slow Loris	EN			Criteria (a)	Possible LoO	No	Bengal Slow Loris is native to Bangladesh, Cambodia, China, India, Laos, Myanmar, Thailand, Vietnam, and Bhutan.[103] This species is arboreal, nocturnal species that occupy dense forest canopy.[104] However, tropical plantation and modified forest can support species population as well.[105] No estimated global population is available. The GMC does not overlap with species' EoO. Expert consultation suggested the species' occurrence within the GMC and its proximity. Data from iNaturalist does not record the species within the GMC and its surrounding. The transect survey and camera trap survey did not record the presence of this species. In comparison with the wide distribution, it is unlikely that the small Project AoA contains habitat support significant global population. Therefore, the Critical Habitat is not triggered.
	Trachypithecus pileatus ssp. tenebricus	Tenebrous Capped Langur	EN			Criteria (a)	Possible LoO	No	Tenebrous Capped Langur occurs in Bhutan and north-eastern India.[106] It is found mostly in tea gardens close to forests and less often in areas that lack forest proximity or where there is abundance of other primate species such as gibbons and Phayre's langurs.

[92] Banerjee, A., & Bandopadhyay, R. (2016). Biodiversity hotspot of Bhutan and its sustainability. *Current Science*, 521-527

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[94] Tempa, Tshering; Hebblewhite, Mark; Mills, L. Scott; Wangchuk, Tshewang R.; Norbu, Nawang; Wangchuk, Tenzin; Nidup, Tshering; Dendup, Pema; Wangchuk, Dorji; Wangdi, Yeshi; and Dorji, Tshering, "Royal Manas National Park, Bhutan: A Hot Spot for Wild Felids" (2013). *Wildlife Biology Faculty Publications*. 32. https://scholarworks.umt.edu/wildbio_pubs/32

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No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									The Project EoO does not overlap with the species' EoO. Expert consultation suggested the possible presence of the species surrounding the GMC. Data from iNaturalist records its presence in Pakke Tiger Reserve (more than 50 km from the GMC). The transect survey and camera trap did not record this species. The AoA is unlikely to contains habitat supporting the significant population, thus Critical Habitat is not triggered.
	Manis crassicaudata	Indian Pangolin	EN			Criteria (a)	Possible LoO	No	It is native to Bangladesh, India, Nepal, Pakistan, and Sri Lanka. It inhabits in various types of tropical forests as well as open land, grasslands, arid areas and degraded habitat, including near villages.[107] The Project AoA overlaps with species' EoO. The transect survey and camera trap does not record the presence of the species. Comparing with the large EoO, the small Project AoA is unlikely to contain habitat supporting significant population of this species. Therefore, Critical habitat is not triggered.
	Moschus chrysogaster	Alpine Musk Deer	EN			Criteria (a)	Unlikely LoO	No	Species distribution range is limited to high elevation from China to Central Bhutan.[108] The Project AoA does not overlap the species' EoO. The transect survey and camera trap did not record the presence of this species. The GMC has lower elevation compared to where the species recorded (checking data from the iNaturalist), thus it is unlikely that the deer will utilize the habitat in the low elevation in GMC. The Project AoA does not contain habitat supporting more than significant global population of this species, and Critical habitat is not triggered.
	Moschus leucogaster	Himalayan Muskdeer	EN	FNCA, FNCR	I/II	Criteria (a)	Unlikely LoO	No	Species distribution range is limited to high elevation from China to Central Bhutan.[109] The Project AoA does not overlap the species' EoO. The transect survey and camera trap did not record the presence of this species. The GMC has lower elevation compared to where the species recorded (checking data from the iNaturalist), thus it is unlikely that the deer will utilize the habitat in the low elevation in GMC. The Project AoA does not contain habitat supporting significant global population of this species, and Critical habitat is not triggered.
	Bos gaurus	Gaur	VU	FNCA, FNCR	I	Criteria (a)	Present	No	Gaur (*Bos gaurus*, IUCN VU, FNCA, FNCRR, CITES I[110]) is the largest wild bovine species in the world.[111] Gaur is an important prey for large carnivores such as tiger, common leopard, and Dhole. Gaur inhabits in forest, savanna, shrubland, and grassland.[112] It occurs in scattered areas in the following range states: Bhutan, Cambodia, China, India, Lao PDR, Malaysia (Peninsular Malaysia only), Myanmar, Nepal, Thailand, and Viet Nam.[113] Global population is approximately 6,000-21,000 individuals.[114] In Bhutan, Gaur apparently persists all over the southern foot-hill zone, notably in RMNP, PWS and Khaling Wildlife Sanctuary.[115] The Gaur population in Bhutan is unknown. Its EoO overlaps the Project AoA.[116] The camera trap captured the presence of 4 Gaurs in the

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[108] Timmins, R.J. & Duckworth, J.W. 2015. *Moschus leucogaster*. *The IUCN Red List of Threatened Species* 2015: e.T13901A61977764. https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T13901A61977764.en. Accessed on 03 October 2024.
[109] Timmins, R.J. & Duckworth, J.W. 2015. *Moschus leucogaster*. *The IUCN Red List of Threatened Species* 2015: e.T13901A61977764. https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T13901A61977764.en. Accessed on 03 October 2024.
[110] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[111] Duckworth, J.W., Sankar, K., Williams, A.C., Samba Kumar, N. & Timmins, R.J. 2016. *Bos gaurus*. *The IUCN Red List of Threatened Species* 2016: e.T2891A46363646. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2891A46363646.en. Accessed on 01 October 2024.
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[114] Duckworth, J.W., Sankar, K., Williams, A.C., Samba Kumar, N. & Timmins, R.J. 2016. *Bos gaurus*. *The IUCN Red List of Threatened Species* 2016: e.T2891A46363646. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2891A46363646.en. Accessed on 01 October 2024.
[115] Duckworth, J.W., Sankar, K., Williams, A.C., Samba Kumar, N. & Timmins, R.J. 2016. *Bos gaurus*. *The IUCN Red List of Threatened Species* 2016: e.T2891A46363646. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2891A46363646.en. Accessed on 01 October 2024.
[116] Timmins, R., Duckworth, J.W., Samba Kumar, N., Anwarul Islam, M., Sagar Baral, H., Long, B. & Maxwell, A. 2015. *Axis porcinus*. *The IUCN Red List of Threatened Species* 2015: e.T41784A22157664. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41784A22157664.en. Accessed on 01 October 2024.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									sub-tropical forest in the southern GMC. Its presence was recorded in 13 days between 13 July and 29 August 2024, suggesting a frequent presence of the species within GMC. Additionally, the transect survey recorded 9 tracks of Gaur in sub-tropical forest and farmland, which is consistent with the camera trap surveys, as the tracks were found in 5 survey locations that were near each other, it is predicted that there was a herd of gaurs. Combination information from camera traps and transect survey, there might be a herd of 5 gaurs within the GMC. The data from iNaturalist indicates the presence of Gaur in Manas National Park and its contiguous forest in India. GBIF recorded the Gaur's occurrence upstream of Mau River (8 km North of GMC). The mean detection probability of Gaur in RMNP was moderate, at 33%, with the actual occupancy rate estimated to be 62.4%, indicating that a significant portion of RMNP is used by Gaur. It is likely that Gaur scatters within the Project AoA and its contiguous forest. However, comparing the small size of the sub-tropical forest within Project AoA with the whole EoO of Gaur, it is unlikely that the Project AoA supports globally important concentrations of Guar, the loss of which would result in the change of the IUCN Red List status to EN or CR. Specifically, a population decline of 60%, or approximately 2,500 individuals, would be required to shift Gaur from its current Vulnerable (VU) status to Endangered (EN). Therefore, the Project AoA does not contain critical habitat for Gaur.
	Panthera pardus	Leopard	VU	FNCA, FNCR	I	Criteria (a)	Present	No	This species has extensive distribution range from Africa to East Asia, but extinct in various places. There is still a distribution along Himalaya foothills. Leopards live in mountainous environments up to an altitude of 4,600 m on Mt. Kenya and 5,200 m in the Himalayas. [117] The most systematic population estimate ranges from 2,813–11,632 Leopards, which equates to 1,688–6,979 mature individuals (60% mature population structure).[118] All subpopulations number fewer than 1,000 mature individuals except the bushveld subpopulation (Kruger National Park, Limpopo, Mpumalanga and Northwest Province), which is likely to number between 1,113–4,454 mature individuals. [119] The transect survey and camera traps confirmed the presence of leopards in the subtropical forests of the southern GMC. Leopards are naturally solitary animals, preferring to live and hunt alone, except when females are raising their cubs, which remain with them for up to two years before becoming independent. Given their solitary behavior, it is unlikely that more than one individual is present within the GMC and its vicinity, estimated to be approximately 0.06% of the global population. A decline of approximately 313 individuals could reduce the global leopard population to 2,500, potentially leading to the species being classified as Endangered (EN). However, it is highly unlikely that the AoA (Ecologically Appropriate Area of Analysis) could support globally significant concentrations of leopards, where their loss would trigger a change in the IUCN Red List status to Endangered (EN) or Critically Endangered (CR). Therefore, Critical Habitat is not triggered.
	Rusa unicolor	Sambar	VU	FNCR		Criteria (a)	Present	No	The species is widely distributed across South and Southeast Asia.[120] Although global population data is not known, the population in India exceeds 50,000 and in Australia Sambars number more than 5,000 individuals. [121] The camera traps detected Sambar deer three times in the subtropical forests of southern GMC. Additionally, four Sambar sightings were recorded during the transect survey, from the Taklai River to the southern GMC. Data from iNaturalist and GBIF confirm the presence of Sambar in RMNP and in lowland forests of India near the GMC, although there are no records from areas directly adjacent to the GMC. Sambar deer are primarily nocturnal, resting during the day in dense forest cover. They are generally solitary but may form small groups during the mating season. Based on

