REPORT ON THE IUCN REACTIVE MONITORING MISSION TO KEOLADEO NATIONAL PARK WORLD HERITAGE PROPERTY, INDIA

13 TO 17 FEBRUARY 2023

Keoladeo National Park © IUCN/Philip McGowan

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ACRONYMS AND ABBREVIATIONS

ASI	Archaeological Survey of India
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
IUCN	International Union for Conservation of Nature
KNP	Keoladeo National Park
mcft	Million cubic feet
MoEF&CC	Ministry of Environment, Forest and Climate Change
MoU	Memorandum of Understanding
OUV	Outstanding Universal Value
PHED	Public Health and Engineering Department
rSOUV	retrospective Statement of Outstanding Universal Value
SEA	Strategic Environmental Assessment
SOC	State of Conservation
SOUV	Statement of Outstanding Universal Value
UNESCO	United Nations Educational Scientific and Cultural Organization
WII	Wildlife Institute of India

EXECUTIVE SUMMARY AND LIST OF RECOMMENDATIONS

1 The property and its challenges

The 2,873 ha Keoladeo National Park (KNP) was inscribed on the World Heritage List in 1985 under natural criterion (iv), which is referred to since 2005 as criterion (x). The nomination justifies inclusion on the World Heritage List under natural criterion (iv) as a habitat of rare and endangered species, noting "The park is a wetland of international importance for migratory waterfowl. It is the wintering ground for the rare Siberian crane and is habitat for large numbers of resident nesting birds." In 2012, the retrospective SOUV was adopted (Decision 36 COM 8E).

A summary of key factors affecting the property that have been raised consistently in SOC reports since inscription, and in Decisions over the last decade, as well as by the previous 2005 and 2008 monitoring missions, provides important context. These are summarised as follows: a) provision of sufficient suitable water to the property; b) invasive species, both terrestrial and freshwater; c) involvement of the local community, first suggested to help with the management of invasive species and more recently stated explicitly as stakeholders in development of an Eco-Sensitive Zone and its management plan; d) management planning and availability of an up-to-date Management Plan; e) monitoring of the ecological status of the property, notably its bird populations; and f) the decline and disappearance of the Siberian Crane.

2 State Party responses

The State Party has recognized in the current 2017-2027 Management Plan that the ecology of KNP has been degraded severely, especially over the past three decades. This is considered due to a reduction in quantity and quality and timing of the water supply to the property, an increase in the spread of invasive alien species, and changing agricultural practices in the surrounding areas. The State Party has responded to these threats by: a) seeking to resolve the existential challenge of providing sufficient water and there are now three sources that may provide water to the KNP; b) seeking to address invasive species, including with local community involvement. Each of the principle invasive species present quite different management challenges and have different ecological consequences; c) undertaking annual counts of overwintering birds and heronries were initiated in 2016 with the involvement of volunteers; d) producing the notification to declare a 500-1500m Eco-Sensitive Zone around the property was adopted by the Ministry of Environment, Forest and Climate Change in July 2019; and e) producing a Management Plan for the period 2017 – 2027 was signed off in July 2021, with the vision "to restore the Park to its full ecological glory by arresting degradation and rejuvenating all degrading areas by relevant interventions and maintain the wetland and allied ecosystem in their purest form in 1987…".

3 The mission

At its 42nd session in Manama, Bahrain (June/July 2018), the World Heritage Committee requested the State Party of India to invite an IUCN Reactive Monitoring mission to the property "to assess its state of conservation and progress made in addressing issues of water provision and invasive species" (Decision **42 COM 7B.68**). The mission request has been reiterated in Committee decisions since.

The mission was requested to review the state of conservation of the property, and notably by carrying out the following tasks (see full Terms of Reference in Annex II): 1) Assess the progress as well as the current and planned mechanisms to sustain adequate water supply (quality and quantity) to the property, which is considered crucial for maintaining its Outstanding Universal Value (OUV); 2) Review the current status of the two sewage treatments plants in Bharatpur city and the water quality monitoring mechanism that are in place for the sewage treatment plants; 3) Review the existing monitoring of bird populations in the property, including the long-term approach and methodology and assess the population

trends of the migratory bird species which underpin the OUV of the property; 4) Assess the progress and effectiveness of controlling invasive species, including a review of the trends and methods used; 5) Review the progress towards revising the Management Plan, including the strategy on invasive species and the monitoring system; 6) Review the current status of discussions to prevent the disposal of cattle carcasses near the property, which may have potential impacts on its OUV; 7) In line with paragraph 173 of the *Operational Guidelines*, assess any other relevant conservation issues that may impact on the OUV of the property, including the conditions of integrity and protection and management.

4 Conclusions

At the time of inscription, the Siberian Crane was of significant conservation concern, and the Park was thought to be the only wintering ground of the species' Central Asian population. This population was very small in the early 1980s and wintered in KNP. The last pair of Siberian cranes wintering in KNP was recorded in the winter of 2001/2002 and it is now considered possibly extinct in India, as well as Afghanistan, Pakistan and Turkmenistan. The Siberian Crane has remained in the checklist of birds at the property throughout this time and is still listed as present between November and March, and the current Management Plan states that there is a possibility of housing and developing a population of Siberian cranes at KNP, in controlled conditions, for the benefit of tourists and education and awareness of the public.

The mission notes that there is no clear list of attributes that convey the OUV of the property. This makes it difficult for the management authorities to be able to monitor the state of conservation of the OUV of the property, and to ensure that appropriate measures are in place to facilitate the effective management of the property.

The wetland of KNP lies in a natural depression that was first managed intensively to attract waterbirds in about 1850. This has created a system of lakes and sluices within the property to manage water levels and water supply to the property has increasingly become an issue. Traditionally water came from Ajan Dam, which impounded water from inundations of the Gambhir and Banganga rivers and lies about 500m southwest of the KNP boundary. Almost since inscription in 1985, water supply to KNP has been a significant issue because of variable rainfall and increasing demand for water for agriculture and domestic purposes. This posed a potentially existential crisis for KNP between about 1997 and 2010 when the Park received very little water and, in four years, none.

The State Party has sought additional sources of water and now there is a system of drainage canals and pipelines bringing water from two new water sources (the National Chambal Sanctuary via the Chambal Pipeline, and the Kosi Depression, via the Govardhan Drain), in addition to that from the Gambhiri River via Panchna and Ajan Dams. This has increased the water supply to the Park since 2011, although it has been variable between years and rarely reaches the amount of 550mcft that has been considered necessary. This figure seems to have been derived during a decade long project conducted by the Bombay Natural History Society during the 1980s. The KNP authorities consider that 650mcft is needed during the monsoon and 100mcft at other times of the year.