[117] Stein, A.B., Gerngross, P., Al Hikmani, H., Balme, G., Bertola, L., Drouilly, M., Farhadinia, M.S., Feng, L., Ghoddousi, A., Henschel, P., Jhala, Y., Khorozyan, I., Kittle, A., Laguardia, A., Luo, S.-J., Mann, G., Miquelle, D., Moheb, Z., Raza, H., Rostro-García, S., Shivakumar, S., Song, D. & Wibisono, H. 2024. *Panthera pardus*. *The IUCN Red List of Threatened Species* 2024: e.T15954A254576956. Accessed on 04 October 2024.
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[119] Swanepoel, L. H., Balme, G., Williams, S., Power, R. J., Snyman, A., Gaigher, I., ... & Child, M. (2016). A conservation assessment of Panthera pardus. *The red list of mammals of South Africa, Swaziland and Lesotho*, 1-13.
[120] Timmins, R., Kawanishi, K., Giman, B, Lynam, A., Chan, B., Steinmetz, R., Sagar Baral, H. & Samba Kumar, N. 2015. *Rusa unicolor* (errata version published in 2015). *The IUCN Red List of Threatened Species* 2015: e.T41790A85628124. https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T41790A22156247.en. Accessed on 04 October 2024.
[121] Available at: ADW: Rusa unicolor: INFORMATION (animaldiversity.org) Accessed date: October 04, 2024

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									current observations, it is suspected that no more than four Sambar reside within the GMC. Given their wide distribution and the limited size of the AoA, it is highly unlikely that this area could support globally significant concentrations of the species. Therefore, the loss of Sambar from the AoA would not result in a change in the IUCN Red List status to EN or Critically Endangered CR. The Critical Habitat is not triggered,
	Budorcas taxicolor	Takin	VU			Criteria (a)	Unlikely LoO	No	Species distribution is limited China, Bhutan, India and Myanmar. This species occurrs in montane forest habitat range from 1,000 – 4,000 m above sea level, which is beyond the elevation profile of the AoA. The survey did not record the presence of this species. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Rucervus duvaucelii	Barasingha	VU		I	Criteria (a)	Possible LoO	No	This species can occur in Sarpang. However, core distribution range of this species is north and central India, and southwestern Nepal. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Lutrogale perspicillata	Smooth-coated Otter	VU			Criteria (a)	Present	No	Smooth-coated Otter distributes in various locations, i.e., South Asia, Southeast Asia, and Middle East.[122] The smooth-coated otter is a social species that requires large stretches of river and estuarine ecosystems for its survival.[123] The EoO overlaps the Project AoA. A total of 3 Smooth-coated Otter was found in the transect survey (direct observation). The species is widely distributed across South and Southeast Asia. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Melursus ursinus	Sloth Bear	VU		I	Criteria (a)	Possible LoO	No	This species distribution in Bhutan is limited to PWS and RMNP. However, the core distribution range of this species is India and Nepal which populations are more abundance than Bhutan. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Myotis sicarius	Mandelli's Mouse-eared Myotis	VU			Criteria (a)	Possible LoO	No	This species is endemic to South Asia. It is possible to be found in Sarpang. However, it is currently known from India (Sikkim and West Bengal) and Nepal (Central). It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Neofelis nebulosa	Clouded Leopard	VU		I	Criteria (a)	Unlikely LoO	No	The species is widely distributed across South, Southeast Asia and south China. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Prionailurus viverrinus	Fishing Cat	VU			Criteria (a)	Possible LoO	No	It is possible to be found in Sarpang, but species records are limited and not verified. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Rhinoceros unicornis	Greater One-horned Rhino	VU	FNCRR	I	Criteria (a)	Unlikely LoO	No	Currently, the Greater One-horned Rhinoceros is found in eight protected areas in India (Kaziranga, Pabitora, Manas, Orang, Jaldapara, Gorumara, Dudhwa, Katerniaghat) and in

[122] Khoo, M., Basak, S., Sivasothi, N., de Silva, P.K. & Reza Lubis, I. 2021. *Lutrogale perspicillata*. *The IUCN Red List of Threatened Species* 2021: e.T12427A164579961. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T12427A164579961.en. Accessed on 17 October 2024.

[123] Jonah Dias, S., James Ciaran White, P., Borker, A. S., & Fernandes, N. V. (2022). Habitat selection of smooth-coated otters (Lutrogale perspicillata) in the peri-coastal, urbanised landscape of Goa, India. *Mammal Research*, *67*(3), 299-309.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									four protected areas in Nepal (Chitwan, Bardia, Suklaphanta, Parsa). Presence in Bhutan is not currently confirmed/ known. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Trachypithecus pileatus	Capped Langur	VU			Criteria (a)	Possible LoO	No	The largest population is in Assam State, India, but they have also been documented in other areas of northeastern India such as the Meghalaya State, as well as across the border in Bangladesh, Bhutan and northwestern Myanmar. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Ursus thibetanus	Asiatic Black Bear	VU		I	Criteria (a)	Unlikely LoO	No	The species is widely distributed across Himalayan region to mainland Southeast Asia and Russia. It is unlikely that the species would be found within the AoA, due to the low elevation. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Arctictis binturong	Binturong	VU			Criteria (a)	Possible LoO	No	The Binturong is widespread in South and Southeast Asia. Population in Bhutan has been rarely recorded in RMNP. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Aonyx cinereus	Asian Small-clawed Otter	VU			Criteria (a)	Possible LoO	No	The Asian Small-clawed Otter has a large distribution range, extending from India in South Asia eastwards through Southeast Asia (peninsula and insula). It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Capricornis sumatraensis	Mainland Serow	VU	FNCA, FNCRR	I	Criteria (a)	Possible LoO	No	The Mainland Serow occurs across eleven countries, including China, Southeast Asia and Himalayan range. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.
	Canis lupus ssp. chanco	Himalayan Wolf	VU		I/II	Criteria (a)	Unlikely LoO	No	The known distribution if this species is Tibetan Plateau and mountain of Central Asia. It is unlikely that the species would be found within the AoA, due to the low elevation. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat is not triggered.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Hylopetes alboniger		LC	FNCA		Criteria (a)	Possible LoO	No	Its wide distribution includes Bangladesh, Cambodia, China, India, Lao People's Democratic Republic, Myanmar, Nepal, Thailand, Viet Nam and Bhutan.[124] This is an arboreal and nocturnal species, found in tropical and subtropical montane forests, and in more temperate oak and rhododendron forests with elevation ranging between 100 – 4,000 m. [125] The transect survey and camera trap did not record this species. Data from GBIF and iNaturalist did not record its occurrence in the GMC and its proximity. Comparing the wide distribution and the small Project AoA, it is unlikely that Project AoA support significant population. Critical Habitat is not triggered.
	Axis axis	Chital	LC	FNCA, FNCRR		Criteria (a)	Possible LoO	No	Its wide distribution includes Bangladesh, India, Nepal, Sri Lanka, and Bhutan.[126] Chital thrives in a variety of habitats but avoid extremes such as dense moist (evergreen) forests and open semi-desert or desert. [127] No estimate global population is available. The Project AoA overlaps the species' EoO. The transect survey and camera trap did not record this species. Data from iNaturalist recorded its occurrence in the forest contiguous with the GMC and its proximity. Comparing the wide distribution and the small Project AoA, it is unlikely that Project AoA support significant population. Critical Habitat is not triggered.
	Prionailurus bengalensis	Mainland Leopard Cat	LC	FNCA, FNCRR	II	Criteria (a)	Possible LoO	No	Its wide distribution in Asia Pacific.[128] Global population estimation is not available, but it is anticipated to be stable. [129] The Project AoA overlaps the species' EoO. The transect survey and camera trap did not record this species. Data from iNaturalist recorded its occurrence in the forest contiguous with the GMC and its proximity. Comparing the wide distribution and the small Project AoA, it is unlikely that Project AoA support significant population. Critical Habitat is not triggered.
	Reptile								
	Melanochelys tricarinata	Tricarinate Hill Turtle	EN		I	Criteria (a)	Present	No	Tricarinate Hill Turtle (*Melanochelys tricarinata*, IUCN EN, CITES I[130]) is a small to medium-sized turtle, typically reaching a carapace length of around 15–18 cm.[131] Tricarinate Hill Turtle is resident of India and Nepal, uncertain presence in Bangladesh. [132] It inhabits the grassland at the Himalayan foothills and the moist deciduous and wet evergreen forests of the nearby foothill areas up to about 300 m altitude. [133] The global population of this species has not been estimated. Tricarinate Hill Turtle was added into the list of turtle of Bhutan for the first time by Wangyal et al. in 2012.[134] The known distribution of Tricarinate Hill Turtle includes areas east, west, and south of Bhutan, including the Manas Tiger Reserve of Assam State (24

[124] Duckworth, J.W., Tizard, R.J. & Molur, S. 2016. *Hylopetes alboniger*. *The IUCN Red List of Threatened Species* 2016: e.T10600A22244563. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T10600A22244563.en. Accessed on 04 October 2024.
[125] Duckworth, J.W., Tizard, R.J. & Molur, S. 2016. *Hylopetes alboniger*. *The IUCN Red List of Threatened Species* 2016: e.T10600A22244563. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T10600A22244563.en. Accessed on 04 October 2024.
[126] Duckworth, J.W., Kumar, N.S., Anwarul Islam, M., Sagar Baral, H. & Timmins, R. 2015. *Axis axis*. *The IUCN Red List of Threatened Species* 2015: e.T41783A22158006. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41783A22158006.en. Accessed on 04 October 2024.
[127] Duckworth, J.W., Kumar, N.S., Anwarul Islam, M., Sagar Baral, H. & Timmins, R. 2015. *Axis axis*. *The IUCN Red List of Threatened Species* 2015: e.T41783A22158006. https://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T41783A22158006.en. Accessed on 04 October 2024.
[128] Ghimirey, Y., Petersen, W., Jahed, N., Akash, M., Lynam, A.J., Kun, S., Din, J., Nawaz, M.A., Singh, P., Dhendup, T., Chua, M.A.H., Gray, T.N.E. & Phyoe Kyaw, P. 2023. *Prionailurus bengalensis* (amended version of 2022 assessment). *The IUCN Red List of Threatened Species* 2023: e.T223138747A226150742. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T223138747A226150742.en. Accessed on 04 October 2024.
[129] Ghimirey, Y., Petersen, W., Jahed, N., Akash, M., Lynam, A.J., Kun, S., Din, J., Nawaz, M.A., Singh, P., Dhendup, T., Chua, M.A.H., Gray, T.N.E. & Phyoe Kyaw, P. 2023. *Prionailurus bengalensis* (amended version of 2022 assessment). *The IUCN Red List of Threatened Species* 2023: e.T223138747A226150742. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T223138747A226150742.en. Accessed on 04 October 2024.
[130] Appendix I: Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
[131] Horne, B.D., Praschag, P., Choudhury, B.C. & Singh, S. 2020. *Melanochelys tricarinata*. *The IUCN Red List of Threatened Species* 2020: e.T13038A511526. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T13038A511526.en. Accessed on 01 October 2024.
[132] Horne, B.D., Praschag, P., Choudhury, B.C. & Singh, S. 2020. *Melanochelys tricarinata*. *The IUCN Red List of Threatened Species* 2020: e.T13038A511526. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T13038A511526.en. Accessed on 01 October 2024.
[133] Horne, B.D., Praschag, P., Choudhury, B.C. & Singh, S. 2020. *Melanochelys tricarinata*. *The IUCN Red List of Threatened Species* 2020: e.T13038A511526. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T13038A511526.en. Accessed on 01 October 2024.
[134] Katel, O. An Introduction to the Biodiversity of Bhutan.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									from the GMC).[135] During the transect survey, one individual of Tricarinate Hill Turtle was found in the warm broad-leaved forest (northern GMC). The records from iNaturalist indicated the presence of this species in Manas National Park. Therefore, it is suspected that the species is scattered along the Himalayan foothills. Considering that the small Project AoA comparing with the large species' EoO, the Project AoA is unlike to support significant global population. Therefore, Critical habitat is not triggered.
	Indotestudo elongata	Elongated Tortoise	CR			Criteria (a)	Potential LoO	No	The species widely distributes in South and Southeast Asia.[136] The species normally occurs in open deciduous forest patches, including Sal (*Shorea robusta*), as well as evergreen forest habitats, dry thorn forests and savannah grasslands.[137] The Project AoA overlaps the species' EoO. Expert consultation suggested its potential presence within the GMC and its proximity. The transect survey and camera trap did not record this species. Data from iNaturalist does not record its occurrence within the GMC and its proximity. Comparing the wide distribution and the small Project AoA, it is unlikely that Project AoA support significant population. Critical Habitat is not triggered.
	Gavialis gangeticus	Gharial	CR		I	Criteria (a), (c)	Not Present	No	This species is now extinct in Bhutan. The AoA is not expected to sustain significant global population at any point if the species lifecycle. Therefore, Critical habitat is not triggered.
	Nilssonia nigricans	Black Softshell Turtle	CR			Criteria (a)	Unlikely LoO	No	Can occur in AoA however, the publication shows core distribution in Assam (Kaziranga National Park and estuary of Brahmaputra River). The known distribution area is 200 km Southeast of the AoA. The AoA is not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Indotestudo elongata	Elongated Tortoise	CR			Criteria (a)	Possible LoO	No	The species is widely distributed across South and Southeast Asia. The AoA is not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Pangshura sylhetensis	Assam Roofed Turtle	CR			Criteria (a)	Unlikely LoO	No	The publication revealed that core distribution of this species is in Assam (Kaziranga National Park). Species record in Bhutan needs to be confirmed. The known distribution area is 200 km Southeast of the AoA. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Batagur dhongoka	Three-striped Roofed Turtle	CR			Criteria (a)	Not Present	No	This species has a range limited to the Ganga lowlands of northern India and Bangladesh. The known distribution area is 300 km Southwest of the AoA. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Cuora amboinensis	Southeast Asian Box Turtle	EN			Criteria (a)	Possible LoO	No	This species can occur in Sarpang. However, it has wide distribution range from India to Indonesia. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Geoclemys hamiltonii	Spotted Pond Turtle	EN			Criteria (a)	Possible LoO	No	Can occur in Gelephu however, the publication shows core distribution in Assam (Kaziranga National Park and Brahmaputra River). The known distribution area is 200 km Southeast of the AoA. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Morenia petersi	Indian Eyed Turtle	EN			Criteria (a)	Unlikely LoO	No	This species occurs widely throughout the northern tributaries of the Ganga, the-Brahmaputra basin, and their delta region in northern India. Species record in Bhutan need to be confirmed. The known distribution area is more than 200 km Southeast of the AoA. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Varanus flavescens	Yellow Monitor	EN			Criteria (a)	Possible LoO	No	This species is confined to, and has a wide range on, the Indo-Gangetic Plain south of the Himalayas in eastern Pakistan, northern India, Nepal, south central Bhutan (i.e.,