Efforts to secure further water supply continues to maximize the likelihood that sufficient water is obtained each year. There are also efforts to enhance the storage capacity in the Park, including development of a peripheral canal. The status of the ground water level at present is not clear and requires clarifying along with the impact of agriculture on adjacent land on water levels in the Park throughout the year.

The waterbird assemblage represents an important component of the OUV of the property, both resident species that breed in heronries and overwintering waterfowl and waders. However, it is not possible to determine the current status of the bird species that make up

these two groups, because of uncertainties over the approach to monitoring and methodology used, and no analyses have been carried out. Particular uncertainties include the overall approach (total count or sample of the population), the experience, training and variability of observers, the field protocol used, and the analysis and communication of results.

The invasive species *Prosopis juliflora* has become a significant threat to the integrity of the site and the challenges in obtaining adequate water supply over the last 20 years appear to have made the conditions for the spread of the species more favourable. This, together with other vegetation changes requires urgent consideration with an over-riding need for a long-term adaptive management strategy. The mission team is not able to comment on the impact of management on other invasive species, other than water hyacinth removal appears to have been very positive. For other terrestrial plant species, there would seem to be a need to understand how species have spread, notably *Paspalum distichum*. This was commented as favoured by some waterfowl species, but creates an environment that is avoided by others.

The current 2017-2027 Management Plan for the property was signed off in 2021, four years after the last plan concluded. It is strong in some areas, notably securing a reliable supply of enough appropriate water, which is the over-riding challenge for the property. The work needed to tackle invasive species is also well articulated. Identifying indicators that link the impact of these actions to the attributes that convey the OUV would provide excellent insights on the impact of management against either baseline data or targets that would help ensure the OUV. The dynamic nature of the wetland system together with the significant challenges in obtaining sufficient adequate water over the last 20 years has seen changes in the property that almost certainly have affected the OUV beyond the loss of the Siberian Crane. The key challenges are recognised and significant steps have been taken to address the existential issue of water supply, but there remains a gap between management needs to retain and restore OUV and the actions being planned and implemented. There is a clear need to ensure that the OUV and associated attributes, feature more significantly in the Management Plan, as the overarching focus.

The concern over cattle carcass disposal adjacent to the property, appears based on third party and media reports captured in the 2018 SOC report. There was no evidence that this was an ongoing issue.

It is not clear how the proposed establishment of a wetland ex-situ conservation programme will contribute to the OUV at present. The authorities should ensure that any potential consideration to reintroduce Otter, Fishing Cat, Hog Deer and Blackbuck to the property, including ex-situ for tourism purposes, is in line with international best practices of the IUCN Species Survival Commission. Enhanced research capability could significantly increase the likelihood that the OUV could be restored through appropriate monitoring and guiding adaptive management.

5 Recommendations

Recommendation 1: Develop a clear list of attributes that convey the OUV to inform the long-term monitoring, protection and management of the property.

Recommendation 2: Secure a long-term strategic solution to water supply. The demand for water for agricultural and domestic purposes in the region is increasing and will continue to do so. Therefore, high level discussions between key stakeholders are increasingly critical to gain the political support and co-operation between departments to ensure adequate suitable water is supplied each year to the property. This is vital to prevent further deterioration in the ecological status of Keoladeo National Park and to restore the natural hydrological processes. In order to inform discussions on this, the following should be assessed rapidly:

a) ***Clarify water requirements.*** The 550mcft per year figure, identified in the 1980s as a sufficient level of water supply to the property, should be reviewed to ensure that: a) the method for calculating this figure is still agreed, given the current understanding of wetland hydrology; and b) the figure is still appropriate given changes in the property over 40 years and management objectives for restoring the Park (e.g. considering siltation, increasing dryland, absence of wetland processes during drought years). The figures proposed in the Management Plan of 650mcft during the monsoon and 100mcft during the rest of the year should also be considered.
b) ***Consider water quality from different sources***. There is a widespread perception that the primary water source from Ajan Dam remains the best option for KNP, and this water comes from within the water system that the property lies in. Since the property also receives water from other sources, the water quality of all sources should be considered including potential introduction of invasive species.
c) ***Water releases.*** Whilst a strategic solution is being sought, ensure that enough water is released to account for loss along drainage canals so that sufficient water reaches the property.
d) ***Hydrological processes.*** There is clearly a pressing need to understand the present hydrological status of KNP, given the significant lack of water over a sustained period of time and especially between 1997-2011, and the reliance of the park's OUV on these ecological processes for sustaining both overwintering waterfowl and resident breeding birds. There may well be a very strong ecological baseline available through the Bombay Natural History Society research project in the 1980s (see Vijayan, 1991 and references in Anonymous, 1997) and this report should be secured and compared with the present situation to guide future management actions.
e) ***Sewage Treatment Plants.*** The mission team was assured that water from the two plants in Bharatpur City were no longer being considered as options to supply water to the property. At present, there are significant concerns about the risks from using treated sewage water. Water from these plants should not be made available to the property unless there is clear research evidence that the property's hydrological integrity will not be compromised.

Monitoring related recommendations (3 and 4): There is an overriding need for a monitoring programme that is scientifically sound and that can inform the management of the property so that the OUV is maintained and, where necessary, restored. Whilst there is a programme in place to count the overwintering and resident breeding waterbirds, this is not adequate to provide the necessary data to inform management, and addressing this remains a clear priority. It is also very important to have a clear statement about the Siberian Crane at KNP, as it has not occurred for 20 years and yet remains in the bird checklist and Management Plan. The following are necessary:

Recommendation 3: Ensure the current status of the Siberian Crane is accurately reflected in the monitoring and management of the property. This should reflect that there seems virtually no prospect of the species overwintering at the property without restoration of the flyway and co-ordinated transboundary management.

Recommendation 4: Establish a scientifically-based monitoring programme based on the attributes that convey the OUV to inform management of the property, as follows:

a) ***Review existing information as fully and analytically as possible.***
b) ***Design a scientifically sound monitoring, analysis and reporting programme*** *and provide the necessary training for observers and those who would analyse and communicate findings.*
c) ***Consideration should be given to a wider ecological monitoring programme*** that would monitor ecosystem health, especially of the wetland.

Recommendation 5: Establish a long-term adaptive management strategy for invasive species that: a) takes into account the biological characteristics of *P. juliflora* that allow it to be so invasive; b) has a well-designed monitoring programme that allows the impact of management to be evaluated; c) allows management each year to be based on the results of monitoring; d) draws in scientific expertise where possible, such as the IUCN Species Survival Commission Invasive Species Specialist Group; and e) the eradication actions proposed in the current plan, mentioned in Committee Decision 44COM 7B.92 (see below) are reviewed and harmonised with the needs of a long-term scientifically-based adaptive management strategy.