[135] Wangyal, J. T., Wangchuk, D., & Das, I. (2012). First report of turtles from the Himalayan Kingdom of Bhutan. *Chelonian Conservation and Biology*, *11*(2), 268-272.
[136] Rahman, S., Platt, K., Das, I., Choudhury, B.C., Ahmed, M.F., Cota, M., McCormack, T., Timmins, R.J. & Singh, S. 2019. *Indotestudo elongata* (errata version published in 2019). *The IUCN Red List of Threatened Species* 2019: e.T10824A152051190. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T10824A152051190.en. Accessed on 04 October 2024.
[137] Das, I. (2015). Field guide to the reptiles of South-East Asia. Bloomsbury Publishing.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									Sarpang), and Bangladesh. Its distribution mainly follows the major river systems of the Indus, Ganges and Brahmaputra. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Nilssonia gangetica	Indian Softshell Turtle	EN			Criteria (a)	Unlikely LoO	No	This species occurs throughout the northern plains of the Indian Subcontinent, in the Indus, Ganga, Narmada and Mahanadi basins and most tributaries and intervening drainages of Bangladesh, India, Nepal, Pakistan and Afghanistan, and the Brahmaputra basin. The known distribution area is more than 200 km Southeast of the AoA.The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Nilssonia hurum	Indian Peacock Softshell Turtle	EN			Criteria (a)	Unlikely LoO	No	This species occurs throughout the northern plains of the Indian Subcontinent, in the Indus, Ganga, Narmada and Mahanadi basins and most tributaries and intervening drainages of Bangladesh, India, Nepal, Pakistan and Afghanistan, and the Brahmaputra basin. The known distribution area is more than 200 km Southeast of the AoA. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Cuora mouhotii	Keeled Box Turtle	EN			Criteria (a)	Possible LoO	No	This species can occur in Sarpang, especially in PWS. The species is primarily known from South China and Vietnam. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Crocodylus palustris	Mugger	VU			Criteria (a)	Unlikely LoO	No	This species is found in India, Sri Lanka, Pakistan, Nepal and possibly from Bangladesh, its range extends westwards into eastern Iran. The species was last seen in Bhutan in the 1960s. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Pangshura tecta	Indian Roofed Turtle	VU			Criteria (a)	Unlikely LoO	No	This species occurs in the Sub-Himalayan lowlands of the Indus, Saharmati, Mahi, Narmada, Ganga and Mahanadi River systems of Pakistan, India, Nepal and Bangladesh. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Oligodon erythrorhachis	Namsang Kukri Snake	VU			Criteria (a)	Possible LoO	No	This species is currently known from only three localities in India. It has been found in Namsang, Jeypore District, Assam, Chessa, Papum Pare District, Arunachal Pradesh, and from Manas Tiger Reserve in Assam. The species can also be found in Bhutan, but the record need to be confirmed. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Oligodon juglandifer	Walnut Kukri Snake	VU			Criteria (a)	Possible LoO	No	Based on the expert consultation this species has been recorded in PWS. However, species core distribution is Darjeeling District near Gopaldhara in West Bengal and Sikkim in India, and in Wangdue Phodrang, Jigme Singye Wangchuck National Park, and near Wamrong in central Bhutan. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Ophiophagus hannah	King Cobra	VU			Criteria (a)	Present	No	This species is widely distributed in South and Southeast Asia, from Nepal and India across southern China, southward to the Philippines and Indonesia east as far as Sulawesi and Bali as well as the Malaysian territories of Sarawak and Sabah, and Brunei.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									The Project AoA overlaps with the species' EoO. Data from iNaturalist suggested its presence scattered in PWS and RMNP. A total of 4 King Cobra was found in the transect survey in the agriculture (northern GMC) and in the sub-tropical forest (southern GMC). Comparing the small project AoA and the large EoO, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Elaphe taeniura	Cave Racer	VU			Criteria (a)	Possible LoO	No	This species occurs from northeastern India, Bhutan across mainland China to Taiwan and the Ryukyu Islands (Japan), southward to Sumatra (Indonesia) and Borneo. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Python bivittatus	Burmese Python	VU				Present	No	This species occurs from northeast India, Bhutan through Nepal to Indonesia and China (including Hainan). It is absent from Peninsular Malaysia, with a southern limit to its distribution in mainland Asia of Surat Thani in Thailand. The Project AoA overlaps with the species' EoO. Data from iNaturalist did not record its presence within the GMC and its vicinity. The transect survey recorded the occurrence of 2 Burmese Python in the sub-tropical forest. Comparing the small project AoA with the large species' EoO, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Cnemaspis assamensis	Assamese Day Gecko	VU				Possible LoO	No	This species is known only from Assam in northeast India, where it has been recorded from three localities along the Brahmaputra River on both banks, and from RMNP in Bhutan. Its distribution appears to be limited to the Terai floodplain, where it is likely to occur between Garbhanga Reserve Forest and Garo-Khasi Hills and on the slopes of Karbi-Anglong. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Lissemys punctata	Indian Flapshell Turtle	VU				Unlikely LoO	No	Based on expert consultation, this species is not present in Sarpang. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Xenochrophis cerasogaster	Painted Keelback	VU				Unlikely LoO	No	Based on expert consultation, this species is not present in Sarpang. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Boiga gokool	Eastern Cat Snake	LC			Criteria (b)	Possible LoO	No	*Boiga gokool* is a South Asian endemic species and known with certainty only from India and Bangladesh. The AoA does not overlap with the EoO, so it is unlikely that the AoA regularly holds significant global population. Thus, Critical Habitat is not triggered.
	Amphibian								
	Amolops monticola	Mountain Cascade Frog	EN			Criteria (a)	Possible LoO	No	The record of this species in Sarpang is only in PWS. The AoA may not expected to sustain significant global population. Therefore, Critical habitat is not triggered.
	Uperodon assamensis	Assamese Balloon Frog	VU			Criteria (a)	Possible LoO	No	This species can occur in Sarpang. However, core distribution of this species is Assam, India. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Minervarya chilapata	Chilapata Rainpool Frog	VU			Criteria (a)	Possible LoO	No	This species can be found along Bhutan-India broader. However, the core distribution is West Bengal and Assam, India. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Tylototriton himalayanus	Himalayan Salamander	VU			Criteria (a)	Unlikely LoO	No	Based on expert consultation, this species is not present in Sarpang. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Megophrys robusta	Bengal Spadefoot Toad	LC			Criteria (b)	Unlikely LoO	No	Endemic to Bhutan and some part of India (West Bengal and Arunachal Pradesh). However, distribution range in Bhutan is limited to northern part close to China broader. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Kalophrynus orangensis	Orang Sticky Frog	LC			Criteria (b)	Not Present	No	This species is endemic to India (West Bengal and Assam) and in Bangladesh. The AoA may not expected to regularly hold significant global population size. Therefore, Critical habitat is not triggered.
	Chirixalus simus	Assam Asian Treefrog	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to India and Bangladesh. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Nasutixalus jerdonii	Jerdon's Bubble-nest Frog	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to India and Myanmar. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Raorchestes shillongensis	Shillong Bush Frog	LC			Criteria (b)	Not Present	No	This species is endemic to India. The AoA may not expected to regularly hold significant global population size. Therefore, Critical habitat is not triggered.
	Leptobrachium rakhinense	Rakhine Bicolor-eyed Toadfrog	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to Bangladesh, Myanmar, and India. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Theloderma baibungense	Baibung Small Treefrog	LC			Criteria (b)	Not Present	No	This species is endemic to China. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Birds								
	Buceros bicornis	Great Hornbill	VU		I	Criteria (a)	Present	No	Great Horbill is resident to the forests of South and Southeast Asia, found in countries like India, Nepal, Bhutan, Myanmar, Thailand, Laos, Vietnam, Cambodia, Indonesia, and Malaysia. This species frequents wet evergreen and mixed deciduous forests, ranging out into open deciduous areas to visit fruit trees and ascending slopes to at least 1,560 m in south India and Raman and up to 2,000 m in Thailand.[138] Hornbill Action Plan indicated that the species inhabit mostly in the altitude range of 600 to 2000 m.a.s.l,[139] while the limit of the Project AoA is 500 m. The global population is estimated 13,000-27,000 individuals.[140] The EoO is approximately 10,300,000 km^2.[141] Data from iNaturalist and GBIF suggest the frequent occurrence of the Great Hornbill in central and southern Bhutan, with higher densities particularly noted in the lowland areas bordering India. The transect survey recorded two Great Hornbills across four grids in the subtropical forest of southern GMC. It is highly likely that these four sightings represent the same two individuals. Available research recorded the frequent occurrence of Great Hornbill in Zhemgang District (Royal Mans National Park) with 1-7 individuals each encounter.[142] The Project AoA accounts for 0.001% of the species' EoO. While it is possible that more Great Hornbills may inhabit the Project AoA, given the smaller size of the project area compared to the species' wider distribution, it is unlikely that the Project AoA supports a significant population of this species. The loss of which would not result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat for this species is not triggered.
	Rhyticeros undulatus	Wreathed Hornbill	VU			Criteria (a)	Present	No	It can be found in South-east Asia from southern Bhutan and north-eastern India east to Vietnam and south across Malaysia to western Indonesia east to Borneo, Java and Bali, including some nearby islands. The Wreathed hornbill occurs in extensive tracts of