Recommendation 6: Review the 2017-2027 Management Plan with an explicit focus on the management of the OUV of the property. This review should identify where there are gaps in addressing challenges facing the property's OUV in the short-term (before 2027) so that any urgent management needs can be identified. The next management planning process should start in good time to deliver a plan that explicitly links actions to attributes that convey the OUV, before the current plan expires in 2027. The 40th anniversary of inscription in 2025 provides an ideal opportunity to launch a new plan that describes the management to conserve and enhance attributes, once identified.

Recommendation 7: Ensure management planning and decision-making is focused specifically on the OUV of the property, including that planned activities explicitly and transparently contribute to its protection and management. *This will help shape the research necessary to inform management and monitor progress. In the short-term, the planned establishment of an ex-situ management programme for four species of mammal should be reconsidered*, *specifically whether it would be appropriate and the best use of resources given other urgent management priorities in the context of the OUV.*

I. THE PROPERTY

1.1 Summary of the Statement of Outstanding Universal Value (SOUV)

The KNP, with an area of 2,873 ha, was inscribed on the World Heritage List in 1985 under natural criterion (iv), which is referred to since 2005 as criterion (x)[1]. Noting that at the time of inscription there was no requirement under the Operational Guidelines to prepare a Statement of Outstanding Universal Value (SOUV), the original nomination document justifies inclusion on the World Heritage List under natural criterion (iv) as a habitat of rare and endangered species, noting "The KNP is a wetland of international importance for migratory waterfowl. It is the wintering ground for the rare Siberian crane and is habitat for large numbers of resident nesting birds."

In 2012, a retrospective SOUV (rSOUV) was proposed (see page 39 of WHC-12/36.COM/8E) and adopted retrospectively (Decision 36 COM 8E) and is provided in Annex I to this report. This rSOUV refers to the property under criterion (x), noting:

> *"The Keoladeo National Park is a wetland of international importance for migratory waterfowl, where birds migrating down the Central Asian flyway congregate before dispersing to other regions. At time of inscription, it was the wintering ground for the Critically Endangered Siberian Crane, and is habitat for large numbers of resident nesting birds. Some 375 bird species have been recorded from the property including five Critically Endangered, two Endangered and six vulnerable species. Around 115 species of birds breed in the park which includes 15 water bird species forming one of the most spectacular heronries of the region. The habitat mosaic of the property supports a large number of species in a small area, with 42 species of raptors recorded"*

At the time of inscription, the Siberian Crane (*Leucogeranus leucogeranus*) was of significant conservation concern[2], and KNP was thought to be the only wintering ground in India of the species' Central Asian population. This population was very small in the early 1980s and bred in northern West Siberia and migrated across the Russian Federation, Kazakhstan, Uzbekistan, Turkmenistan, Afghanistan, and Pakistan, before arriving at the wintering grounds in KNP. The last pair of Siberian cranes wintering in KNP was recorded in the winter of 2001/2002 and it is now considered possibly extinct in India, as well as Afghanistan, Pakistan and Turkmenistan (BirdLife International 2023: see also Convention on Migratory Species, undated).

The *2017-2027 Management Plan - KNP* (Gupta, 2021[3]) provides additional details to describe the OUV:

- An internationally important wetland for massive congregation of waterfowl and an important wintering ground on the Central Asian Flyway for migratory waterfowl from the Palearctic region; and
- One of the world's greatest heronries with 15 species, where over 20,000 birds nest, including Painted Stork, Openbill Stork, Grey Heron, Purple Heron, Night Heron, Large Egret, Intermediate Egret, Little Egret, Cattle Egret, Black-headed Ibis, Little Cormorant, Indian Shag, Large Cormorant, Indian Darter, and Eurasian Spoonbill.

[1] Until the end of 2004, World Heritage sites were selected on the basis of six cultural and four natural criteria. With the adoption of the revised *Operational Guidelines for the Implementation of the World Heritage Convention*, only one set of ten criteria exists. It is important to note that natural criterion (iv) at the time of inscription equates to current criterion (x) (see https://whc.unesco.org/en/criteria/).

[2] The species was first categorized on the IUCN Red List of Threatened Species as "Threatened" in 1988, then as "Endangered" in 1994, and as "Critically Endangered" since 2000

[3] The management plan is undated, and the mission team was told that it was finalised and signed off by the Wildlife Wing of the Rajasthan Forest Department in July 2021.

It also suggests the following as contributing to the OUV:

- About 41 species of raptors, including the largest population of globally threatened Greater Spotted Eagle and the Lesser Spotted Eagle; and
- Last remaining natural patch of Yamuna floodplain grassland, largest patch of *Mitragyna parvifolia* in the semi-arid biogeographical zone.

The Management Plan also identified other important biodiversity and cultural values as follows (Gupta, 2021):

- High species richness in small area of 2,873 hectare with 375 species of birds, 372 species of plants, 34 species of mammals, 14 species of snakes, 5 species of lizards, 3 species of geckos, 7 species of turtles, 8 species of amphibians, 57 species of fish, 71 species of butterflies, more than 16 species of dragonflies and more than 8 species of spiders; and
- Keoladeo (Shiva) temple located in the centre of Park, Sautan Wale Hanuman Temple, Sita Ram Temple, duck shooting inscriptions, Kadam Kunj Shikargah, Shanti Kutir Shikargah (now the Forest Rest House);

However, the mission notes that there is no clear list of attributes that convey the OUV of the property. This makes is difficult for the management authorities to be able to monitor the state of conservation of the OUV, and to ensure that appropriate measures are in place to facilitate the effective management of the property. It is therefore recommended that this be remedied as a matter of urgency, so that future management can be directed very clearly at restoring these attributes (see Section IV).

1.2 Summary of key SOC decisions and issues

Since the time of inscription, several issues affecting the property have been identified in State of Conservation (SOC) reports provided to the World Heritage Committee between 1990 and 2021, in monitoring missions to the property (2005 UNESCO mission; 2008 UNESCO/IUCN mission), and in related Committee Decisions. A summary review of key factors affecting the property that have been raised consistently in SOC reports since inscription, and in Decisions over the last decade (see Tables 1 and 2), as well as by the previous missions, provides important context. These are summarized into the following six key themes:

a) provision of sufficient suitable water to the property;
b) invasive species, both terrestrial and freshwater;
c) involvement of the local community, first suggested to help with the management of invasive species and more recently stated explicitly as stakeholders in development of an Eco-Sensitive Zone and its management plan;
d) management planning and availability of an up-to-date Management Plan;
e) monitoring of the ecological status of the property, notably its bird populations; and
f) the decline and disappearance of the Siberian Crane (see section below).

Table 1: Factors affecting the property as identified in SOC reports since inscription.

	2021	2018	2016	2014	2012	2011	2009	2008	2007	2006	2005	1997	1994	1990
Invasive/alien freshwater species	x	x	x	x	x	x	x	x	x	x				
Invasive/alien terrestrial species	x	x	x	x	x	x	x	x	x	x		x	x	x
Management systems/ Management Plan	x						x	x						
Other climate change impacts	x													
Solid waste	x													
Water (extraction)[4]	x	x	x	x	x	x	x	x	x	x	x		x	x
Water infrastructure	x	x	x	x	x	x	x	x	x	x	x			
Drought									x	x	x			
Impacts of tourism/visitor/ recreation[5]										x				
Disappearance of Siberian cranes[6]	x	x												
Decline in the population of Siberian cranes												x	x	x

Table 2: Factors affecting the property that have been mentioned in Decisions over the last decade (since 2012).

	2021	2018	2016	2014	2012
Invasive/alien freshwater species	x	x	x	x	x
Invasive/alien terrestrial species	x	x	x	x	x
Management systems/ Management Plan	x	x	x	x	
Ecosystem monitoring:					
Ecosystem changes					x
Bird populations	x	x	x	x	x
Cattle carcass	x				
Water infrastructure	x				x
Provision of water	x	x	x		
Data on water flows from all sources				x	
Local community involvement/stakeholder consultation	x	x	x	x	x
Satellite wetlands[7]		x		x	
Development on the edge of the property	x	x	x	x	x

The mission also notes the conclusions and recommendations of the 2005 UNESCO and 2008 UNESCO/IUCN monitoring missions to the property as follows:

[4] The mission notes that reference to 'water extraction' is unclear since the water issues related to the property are more concerned with quantity and quality of water being delivered to the property than water being removed.
[5] Some issues appear for a single year only (e.g. impacts of tourism/recreation in 2006, monitoring of ecosystem changes in 2012) and it is not clear if those issues were resolved or not, and they may be relevant in 2023.
[6] Given that the Siberian Crane has not been recorded in the property since 2001/2002, its inclusion as a factor from 2018 onwards should be clarified for management purposes.
[7] The mission notes that satellite wetlands are suggested as critical to ensuring the OUV of the property, although the scientific basis for this statement does not seem to be in place (see section below).

a) the release of a minimum of 350 mcft (million cubic feet) of water from the Ajan Dam;
b) the collection of data making it possible to monitor the changes in ecological character, notably the extent of wetland habitat and the numbers and diversity of wintering and nesting birds; and
c) finding of a solution to the problem of feral cattle grazing within the park.

The 2008 UNESCO/IUCN monitoring mission concluded that the most serious threats "by far" were water supply (both quality and quantity) and rapid invasion of *Prosopis juliflora*. The mission recommended to:

a) complete the Govardhan Drain diversion project in time to take advantage of the 2008 monsoon, and report on progress in the Dholpur-Bharatpur drinking water project;
b) complete the *Prosopis* invasive plant control measures and put into place a permanent control programme for this, and other invasive plants;
c) collaborate with local communities and stakeholders on management of the property in particular for the eradication of invasive vegetation;
d) implement a monitoring programme of breeding and wintering birds in the property and in the region as soon as possible, with special attention to the Siberian Crane, to enable monitoring of the OUV of the property; and to make the results of such monitoring available to international conservation organisations, engaging with conservation organisations as appropriate;
e) continue to invest in the maintenance and improvement of the property's infrastructure, including tourism infrastructure;
f) carry out a public use planning exercise with the objectives of better defining management authority, state and central government investments in this regard;
g) support the efforts to identify and improve management of satellite wetlands surrounding the property as a strategy to enhance the resilience of bird populations to climatic and hydrological variations in the region;

The main factors that have been raised in SOC reports, Decisions and the missions are the subject of the present mission, apart from the Siberian Crane (see section below) and so State Party responses will be discussed in more details in Section IV under each issue. In brief, however, the State Party has:

- sought to resolve the existential challenge of providing sufficient water and there are now three sources that may provide water to the Park;
- sought to address invasive species, including with local community involvement. Each of the principle invasive species present quite different management challenges and have different ecological consequences;
- annual counts of overwintering birds and heronries were initiated in 2016 with the involvement of volunteer experts. There are some counts for the satellite wetlands;
- the notification to declare a 500 – 1500m Eco-Sensitive Zone around the property was adopted by Ministry of Environment, Forest and Climate Change in July 2019;
- a Management Plan for the period 2017 – 2027 was signed off in July 2021;

II. SUMMARY OF THE NATIONAL MANAGEMENT SYSTEM FOR THE PRESERVATION AND MANAGEMENT OF THE WORLD HERITAGE PROPERTY

The KNP was first designated as a Bird Sanctuary in 1956, then declared as a Protected Forest in 1967 under the provisions of Rajasthan's Forest act (1953). In 1982, the area was upgraded to the status of a National Park under the Wildlife (Protection) act (1972). Finally, in 2018 an Eco-Sensitive Zone (a kind of buffer zone) was established around KNP by notification of the Ministry of Environment, Forest and Climate Change (MoEF&CC) in exercising powers under the Environment (Protection) Act (1986) (See State of Conservation Report by the State Party 2019). A map of the property is included in Annex IV.

At the national level, the Archaeological Survey of India (ASI) under the Ministry of Culture is the focal point for all World Heritage matters and provides technical support for managing cultural World Heritage properties, while the Wildlife Institute of India (WII) under MoEF&CC through a Memorandum of Understanding (MoU) with ASI provides technical support for managing the natural World Heritage sites of India. All SOC reports and nomination dossiers are peer-reviewed by a national Advisory Body, led by the Director General of ASI and consisting of representatives from relevant Ministries/agencies.

At the State level, the Forest Department/Chief Wildlife Warden is overall responsible for management of protected areas within the territory, including natural World Heritage properties. The Chief Wildlife Warden of the Forestry Department of Rajasthan is the key position for the KNP, especially negotiation with Rajasthan's Public Health and Engineering Department (PHED) and the Irrigation department for better water management and supply to the KNP and satellite wetlands.