[138] BirdLife International. 2020. *Buceros bicornis*. *The IUCN Red List of Threatened Species* 2020: e.T22682453A184603863. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22682453A184603863.en. Accessed on 03 October 2024.
[139] Hornbill Action Plan 2023. Available at: Hornbill_Action_Plan.pdf. Accessed date: 28 October, 2024.
[140] BirdLife International. 2020. *Buceros bicornis*. *The IUCN Red List of Threatened Species* 2020: e.T22682453A184603863. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22682453A184603863.en. Accessed on 03 October 2024.
[141] Birdlife International. Available at: Great Hornbill (Buceros bicornis) - BirdLife species factsheet Accessed date: October 28, 2024
[142] Sherub, K. A. R. M. A., & Tshering, S. A. N. G. A. Y. (2019). Rapid assessment of two sympatric hornbill species populations and their nesting behaviour in Zhemgang district, Bhutan. *BirdingAsia*, *31*, 54-58.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									primary rainforest, mainly in the foothills, but has been recorded to 2,560 m elevation.[143] The EoO is estimated 7,020,000 km^2.[144] Two Wreathed Hornbill individuals were recorded in Grid_37 on July 16, and Grid_28 on July 17. It is highly likely that these two sightings represent the same two individuals. Data from eBird indicated its presence within the Project area and its proximity. The Project AoA accounts for 0.001% of the species' EoO. While it is possible that more Wreathed Hornbill may inhabit the Project AoA, given the smaller size of the Project area and Project AoA compared to the species' wider distribution, it is unlikely that the Project AoA supports a significant population of this species. The loss of which would not result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat for this species is not triggered.
	Haliaeetus leucoryphus	Pallas's Fish-eagle	EN			Criteria (a), (c)	Possible LoO	No	The global population is 1000-2499 mature individuals and its estimated EoO is 1,740,000 km^2.[145] In Bhutan, there are reports of birds occasionally being observed in four major river basins, Punatshangchu, Mangdichu, Kurichu and Drangmichu. Although the species may occur in Bhutan, but the known habitats are not located within AoA. Additionally, the AoA is an insignificant fraction (0.006%) of the EoO. The AoA is not expected to sustain ≥ 1% of the global population at any point if the species lifecycle. Therefore, Critical habitat is not triggered.
	Aquila nipalensis	Steppe Eagle	EN			Criteria (a), (c)	Possible LoO	No	The global population is approx. 50000-75000 mature individuals and the species' EoO is approx. 12,600,000 km^2.[146] While the preferred habitat of this species may be present within the AoA, it is unlikely that the AoA supports a significant portion of the population. Additionally, the AoA is an insignificant fraction (0.0008%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle. Therefore, Critical habitat is not triggered.
	Aythya ferina	Common Pochard	VU			Criteria (a), (c)	Possible LoO	No	The global population is 760000-790000 mature individuals and its estimated EoO is 548,000 km^2.[147] Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. Additionally, the AoA is an insignificant fraction (0.002%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle. Therefore, Critical habitat is not triggered.
	Halcyon pileata	Black-capped Kingfisher	VU			Criteria (a), (c)	Possible LoO	No	The species population likely exceeds 10,000 mature individuals and its estimated EoO is 5,160,000 km^2.[148] No IBA within the Project AoA is identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.002%) of the EoO and therefore the AoA may not expected to regularly hold significant global population size AND ≥ 10 reproductive units of a species. In essence the rationale needs to be more explicit for screening out.
	Apus acuticauda	Dark-rumped Swift	VU			Criteria (a), (b), c	Possible LoO	No	The global population is 250-700 mature individuals and its estimated EoO is 158,000 km^2.[149]No IBA within the Project AoA is identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.002%) of the EoO. Therefore, the AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Grus antigone	Sarus Crane	VU			Criteria (a), (c)	Possible LoO	No	The global population is approx. 13000-15000 mature individuals and the species' EoO is 13,800,000 km^2.[150] Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA.

[143] IUCN Hornbill. Available at: Wreathed hornbill | IUCN Hornbill Specialist Group Accessed date: October 28, 2024
[144] Birdlife International. Available at: Wreathed Hornbill (Rhyticeros undulatus) - BirdLife species factsheet Accessed date: Oct 28, 2024
[145] Birdlife International. Available at: Pallas's Fish-eagle (Haliaeetus leucoryphus) - BirdLife species factsheet Accessed date: October 28, 2024.
[146] Birdlife International. Available at: Steppe Eagle (Aquila nipalensis) - BirdLife species factsheet Accessed date: Oct 28, 2024
[147] Birdlife International. Available at: Common Pochard (Aythya ferina) - BirdLife species factsheet Accessed date: Oct 28, 2024
[148] Birdlife International. Available at: Black-capped Kingfisher (Halcyon pileata) - BirdLife species factsheet Accessed date: October 28, 2024.
[149] Birdlife International. Available at: Dark-rumped Swift (Apus acuticauda) - BirdLife species factsheet Accessed date: Oct 28, 2024
[150] Birdlife international. Available at: Sarus Crane (Grus antigone) - BirdLife species factsheet Accessed date: October 28, 2024

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									The AoA is an insignificant fraction (0.0007%) of the EoO. The AoA may not expected to sustain significant global population at any point during the species lifecycle. Therefore, Critical habitat is not triggered.
	Gallinago nemoricola	Wood Snipe	VU	FNCR		Criteria (a), (c)	Possible LoO	No	The global population is approx. 2500-9999 mature individuals and its EoO is approx. 1,270,000 km^2.[151] Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.009%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Clanga clanga	Greater Spotted Eagle	VU			Criteria (a), (c)	Possible LoO	No	The global population is approx. 3900-10000 mature individuals and its EoO is 15,300,000 km^2.[152]Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.0007%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Aquila heliaca	Eastern Imperial Eagle	VU			Criteria (a), (c)	Possible LoO	No	The global population is approx. 2500-9999 mature individuals and its EoO is 15,400,000 km^2.[153]Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.0007%) of the EoO. The The AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Turdus feae	Grey-sided Thrush	VU			Criteria (a), (c)	Possible LoO	No	The global population is approx. 2500-9999 mature individuals and its EoO is 327,000 km^2.[154] Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.003%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Saxicola insignis	White-throated Bushchat	VU			Criteria (a), (c)	Possible LoO	No	The global population is approx. 2500-9999 mature individuals and its EoO is 232,000 km^2.[155] Although the species may occur in Bhutan, but there's no IBA identified as congregation or important site that may support a significant portion of migratory waterbird species within AoA. The AoA is an insignificant fraction (0.05%) of the EoO. The AoA may not expected to sustain significant global population at any point if the species lifecycle Therefore, Critical habitat is not triggered.
	Sitta formosa	Beautiful Nuthatch	VU	FNCR		Criteria (a), (c)	Possible LoO	No	This species has a broad range encompassing Bhutan, north-east India (with recent records from Arunachal Pradesh, Assam, Nagaland and northern West Bengal), west, north and east Myanmar (including Kachin, Mt Sarameti, Arakan Hills, and Salween-Mekong watershed east of Mong Hang), Huanglianshan Nature Reserve in south-east Yunnan, China, East and West Tonkin, north Viet Nam, and north and central Laos (including the Annamite Range), with a few records from extreme north-west Thailand. The global population is approx. 2500-9999 mature individuals and its EoO is 1,220,000 km^2.[156] The AoA is an insignificant fraction (0.008%) of the EoO. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.

[151] Birdlife International. Available at: Wood Snipe (Gallinago nemoricola) - BirdLife species factsheet Accessed date: October 28, 2024
[152] Birdlife International. Available at: Greater Spotted Eagle (Clanga clanga) - BirdLife species factsheet Accessed date: October 28, 2024
[153] Birdlife International. Available at: Eastern Imperial Eagle (Aquila heliaca) - BirdLife species factsheet Accessed date: October 28, 2024
[154] Birdlife International. Available at: Grey-sided Thrush (Turdus feae) - BirdLife species factsheet Accessed date: October 28, 2024
[155] Birdlife International. Available at: White-throated Bushchat (Saxicola insignis) - BirdLife species factsheet Accessed date: October 28, 2024
[156] Birdlife International. Available at: Beautiful Nuthatch (Sitta formosa) - BirdLife species factsheet Accessed date: October 28, 2024

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Schoenicola striatus	Bristled Grassbird	VU			Criteria (a), (c)	Possible LoO	No	This species is endemic to the Indian Subcontinent. It can be found in Bhutan. However, most of species' records come from Bangladesh, India, Nepal, and Pakistan. The global population is approx. 2500-9999 mature individuals and its EoO is 2,490,000 km^2.[157] The AoA is an insignificant fraction (0.004 %) of the EoO. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Ortygornis gularis	Swamp Francolin	VU			Criteria (a)	Unlikely LoO	No	This species can be found in Sarpang as the habitat theoretically suit for species requirement. However, it is known as endemic to the Ganges and Brahmaputra River basins, from the Terai of western Nepal to Uttar Pradesh, Bihar, West Bengal, Assam, and Arunachal Pradesh, northern India. The global population is approx. 10000-19999 mature individuals and its EoO is 414,000 km^2.[158] The AoA is an insignificant fraction (0.004 %) of the EoO. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Mulleripicus pulverulentus	Great Slaty Woodpecker	VU	FNCR		Criteria (a)	Possible LoO	No	This species is found in South-East Asia, from northern India through the foothills of the Himalaya (including, locally, Nepal and Bhutan) to southern China, Myanmar, Lao PDR, Viet Nam, Cambodia and Thailand, and through Peninsular Malaysia to Sumatra (Indonesia), Borneo, and Palawan, Philippines. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Aceros nipalensis	Rufous-necked Hornbill	VU			Criteria (a)	Possible LoO	No	This species has wide distribution from Bhutan, north-east India, Myanmar, southern Yunnan and south-east Tibet, China, Thailand, Laos and Viet Nam. The global population is approximately 7000-10000 mature individuals and its estimated EoO is 1,580,000 km^2.[159] Available research recorded the frequent occurrence of Rufous-necked Hornbill in Zhemgang District (Royal Mans National Park) with 2-11 individuals each encounter.[160] This species was found in Sarpang-Gelephu Foothills IBA[161],[162]. The Project AoA accounts for 0.007% of the species' EoO. While it is possible that Rufous-necked Hornbill may inhabit the Project AoA, given the smaller size of the Project area and Project AoA compared to the species' wider distribution, it is unlikely that the Project AoA supports a significant population of this species. The loss of which would not result in the change of the IUCN Red List status to EN or CR. Therefore, the Critical Habitat for this species is not triggered.
	Sterna aurantia	River Tern	VU	FNCR		Criteria (a)	Possible LoO	No	This species can occur in Sarpang; However, it has wide distribution range. It occurs along river systems across a wide range in southern and south-east Asia, being found in Pakistan, India, Bangladesh, Myanmar, Thailand, Cambodia, and southern China (Yunnan), as well as Nepal, Bhutan, Laos, and Vietnam during the non-breeding season. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Prinia cinereocapilla	Grey-crowned Prinia	VU			Criteria (a), (b)	Possible LoO	No	This species has been recorded in the terai of Uttar Pradesh, West Bengal and Assam, India, Nepal and Bhutan. The The Nepalese population is currently estimated at between 1,500 and 2,000 individuals. As the AoA is not a core distribution area, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.