At the site level, the administration of the KNP is headed by the Deputy Conservator of Forest (Wildlife) of Bharatpur. The Park administration is divided into four management units, which are called ranges, headed by range forest officers. The four ranges are: a) Wildlife range for protection of wildlife and management of habitat; b) Tourism range looks after the entry to the park, ticketing, and visitor facilities; c) Research range looks after the Interpretation centre, research, training and workshop related activities[8]; d) Flying squad range after patrolling activities. The four Range Forest Officers report to the Assistant Conservator of Forests of the Park. The Range Forest Officers have a team consisting of Foresters and Forest Guards. Currently, the Park Administration has 96 permanent and 34 "work charge" staff.

In 1981, the KNP became one of India's first two Ramsar sites and was included on the Ramsar "Montreux Record"[9] in 1990 because of management problems associated with water shortage and an unbalanced grazing regime. In 1998, India also joined signature countries of the *MoU concerning Conservation Measures for the Siberian Crane and Conservation Plan* under the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

[8] The Range Forest Officer for Research post is vacant at present (see Section 4.7.4 below)

[9] The Montreux Record is a "record of wetland sites on the List of Wetlands of International Importance, where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference" maintained under Recommendation 4.8, 4th Conference of the Parties to the Ramsar Convention, Montreux, Switzerland. See Ramsar Convention on Wetlands (2020).

III. THE MISSION

At its 42nd session in Manama, Bahrain (June/July 2018), the World Heritage Committee requested the State Party of India to invite an IUCN Reactive Monitoring mission to the property "to assess its state of conservation and progress made in addressing issues of water provision and invasive species" (Decision **42 COM 7B.68**).

The State Party of India invited an IUCN mission to the property in its correspondence on 20 November 2020 however the mission was postponed due to the COVID-19 pandemic.

At its extended 44th session (Fuzhou/Online meeting, July 2021), the World Heritage Committee requested the mission "to take place prior to the next session of the Committee, to assess its state of conservation and the progress made in addressing issues of water provision and invasive alien species" (Decision **44 COM 7B.92**).

The mission was requested to review the state of conservation of the property, and notably by carrying out the following tasks (see full Terms of Reference in Annex II):

1. Assess the progress as well as the current and planned mechanisms to sustain adequate water supply (quality and quantity) to the property, which is considered crucial for maintaining its Outstanding Universal Value (OUV);
2. Review the current status of the two sewage treatments plants in Bharatpur city and the water quality monitoring mechanism that are in place for the sewage treatment plants;
3. Review the existing monitoring of bird populations in the property, including the long-term approach and methodology and assess the population trends of the migratory bird species which underpin the OUV of the property;
4. Assess the progress and effectiveness of controlling invasive species, including a review of the trends and methods used;
5. Review the progress towards revising the Management Plan, including the strategy on invasive species and the monitoring system;
6. Review the current status of discussions to prevent the disposal of cattle carcasses near the property, which may have potential impacts on its OUV;
7. In line with paragraph 173 of the *Operational Guidelines*, assess any other relevant conservation issues that may impact on the OUV of the property, including the conditions of integrity and protection and management.

The mission was undertaken on 13-17 February 2023 by Mr Chimed-Ochir Bazarsad and Mr Philip McGowan representing IUCN. The mission held meetings with the Archaeological Survey of India, Ministry of Environment, Forest and Climate Change, Rajasthan Forest Department, Rajasthan Water Resources Department, Rajasthan Public Health and Engineering Department, two Eco-Development Committees adjacent to KNP, nature guides and rickshaw pullers, retired forest staff who had experience in working in the park over a long time period, and staff in the national Chambal Sanctuary. The mission undertook a field visit to the KNP, Ajan Dam, National Chambal Sanctuary and the Chambal Pipeline Project and Govardhan Drain Project (see mission programme and list of stakeholders, Annex III)."

The mission did not meet any independent scientists who either had conducted research in KNP or wished to.

The mission also unable to consult the report of the decade-long Bombay natural History Society research project that was conducted from 1980 to 1990 (Vijayan, 1991), or the previous Management Plan (ie pre-2017) for the property.

IV. ASSESSMENT OF THE STATE OF CONSERVATION OF THE PROPERTY

4.1 The attributes of Outstanding Universal Value

As outlined in Section I, there are various references to the OUV in the rSOUV and current Management Plan, however the mission notes there is no clear list of the attributes that convey the OUV of the property.

This makes is difficult for the management authorities to know what ecological outcomes define the OUV and, therefore, what features should be monitored. This, in turn, makes it hard to report on the state of conservation of the OUV, and to ensure that appropriate measures are in place to facilitate the effective management of the property. It is therefore recommended that this be remedied as a matter of urgency, so that future management can be directed very clearly at restoring these attributes.

The identification of attributes should be based on the rSOUV and other relevant sources such as the Management Plan and, ideally the long-running Bombay natural History Society research project undertaken in the 1980s (see Vijayan, 1991). As the OUV centres on the bird assemblages, both resident breeding waterbirds in heronries, and overwintering waterfowl and waders, it seems that attributes to be considered should include both overall numbers and the species composition of each these assemblages. Therefore, attributes that may be considered include the diversity of overwintering and resident breeding waterbirds such as the total number of overwintering and heronry species, the number of globally threatened species and their population sizes, and the number of individuals of overwintering and heronry species considered 'key' at KNP.

When considering the overall conservation state of the property, and whether changes to the OUV and its attributes are likely in the near future, the following seem key indicators: water quality and quantity, condition of wetland vegetation, distribution of invasive species and for resident breeding birds in the heronries, some indication of breeding success would be helpful in identifying potential challenges before they have an impact on the adult population. In addition, population data on the main heronry species and the number of nests each year should be analysed so that trends are clear and reported against attributes. Technical guidance on identifying attributes is available through the IUCN-ICCROM World Heritage Leadership Programme (e.g. see Tool 1 in the *Guidance and Toolkit for Impact Assessments in a World Heritage Context*).

Recommendation 1: Develop a clear list of attributes that convey the OUV to inform the long-term monitoring, protection and management of the property.

4.2 Issues 1 and 2: Water supply and potential provision of treated sewage water

This section addresses the following two issues in the ToRs, which relate to ensuring the supply of enough water of suitable quality for the KNP:

- *Issue 1: Assess the progress as well as the current and planned mechanisms to sustain adequate water supply (quality and quantity) to the property, which is considered crucial for maintaining its Outstanding Universal Value (OUV); and*
- *Issue 2: Review the current status of the two sewage treatments plants in Bharatpur city and the water quality monitoring mechanism that are in place for the sewage treatment plants.*

4.2.1 Background

A large part of Bharatpur District, within which KNP lies, in a shallow saucer-shaped valley with several rivers crossing the district (Government of Rajasthan, 2020). The shape of the

valley and the presence of several rivers leads to high water levels during the rainy season and thus flooding. The district is considered 'disaster-prone' (Government of Rajasthan, 2020). The marshes of Bharatpur have, in the past, stored flood water from the Banganga, Ruparail and Ghambiri rivers and then released the water over subsequent months towards the east of the flood plain (Sharma et al. 2015: see also UNESCO 2008). Consequently, there is a long tradition of irrigation in the floodplain and now there is high water demand for agricultural and domestic purposes. The increase in demand for ground and surface water has led to a drop in water levels in the last few years (Government of Rajasthan, 2020).