[157] Birdlife International. Available at: Bristled Grassbird (Schoenicola striatus) - BirdLife species factsheet Accessed date: October 28, 2024
[158] Birdlife International. Available at: Swamp Francolin (Ortygornis gularis) - BirdLife species factsheet Accessed date: October 28, 2024
[159] Birdlife International. Available at: Rufous-necked Hornbill (Aceros nipalensis) - BirdLife species factsheet Accessed date: October 28, 2024.
[160] Sherub, K. A. R. M. A., & Tshering, S. A. N. G. A. Y. (2019). Rapid assessment of two sympatric hornbill species populations and their nesting behaviour in Zhemgang district, Bhutan. *BirdingAsia*, *31*, 54-58.
[161] Ibat report. 2024
[162] Available at: Biodiversity Checklist of Sarpang district based on the secondary information 2022. (researchgate.net) Accessed date: Oct 17, 2024

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Chrysomma altirostre	Jerdon's Babbler	VU			Criteria (a), (b)	Possible LoO	No	This species can be found in Sarpang, but the core distribution area is in Assam. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Argya longirostris	Slender-billed Babbler	VU			Criteria (a), (b)	Unlikely LoO	No	No record from Bhutan. The known distribution range is in Assam. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Paradoxornis flavirostris	Black-breasted Parrotbill	VU			Criteria (a), (b)	Not Present	No	This species is endemic to the Indian subcontinent, where it is known from the plains and foothills of the Brahmaputra valley in Arunachal Pradesh and Assam, north-east India. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Clanga hastata	Indian Spotted Eagle	VU			Criteria (a)	Possible LoO	No	This species appears to be a widespread species that has always been recorded at very low densities in the lowlands of the Indian subcontinent, occurring in Nepal, India, and Myanmar. According to species record on eBird platform, there are few records of this species on the west of PWS. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. Therefore, Critical habitat is not triggered.
	Fulvetta ludlowi	Brown-throated Fulvetta	LC			Criteria (b), (c)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to China, India, Nepal and Myanmar. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Trochalopteron imbricatum	Bhutan Laughingthrush	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to China, and India. The AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Harpactes wardi	Ward's Trogon	LC	FNCR		Criteria (a), (c)	Possible LoO	No	It distributes in China, India, Myanmar, and Bhutan.[163] It is altitudinal migrant species. This species is found in the lower and middle storey, undergrowth and bamboo of tall broadleaved evergreen forest between 1,500 and 3,200 m, perhaps moving to lower elevations during the cold season, down to c.300 m in some areas. [164] It feeds on insects (such as moths, stick-insects, grasshoppers and bugs) and seeds. [165] The Project AoA does not overlap with the species' EoO. Data from eBIRD suggests the species scatters in Bhutan. The species was not found during the terrestrial survey (July-August 2024). Comparing the small Project AoA with the large species' EoO, the AoA may not expected to regularly hold significant global population. Therefore, Critical habitat is not triggered.
	Flora								
	Cheirostylis sherriffii		CR			Criteria (a)	Possible LoO	No	It grows in humid evergreen lower montane forest.[166] It occurs in the montane habitat at 2,000 above sea level.[167] IUCN data indicates the presence of this species in Bhutan solely. GBIF shows its wide distribution, e.g., Nepal, Vietnam, Myanmar, China, India and, Bhutan, while iNaturalist does not have any record. Expert consultation suggested the species may occur within the Project AoA. However, our plot survey did not record this species' presence. It is unlikely that Project AoA supports habitat for the significant global population of this species. Therefore, the Critical Habitat is not triggered.

[163] BirdLife International. 2023. *Harpactes wardi*. *The IUCN Red List of Threatened Species* 2023: e.T22682857A181578166. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T22682857A181578166.en. Accessed on 04 October 2024.
[164] BirdLife International. 2023. *Harpactes wardi*. *The IUCN Red List of Threatened Species* 2023: e.T22682857A181578166. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T22682857A181578166.en. Accessed on 04 October 2024.
[165] BirdLife International. 2023. *Harpactes wardi*. *The IUCN Red List of Threatened Species* 2023: e.T22682857A181578166. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T22682857A181578166.en. Accessed on 04 October 2024.
[166] Bhutan Endemic Flowering Plants Workshop. 2017. *Cheirostylis sherriffii*. *The IUCN Red List of Threatened Species* 2017: e.T44786356A44787120. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T44786356A44787120.en. Accessed on 03 October 2024.
[167] Pearce, N., & Cribb, P. (1999). Notes relating to the flora of Bhutan: XXXVII. New species and records of Orchidaceae from Bhutan and India (Sikkim). Edinburgh Journal of Botany, 56(2), 273-284.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Tectona Grandis		EN			Criteria (a)	Present	No	Teak is large tree species grows in monsoon, dry, moist and deciduous forests.[168] It occurs at altitudes from 100 m asl to over 700 m asl.[169] Teak is resident in India, Lao People's Democratic Republic, Myanmar, and Thailand.[170] According to available data from iNaturalist and GBIF, it largely distributed in India, Bangladesh, Myanmar, Laos, Thailand, Indonesia, Nigeria, Ghana, and Central America. Teak is not indigenous to Bhutan.[171] It was introduced to the country in the early 1950s in plantations, mainly concentrated in the south, bordering the Indian states of Assam and West Bengal. [172] The plot survey recorded 19 teaks within sub-tropical forest in the southern GMC. In comparison with large distribution of Teak, the small size of Project AoA with does not contain habitat supporting significant global Teak population. The Project AoA, thus, does not contain critical habitat of Teak.
	Hoya bhutanica		EN			Criteria (a)	Possible LoO	Yes	This species is endemic to Bhutan. It is recorded from two sites - one in Gelephu (Sarpang district), and one in Mondokha, Dungna-Metakha (tri-junction), Gedu (Chukha district).[173] No population estimation is available. The IUCN Data indicated the occurrence of this species within the forest contiguous to the crop land in the northern GMC. Expert consultation suggested the species may present in the Project AoA. Available data suggested its presence in the southern Project area and its proximity.[174] However, our plot survey did not record this species' presence. Given the restricted range of the species, a conservative approach has been taken to trigger critical habitat.
	Aporosa cardiosperma		VU			Criteria (a)	Present	No	The species is native in Sri Lanka.[175] It is tree species occurring in lowland wet evergreen forest.176 Available date from iNaturalist and GBIF suggests its wide distribution in Southeast Asia and Australia. The plot survey recorded 53 trees of this species across two plots in the southern GMC forest. When compared to the species' broader distribution, the small size of the Project AoA habitat does not support the significant global population of this species. Therefore, the criteria for Critical Habitat are not triggered.
	Litchi chinensis		VU			Criteria (a)	Present	No	It is a canopy tree of middle elevation rainforest below 800 m.[177] Data from the iNaturalist and GBIF suggest the wide distribution of this species, i.e., Southeast Asia, Southeast Africa, and America. The plot transect survey recorded 1 *Litchi chinensis* in the crop land in the southern GMC. The plot survey counted only 1 tree species. In comparison with large distribution of species, the small size of Project AoA habitat does not support the significant global population. The Critical habitat, thus, is not triggered.
	Strobilanthes accrescens subsp. accrescens		EN			Criteria (a)	Unlikely LoO	No	This species is endemic to Bhutan. It is found along Thimphu-Phuentsholing highway at elevation 1,500 – 2,200 m. The species is not expected to occur in the AoA due to the low elevation. The AoA is not expected to sustain significant global population. The Critical habitat, thus, is not triggered.