The wetland that now comprises KNP is believed to have been created by 1756, by which time the Ajan Dam had been constructed (UNESCO, 2008). In about 1850 at least ten extensive, but only seasonally inundated, lagoons were created that were divided by a system of earthen dykes (bunds) (Scott, 1989). Duck shooting across the wetland started about 1899 (UNESCO, 2008) and further works were undertaken to create a system of dams and sluices that created jheels[10] to attract a range of water birds for shooting (Gupta 2021). In the late 1980s the Park received its water from the Ajan Dam, located about 500m southwest of the Park. The Ajan Dam received its water from the Gambhiri and Banganga Rivers via the Pichuna and Uchain canals respectively (Kumar and Vijayan, 1988), and still does.

Water supply has been a challenge since inscription, and this challenge increased substantially with the increase in height of the Panchna Dam across the Gambhir River during the years 2002-2003[11] and no water release to the park over four years (2002, 2004, 2006 and 2007). Therefore, the World Heritage Committee has regularly expressed its concerns over the ecological situation at the park related to water supply since 2005. This irregular water supply combined with a failed monsoon of 2006 and 2007, worsened the ecological situation of the park and seems to have created favourable conditions for the spread of the drought-resistant invasive species *P. juliflora* throughout the park. There is also an association between the annual rainfall and water released to the park: when there was less rainfall than normal[12], the park received less water.

4.2.2 Summary of the issue

Four important points arise from this background:

1. The property lies in a natural depression that is prone to significant natural fluctuations in water level between seasons;
2. There has been an increase in demand for surface and ground water for agriculture and domestic purposes that is causing a continuous decline in water level in the floodplain;
3. The ecological value of the property is based on an artificially created wetland that has been subject to subsequent works to create the present configuration of wetland and terrestrial blocks; and
4. The demand for water in the district is continuing to increase and to the current challenges of securing sufficient water for the park are likely to intensify in the coming years.

As noted in Section I, water supply (quality and especially quantity) has been an issue since inscription (Tables 1 and 2), although the specific aspects of concern have changed over time. The minimum amount of water needed from external sources each year has long been considered to be 550 million cubic feet (mcft). The reference for this number appears to be the Hydrobiology Project carried out by the Bombay Natural History Society during the 1980s

[10] jheel is the Hindi word for 'lake'.
[11] https://www.wwfindia.org/about_wwf/critical_regions/wetlands/bharatpur2/challenges/
[12] Normal annual rainfall considered as 675 mm (Source: M.S. Shekhawat et.al, 2011, Estimation of groundwater resource in and around the KNP)

(Vijayan, 1991), although the Park authorities did not have a copy of this study at the time of the mission, and so the mission team was not able to view it. It seems critical to evaluate this study and determine if the identified minimum required water level is appropriate, given that the figure was proposed nearly 40 years ago and taking into account the current ecological status of the park.

It is further noted that Annex V makes clear that the recommended amount of 550mcft of water from external sources has been received in only 11 of 44 years since 1976 (Annex V; Water supply received in KNP during 1976 -2022 and rainfall (in mm) in Bharatpur), as follows:

- 1976-1985: at least 280mcft water received each year, more than 345mcft in three years and 513mcft in three years;
- 1986-1989: very limited water received in three of the four years;
- 1990-1996: six out of seven years of relatively good water supply;
- 1997-2010: very poor water supply in most years, and especially between 2002 and 2009, when there were four years with no water received; and
- 2011- increase in water supply each year, but still very variable between years

NB: Sharma et al. (2015) give different figures from those in Table 3 and Annex V for total water received in KNP between 2010 and 2014, namely (in mcft) 195 [2010], 297 [2011], 596 [2012], 393 [2013] and 264 [2014].

Table 3 provides these figures since 2004, when rainfall data for the property were available.

Table 3: Annual supply of water from external sources received in KNP and annual rainfall between 2004 and 2023. Sources: External water sources - Gupta, 2021, page 134 and Rajasthan Forest Department, 2023 and rainfall data - Shekhawat et al., 2010 for 2004-2008 and https://www.timeanddate.com/weather/india/bharatpur/climate for 2012 onwards).

Year	Water received in KNP (mcft)	Annual rainfall (mm)
2004	18.00	608
2005	480.90	1041
2006	0.00	373.5
2007	0.00	539
2008	556.38	786
2009	0.00	
2010	216.00	
2011	311.11	
2012	552.00	793.1
2013	678.75	689.6
2014	191.00	558
2015	390.00	647.9
2016	629.81	718.9
2017	175.00	435.8
2018	710.95	1095.7
2019	375.00	574.2
2020	589.28	762
2021	500.00	1012.4
2023	550.00	779.9

4.2.3 External change and management response

As noted above, a key change that took place outside the property that has had a significant impact on water availability was the raising of the height of the Panchna Dam in 2003 (Sharma et al. 2015; Gupta, 2021), which subsequently resulted in much less water being released into KNP, and in some years, none. Gupta (2021) states that “The park has seen severe water

shortage for a period of 15 years at the start of 21st century which has initiated many irreversible changes in the vegetation."

It was critical therefore, that this water shortage was addressed, and has been partly done through the construction of the pipeline from the Chambal River (Dholpur-Bharatpur drinking water pipeline) and the Govardhan Drain pipeline, which allowed the park to access two additional sources from 2011 (Chambal) and 2012 (Govardhan), providing an important contribution to the amount of water received each year (see Table 3 and Annex V). These have been significant projects, the first a pipeline bringing water from the Chambal River km away and the second, an 80km long channel draining flood water from near Kosi and surrounding area in Uttar Pradesh.

These developments have resulted in an overall increase in water released into the Park over the last decade, although there remains considerable variation between years. However, the Park's current Management Plan states that these two pipeline projects cannot compensate for the loss of water from the Ajan Dam (Gupta, 2021) since the 2003 raising of the Panchna Dam across the Gambhiri River and which supplies water to Ajan Dam. Furthermore, the Management Plan states that the Park's changing ecology means that more water is required each year for its complete rejuvenation and concludes that a minimum of 650 mcft water during each monsoon season is needed to allow flushing (Gupta 2021).