[168] Gua, B., Pedersen, A. & Barstow, M. 2022. *Tectona grandis*. *The IUCN Red List of Threatened Species* 2022: e.T62019830A62019832. https://dx.doi.org/10.2305/IUCN.UK.2022-2.RLTS.T62019830A62019832.en. Accessed on 02 October 2024.
[169] Gua, B., Pedersen, A. & Barstow, M. 2022. *Tectona grandis*. *The IUCN Red List of Threatened Species* 2022: e.T62019830A62019832. https://dx.doi.org/10.2305/IUCN.UK.2022-2.RLTS.T62019830A62019832.en. Accessed on 02 October 2024.
[170] Gua, B., Pedersen, A. & Barstow, M. 2022. *Tectona grandis*. *The IUCN Red List of Threatened Species* 2022: e.T62019830A62019832. https://dx.doi.org/10.2305/IUCN.UK.2022-2.RLTS.T62019830A62019832.en. Accessed on 02 October 2024.
[171] FAO. Available at: Management of teak plantations in Bhutan - Mr. Chimi Dorji (fao.org) Access date: September 24, 2024
[172] FAO. Available at: Management of teak plantations in Bhutan - Mr. Chimi Dorji (fao.org) Access date: September 24, 2024
[173] Bhutan Endemic Flowering Plants Workshop. 2017. *Hoya bhutanica*. *The IUCN Red List of Threatened Species* 2017: e.T84487492A84548403. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T84487492A84548403.en. Accessed on 03 October 2024.
[174] Endemic Plants of Bhutan. Available at: Hoya bhutanica A.J.C. Grierson & D.G. Long | Species
[175] World Conservation Monitoring Centre. 2018. *Aporosa cardiosperma* (amended version of 1998 assessment). *The IUCN Red List of Threatened Species* 2018: e.T33511A136127071. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T33511A136127071.en. Accessed on 03 October 2024.
[176] A tree occurring in lowland wet evergreen forest.
[177] World Conservation Monitoring Centre. 1998. *Litchi chinensis* var. *euspontanea*. *The IUCN Red List of Threatened Species* 1998: e.T32359A9700925. https://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32359A9700925.en. Accessed on 03 October 2024.

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	Phoebe bootanica		EN			Criteria (a)	Unlikely LoO	No	This species grows in moist sub-tropical forests and temperate forests between 1,300 – 1,600 m. The species is not expected to occur in the AoA due to the low elevation. This tree species is known from Nepal, Sikkim (India) and Bhutan. Because the wide distribution, the AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Impatiens sikkimensis	Sikkim Balsam	EN			Criteria (a)	Not Present	No	This species is endemic to Eastern Himalaya. In Bhutan it found only in Xhemghang province. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Sloanea tomentosa	XIn Ye Hou Huan Xi	EN			Criteria (a)	Possible LoO	No	This species has wide distribution range from Himalayan region to China and mainland Southeast Asia. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Corallodiscus cooperi		VU			Criteria (a)	Unlikely LoO	No	This species is endemic to western-central Bhutan between 1,980-3,200 m. It has been recorded from Thimphu (Dotena Chu), Trongsa (Chendebji, Tshangkha to Tongsa), Bumthang (Near Bumthang, Dhur valley, Shabjethang), Tashiyangtse, Yutema and Chukha. The species is not expected to occur in the AoA due to the low elevation. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Buddleja bhutanica		VU			Criteria (a)	Unlikely LoO	No	This species is endemic to Bhutan, and is found from 1310-2500 m. It has been recorded from Punakha (Lobesa and Thinleygang); Etoneysa, Kazhi, Taksha, Sha Ngawang (Wangdiphodrang); Drukgyal Dzong, (Paro); and Sisina (Thimphu), Shemjong (Tsirang). The species is not expected to occur in the AoA due to the low elevation. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Beilschmiedia clarkei		VU			Criteria (a)	Possible LoO	No	Based on expert consultation, this species is present in Sarpang. It has wide distribution range from India, Bhutan, Myanmar, Northern Thailand and Laos. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Litsea albescens		VU			Criteria (a)	Possible LoO	No	This tree species is known from S.E. Tibet (China), Sikkim and Meghalaya states (India) and Bhutan. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Litsea nitida		VU			Criteria (a)	Possible LoO	No	This tree species is known from Bhutan, India (Assam, Meghalaya), Bangladesh and Myanmar. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Litsea panamanja		VU			Criteria (a)	Possible LoO	No	This tree species in known from Nepal, Bhutan, India (Sikkim and West Bengal) and Bangladesh. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
	Impatiens infundibularis	The Kurseong Balsam	VU			Criteria (a)	Possible LoO	No	This species is endemic to the Eastern Himalaya, with records from India and Bhutan but most of the records come from Darjeeling. As the AoA may not be a core distribution area, it is unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Impatiens pseudolaevigata	The Kameng Balsam	VU			Criteria (a)	Unlikely LoO	No	The species is known from Sessa to Zero Point area, West Kameng district, Arunachal Pradesh, India, and from Bhutan in Malaya top, Zhemgang district. As the AoA is outside known reported location, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Cinnadenia paniculata		VU			Criteria (a)	Unlikely LoO	No	This tree species is known from North India, Bhutan and possibly Myanmar. It grows along the edges of broad-leaved forest, between 730–2,000 m altitude. As the high elevation area in AoA is limited, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Trillium tschonoskii	Keun-yeon-yeong-cho	EN			Criteria (a)	Possible LoO	No	The species has extensive distribution range from Himalayan region to Russia and Taiwan. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Dactylorhiza hatagirea	Salampanja	EN			Criteria (a)	Not Present	No	This species grows in alpine forests between 2,500 – 5,000 m. The species is not expected to be present within the AoA due to low elevation. This species has extensive distribution range throughout Himalayan region with several known locations. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Bambusa clavata		VU			Criteria (a)	Possible LoO	No	This species is endemic to Bhutan and is found from 300-1600 m, in Punakha (Thinleygang), Trongsa, Buli, Zhemgang, Sarpang, Gelephu. It is found at low altitudes. It can be found in warm shady areas, along streams and riverbanks. The species is localized, but quite common where it is found. As the required habitat is plenty throughout Bhutan, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Drepanostachyum annulatum		VU			Criteria (a)	Unlikely LoO	No	This species is endemic to Bhutan, with an elevation range around 1000-2000 m. It is recorded from two sites, both in the Chukha area. The species is not expected to be present within the AoA due to low elevation. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Oryza malampuzhaensis		VU			Criteria (a)	Unlikely LoO	No	It can be found in Sarpang. However, Sarpang is not core distribution area as it is endemic to Kerela region in India. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Paris polyphylla	Love Apple	VU			Criteria (a)	Unlikely LoO	No	This species is mainly distributed in the temperate forest across the Himalayas to Western China preferring an altitudinal range of 1,800-3,300 metres above sea level. The species occurs in Bangladesh, China, India, Laos, Myanmar, Nepal, Taiwan, Thailand, and Viet Nam. In Bhutan, it is found in Singkhar Lauri and Gomdar, Samdrup Jongkhar Dzongkhag, Kangpara and Rumang gewogs in Trashigang Dzongkhag and the villages of Zhobel, Jurmin, and Shumar in Pemagathsel Dzongkhag. The species is not expected to be present within the AoA due to low elevation. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the

No	Scientific name	Common name	IUCN Red List	National Regulation	CITES	CH Candidate	LoO Category	CH species	Assessment
									change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Fritillaria cirrhosa	Yellow Himalayan Fritillary	VU			Criteria (a)	Not Present	No	The species is "near endemic" to the Himalayas. It is distributed in Bhutan, China, India, Myanmar, Nepal, and Pakistan. Alpine slopes and shrublands of the Himalayas at altitudes between 2,700 and 4,000 m are the preferred habitats of the species. The species is not expected to be present within the AoA due to low elevation. As the suitable habitat of this species in AoA is limited, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Salvinia natans	Floating Fern	LC			Criteria (b)	Possible LoO	No	This is not restricted range species. It is occurring in central and eastern Europe and in Asia, from the Caucasus to China, northern parts of India and into southeast Asia, and Japan. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Fish								
	Amblyceps arunchalensis		EN			Criteria (a)	Unlikely LoO	No	Likely to be endemic of Arunachal Pradesh, India. The known distribution area is 400 km Southeast of the AoA. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Schistura sijuensis		EN			Criteria (a), (b)	Unlikely LoO	No	Even though the habitat in Sarpang is theoretically possible to support species population, it is only recorded from Siju cave in the Garo Hills, Meghalaya, India. Now this species known as endemic to India. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Tor putitora		EN			Criteria (a), (c)	Present	No	It can be found in South Asia and parts of North and Northeast India.[178] The species population has not been estimated yet, but the IUCN red List states that several populations exist inside terrestrial protected areas where their populations are increasing or stable. Based consultations with local experts, it can be found in Mau River and other river in protected areas. The aquatic survey did not record the presence of the species in the Mau River and Taklai River. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Wallago attu		VU			Criteria (a), (c)	Possible LoO	No	The species is widely distributed across South and mainland Southeast Asia. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Schizothorax plagiostomus	Snow Trout	VU			Criteria (a), (c)	Possible LoO	No	Based on expert consultation, this species is present in Sarpang. It has wide distribution range from Pakistan, India, Nepal, Afghanistan, Bhutan and Tibet, China. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Bagarius bagarius		VU			Criteria (a)	Possible LoO	No	This species is known throughout the Indian subcontinent, from the Indus and Ganges-Brahmaputra River drainages southwards to the Cauvery River drainage. As the species has wide distribution range, it is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Pseudosphromenus cupanus	Spiketail Paradise Fish	LC			Criteria (b)	Unlikely LoO	No	This species distribution is India, Sri Lanka, Bangladesh, Indonesia, Malaysia, Thailand, and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.