The 2019 State Party SOC report stated that the search for sustainable solutions to the shortage of water had led to a revival of the consideration of using treated waste water from two sewage treatment plants in Bharatpur City (State Party of India, 2019). It was considered that this could contribute about 110mcft per annum and was in the final stages of commissioning. The issue was still under consideration in the latest 2022 State Party SOC report (see Deputy Conservator of Forest, Keoladeo National Park, 2022).

4.2.4 Current situation and issues

At the start of the mission, the mission team was provided with a document (Rajasthan Forest Department, 2023) that provided commentary on the mission ToRs, and summarised the objectives of the 2017-2027 Management Plan and the 'Problems' in achieving each objective. For Management Objective 1 "*To arrange for more good quality water for the park in order to restore wetland processes of cyclical flooding, flushing and drying*", the problems listed that need to be resolved are:

1. The principal source of water – the Ajan Dam – has not been able to supply sufficient quantity of water for almost two decades now. As a result, the Park has faced multiple severe droughts and has degraded to a large extent.
2. The Chambal and Govardhan Drain are unable to compensate for the deficiency in water supply from Ajan Dam.
3. The costs of electricity required for pumping water from Govardhan Drain has been very high (to the tune of Rs 125 to 150 lacs per annum).
4. There is pilferage from these water sources by local residents.
5. The quantity of water supply from Chambal and Govardhan Drain is not measured accurately.
6. Ground water has also dried up partly due to excessive use by agriculture sector nearby and partly due to poor recharge and erratic rainfall pattern.
7. The storage capacity of water inside has also reduced due to siltation in the Park.
8. There is opposition to supply of water to KNP from a section of the general public.

The statement above about the decline in ground water is supported in the technical report on the renovation of the Govardhan Drain (Government of Rajasthan 2020), but appears to be contradicted in the Park's Management Plan (Gupta 2021), which states: "Groundwater levels within the park and in low-lying areas nearby are relatively higher." and by stakeholders

when they discussed their changes in agricultural crops that they grow adjacent to the Park (see below).

Regarding the Sewage Treatment Plants (STPs) in Bharatpur, comments made in a consultation meeting held during the preparation of the current Management Plan (see Appendix in Gupta, 2021) indicated that permission to use water from these plants in the property had been given, but the consultation raised concerns. These concerns included the suitability of introducing wastewater to KNP, citing its organic nature, biological oxygen demand, suspended solids, impact on the ecosystem, especially fish and waterbirds, and the risk of making it more difficult to receive water from the three main sources to KNP. This last point was not explained further, but is presumably because if the wastewater was seen as a regular and secure source, the Park would be a lower priority for the other, preferred, sources of water.

It was further stated that the plan had been dropped before due to the views of 'each and every stakeholder of KNP'. Despite these concerns, the Management Plan (Gupta, 2021) included STPs as options for water supply to the property, considering them 'financially and socially viable'. The Management Plan contained a range of options to be considered for securing sufficient water supply, as follows:

- Better utilization of currently active sources of water: a) water from Gambhiri river/Panchna and Ajan Dams; b) water from Govardhan Drain Project; c) water from Dholpur-Bharatpur Drinking Water Project (Chambal Pipeline); d) Chiksana Canal Project; e) ground water through maintaining existing open/shallow/deep bore wells;
- Searching for new alternatives for water (an urgent priority): a) dedicated pipeline from Ajan Dam; b) gravity pipeline from Bandh Baretha reservoir; c) utilizing treated wastewater of Bharatpur city; d) more water from Chambal river; d) Yamuna revival plan for Gambhir and Banganga river; e) storage of Bharatpur water supply;
- Expansion of storage capacity in the park; a) developing and maintaining perennial deep ponds; b) new peripheral water body/canal; and
- Maintenance of water control management: a) canal management; b) management of sluice gates; c) control at time of flooding; d) maintain drainage system.

During the mission, a range of additional related issues were raised by stakeholders or observations made by the mission that are relevant to the quantity and quality of water received in the Park, as follows:

Management and infrastructure

- It is formally mandated that KNP should receive 62.5mcft per annum from the National Chambal Sanctuary (Gupta 2021, page 146);
- The Chief Wildlife Warden with responsibility for KNP also has responsibility for the National Chambal Sanctuary, and is responsible for water management in both;
- At present there is no infrastructure to bring treated water from the city to KNP and no plan to build such infrastructure;
- A plan has been approved for the renovation of the Govardhan Drain, at a cost of 162.69 lakhs[13];
- Water from Ajan Dam is a political issue because of the demand this water for agriculture and the number of farms and farmers involved;
- There is an Eastern Rajasthan Canal Project being developed for irrigation purposes, that will run from Chambal to Bharatpur to Alwar, and a second project for drinking water and the budget has been approved. It may be possible for KNP to receive water from one of these pipelines, which would provide 5-6% of the Park's annual water requirement (28mcft);

[13] 1 lakh = Rs100,000. 162.69 lakhs = US$125,000

- Tanks ("diggies") were being constructed to hold water. Two had been dug in 'O Block' and one more was to be constructed. Another was to be dug in 'J Block' to hold water from the Govardhan Drain. These would be used to check water quality;
- Siltation is an issue and this is believed to have reduced the water storage capacity in the Park;
- A peripheral canal is being constructed with a dual purpose, to avoid cattle being put in the park and for water storage:
- It was mentioned by several stakeholders that water from the Govardhan Drain had a bad odour and was inferior to water from Ajan Dam;

Demand and agriculture
Ajan Dam is by far the preferred source of water for the property (according to park management and nature guides) and the dam extends over about 15,000ha. There are many thousands of households with a right to the land encompassed by Ajan Dam, which has to be emptied by October so that the land can be cultivated during the winter months. The exact date is determined each year by a farmer-led committee;

- Overall, the demand for water for irrigation is increasing;
- There has been a change in crops grown around the park in recent years because of an increase in the supply of water. Whereas 20-30 years ago the crops would have been green pea and grain, it is now wheat, millet and mustard, which are more commercial. The mission was told that the villagers understand the role that the Park, and its supply of water, have played in this change. The mission was also told that these crops are less used by birds than the previous crops were;
- Flooding grasslands would help the grasslands revert to their 1980s state; and
- Nature guides commented that all wetlands need flushing every 4-5 years and this is not happening at present. The Management Plan (Gupta 2021) also discusses the need for flushing cycles;

4.2.5 Summary of the present situation

This context describing the natural topography, history, management challenges and responses, and current perspectives allows the mission team to draw the following conclusions.