[178] Jha, B.R., Rayamajhi, A., Dahanukar, N., Harrison, A. & Pinder, A. 2018. *Tor putitora*. *The IUCN Red List of Threatened Species* 2018: e.T126319882A126322226. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T126319882A126322226.en. Accessed on 04 October 2024.

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	Oryzias carnaticus	Spotted Ricefish	LC			Criteria (b)	Unlikely LoO	No	This species distribution is India, Sri Lanka, Bangladesh, and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Bengala elanga	Bengala Barb	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to India, Bangladesh and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Aplocheilus lineatus	Striped panchax	LC			Criteria (b)	Unlikely LoO	No	This species is endemic to India. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Hemibagrus menoda		LC			Criteria (b)	Unlikely LoO	No	This species distribution is India, Nepal and Bangladesh. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Amblyceps mangois		LC			Criteria (b)	Unlikely LoO	No	This species distribution is India and Pakistan. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Xenentodon cancila		LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to India, Bangladesh, Thailand, Sri Lanka, Nepal and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Batasio batasio		LC			Criteria (b)	Unlikely LoO	No	This species distribution is India and Bangladesh. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Badis blosyrus		LC			Criteria (b)	Unlikely LoO	No	This species is endemic to India. The record in Bhutan needs to be verified. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Psilorhynchus homaloptera	Homaloptera minnow	LC			Criteria (b)	Unlikely LoO	No	This species distribution is India, Nepal and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Oreichthys cosuatis		LC			Criteria (b)	Unlikely LoO	No	This species distribution is India, Bangladesh, Thailand, and Myanmar. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Ctenops nobilis		NT			Criteria (b)	Unlikely LoO	No	This species is endemic to India (Bengal, Bihar, Assam and Sikkim) and in Bangladesh. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Batasio merianiensis		DD			Criteria (b)	Unlikely LoO	No	This species is known from Meriani and in Gurfhula River near Kumapara in Assam Brahmaputra River drainage, India.[179]
	Schizothorax richardsonii	Asla/ Snowtrout	VU			Criteria (a), (c)	Unlikely LoO	No	It can be found in Himalayan region of India, Sikkim and Bhutan, Nepal, Pakistan, and Afghanistan.[180] *S. richardsonii* can be found in Afghanistan, Bhutan, India, Nepal, and Pakistan.[181] *S. richardsonii* trophically classified as a substrate-scraper with a "blunt-nosed" body shape that inhabits higher-elevation reaches.[182] *S. richardsonii* will migrate upstream in March to spawn in tributaries at 17.5–21.5°C.[183] The presence of *S. richardsonii* was confirmed in Indian Himalayan, and in Mangde Chuu and Berti Chhu (upstream of Mau and Taklai River).[184] However, given *S. richardsonii* occupies in high-elevation niches, [185] it may be unlikely that *S. richardsonii* within the Project area and its proximity.

[179] Ng, H.H. 2010. *Batasio merianiensis*. *The IUCN Red List of Threatened Species* 2010: e.T168347A6480617. https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T168347A6480617.en. Accessed on 25 October 2024.
[180] Fishbase. Available at: Schizothorax richardsonii, Snowtrout : fisheries, gamefish Accessed date: Oct 31, 2024
[181] Vishwanath, W. 2010. *Schizothorax richardsonii* (errata version published in 2020). *The IUCN Red List of Threatened Species* 2010: e.T166525A174786567. https://dx.doi.org/10.2305/IUCN.UK.2010-4.RLTS.T166525A174786567.en. Accessed on 31 October 2024.
[182] Wangmo, S., Wangchuk, K., Douglas, M. R., Tshering, S., & Douglas, M. E. (2023). Exploring freshwater fish biodiversity in Bhutan through species distribution models: a case study on snowtrout (Cyprinidae: Schizothorax spp.). *Journal of the Bhutan Ecological Society*, *5*(5), 1-28.
[183] Wangmo, S., Wangchuk, K., Douglas, M. R., Tshering, S., & Douglas, M. E. (2023). Exploring freshwater fish biodiversity in Bhutan through species distribution models: a case study on snowtrout (Cyprinidae: Schizothorax spp.). *Journal of the Bhutan Ecological Society*, *5*(5), 1-28.
[184] Wangmo, S., Wangchuk, K., Douglas, M. R., Tshering, S., & Douglas, M. E. (2023). Exploring freshwater fish biodiversity in Bhutan through species distribution models: a case study on snowtrout (Cyprinidae: Schizothorax spp.). *Journal of the Bhutan Ecological Society*, *5*(5), 1-28.
[185]

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									The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Schistura reticulofasciata		VU			Criteria (a), (c)	Present	No	While the data from IUCN suggested the species' occurrence in India solely, the aquatic survey recorded 10 individuals in plot 4 and 1 individual in plot 5 (Mau River). The EoO is approx. 12000-13000 km^2. It inhabits streams with pebbles. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Crustaceans								
	Liotelphusa quadrata		VU			Criteria (a)	Not Present	No	Species distribution is limited to Nagaland state on the border of India and Myanmar. The known distribution area is more than 400 km Southeast of the AoA. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Macrobrachium scabriculum		LC			Criteria (b)	Unlikely LoO	No	The species is currently known from eastern Africa, Madagascar, India, Bangladesh, Sri Lanka, and Sumatra. The AoA may not expected to regularly hold significant global population. The Critical habitat, thus, is not triggered.
	Macrobrachium rude		LC			Criteria (b)	Unlikely LoO	No	The species is currently known from eastern Africa, Madagascar, India, Bangladesh, and Sri Lanka. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Macrobrachium rosenbergii	Giant River Prawn	LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to China, India, and Southeast Asia. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Insects								
	Haematopinus oliveri		CR			Criteria (a), (b)	Unlikely LoO	No	The Pygmy Hog-sucking Louse is a parasite found only on the Pygmy Hog, Porcula salvania. Its host distribution is now restricted to a few localities in and around Manas National Park in northwestern Assam. The EoO is estimated 300 km^2.[186] The Project AoA does not overlap the species' EoO. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Bhutanitis ludlowi	Ludlow's Bhutan Glory	EN			Criteria (a)	Unlikely LoO	No	The species was previously only recorded from the Trashiyangsi Valley in Northeastern Bhutan. The known distribution area is 90 km Southeast of the AoA. The AoA may not expected to sustain significant global population. The Critical habitat, thus, is not triggered.
	Coeliccia svihleri		LC			Criteria (b)	Possible LoO	No	This species distribution range of this species is not limited to Bhutan. It also extends to China, India, and Myanmar. The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.
	Fungi								
	Ophiocordyceps sinensis	Chinese Caterpillar Fungus	VU	FNCA, FNCRR		Criteria (a)	Not Present	No	Based on expert consultation, there is no record of this species in Sarpang. This species requires soft soil under trees in mountains over 4000 m high, or in cold, well-drained grassy marshlands. The Project AoA does not overlap with the species' EOOO. It is highly unlikely that the AoA could support globally important concentrations of this species, the loss of which would result in the change of the IUCN Red List status to EN or CR. The Critical habitat, thus, is not triggered.
	Salvinia natans	Floating Fern	LC			Criteria (b)	Possible LoO	No	This is not restricted range species. It is occurring in central and eastern Europe and in Asia, from the Caucasus to China, northern parts of India and into southeast Asia, and Japan.

[186] Gerlach, J. 2014. *Haematopinus oliveri*. *The IUCN Red List of Threatened Species* 2014: e.T9621A21423551. https://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T9621A21423551.en. Accessed on 04 October 2024.

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									The AoA may not expected to regularly hold significant global population size. The Critical habitat, thus, is not triggered.