The wetland of KNP lies in a natural depression that was first managed intensively to attract waterbirds in about 1850. This has created a system of lakes and sluices within the property to manage water levels and water supply to the property has increasingly become an issue. Traditionally water came from Ajan Dam, which impounded water from inundations of the Gambhir and Banganga rivers and lies about 500m southwest from the KNP boundary. Almost since inscription in 1985, water supply to KNP has been a significant issue because of variable rainfall and increasing demand for water for agriculture and domestic purposes. This posed a potentially existential crisis for KNP between about 1997 and 2010 when the Park received very little water and in four years, none.

The State Party has sought additional sources of water and now there is a system of drainage canals and pipelines bringing water from two new water sources (the National Chambal Sanctuary via the Chambal Pipeline, and the Kosi Depression, via the Govardhan Drain), in addition to that from the Gambhiri River via Panchna and Ajan Dams. This has increased the water supply to KNP since 2011, although it has been variable between years and rarely reaches the amount that is believed to be needed, of 550mcft. This figure seems to have been derived during a decade long project conducted by the Bombay Natural History Society during the 1980s (see Anonymous, 1997 for a summary of the research undertaken during that time and a publication list). The KNP administration believes that the changing ecology of the KNP requires more external water every year than that estimated during the 1980s (550 mcft) for its complete rejuvenation. The Management Plan states that KNP requires a minimum 650

mcft water every year in the monsoon season to initiate flushing and 100 mcft water in small doses in non-monsoon months (Gutpa, 2021, page 136).

Efforts to secure further water supply continue in order to maximize the likelihood that sufficient water is obtained each year. There are also efforts to enhance the storage capacity in KNP, including development of a peripheral canal.

The status of the ground water level at present is not clear and requires clarifying along with the impact of agriculture on adjacent land on water levels in KNP throughout the year.

4.2.6 Recommendations

The overriding issue for the property is to secure sufficient water supply to sustain its OUV. Whilst notable strides have been made in the last decade, the amount available in most years still falls below the minimum level considered necessary, and addressing this remains a clear priority. The following are necessary:

Recommendation 2: Secure a long-term strategic solution to water supply. The demand for water for agricultural and domestic purposes in the region is increasing and will continue to do so. Indeed, water is becoming a political issue and water budgeting is necessary in some contexts. Therefore, high level discussions between key stakeholders are increasingly critical to gain the political support and co-operation between departments to ensure adequate suitable water is supplied each year to the property. This is vital to prevent further deterioration in the ecological status of KNP and to restore the natural hydrological processes. In order to inform discussions on this, the following should be assessed rapidly:

a) ***Clarify water requirements.*** The 550mcft per year figure, identified in the 1980s as a sufficient level of water supply to the property, should be reviewed to ensure that: a) the methodfor calculating this figure is still agreed, given the current understanding of wetland hydrology; and b) the figure is still appropriate given changes in the property over 40 years and management objectives for restoring the Park (e.g. considering siltation, increasing dryland, absence of wetland processes during drought years). The figures proposed in the Management Plan of 650mcft during the monsoon and 100mcft during the rest of the year should also be considered.
b) ***Consider water quality from different sources***. There is a widespread perception that the primary water source from Ajan Dam remains the best option for KNP, and this water comes from within the water system that the property lies in. This may be very important, given that Kumar and Vijayan (1989) state that of 40 species recorded in KNP between 1982 and 1985, only six bred there, the rest entered KNP when water was released from Ajan Dam. In addition, there appears to have been no consideration so far of the potential for invasive freshwater species to enter the Park from sources outside the river system (i.e. Chambal and Govardhan Drain) that KNP lies in. This should be explored.
c) ***Water releases.*** Whilst a strategic solution is being sought, ensure that enough water is released to account for loss along drainage canals so that sufficient water reaches the property. The KNP authorities estimate considerable loss between discharge and arrival in the property.
d) ***Hydrological processes.*** There is clearly a pressing need to understand the present hydrological status of KNP, given the significant lack of water over a sustained period of time and especially between 1997-2011, and the reliance of the park's OUV on these ecological processes for sustaining both overwintering waterfowl and resident breeding birds. There may well be a very strong ecological baseline available through the Bombay Natural History Society research project in the 1980s (see Vijayan 1991 and references in Anonymous, 1997) and this report should be secured and compared with the present situation to guide future management actions.
e) ***Sewage Treatment Plants.*** The mission team was assured that water from the two plants in Bharatpur City were no longer being considered as options to supply water to the

property. At present, there are significant concerns about the risks from using treated sewage water. Water from these plants should not be made available to the property unless there is clear research evidence that the property's hydrological integrity will not be compromised.

4.3 Issue 3: Monitoring of the bird population and population trend in Keoladeo National Park and in its satellite wetlands

This section addresses the third issue in the ToRs, to: *Review the existing monitoring of bird populations in the property, including the long-term approach and methodology and assess the population trends of the migratory bird species which underpin the OUV of the property.*

Given the increasing prominence given to 'satellite wetlands', the mission also considers the evidence for the importance of these wetlands in supporting the OUV of the property.

4.3.1 The Siberian Crane

The importance of the property for the Siberian Crane was mentioned explicitly at inscription. As outlined in Section I, however, at the time of inscription the declining population was already a cause for concern, the species was last seen at the site in 2001/2002, and it is now considered possibly extinct in the wider region, i.e. India, Afghanistan, Pakistan and Turkmenistan (BirdLife International 2023). The mission notes that reference to the Siberian Crane at the property has varied across the years and its relevance to KNP and its management objectives requires clarification. The SOC reporting since inscription includes various references to the species, ranging from acknowledging its decline, to recommending implementation of a monitoring programme (2008), and the State Party taking preliminary steps to set up a breeding centre (2011).

Although considered to be possibly extinct in the wider region, the Siberian Crane has remained in the checklist of birds at the property throughout this time and is still listed as present between November and March. The current 2017-2027 Management Plan (Gupta, 2021) describes past efforts to release captive-bred birds between 1992 and 1996 and states: "There is a possibility of housing and developing a population of Siberian crane population at KNP, in controlled conditions, for the benefit of tourists and education and awareness of the public." It is not stated explicitly how this would contribute to retaining the existing OUV. Given that the Siberian Crane has not been recorded in the property in more than two decades, and from an ecological point of view there seems virtually no prospect of it overwintering at the property again, the mission considers that this status should be accurately reflected in the current records of biodiversity for the property (e.g. its bird checklist), as well as in its monitoring and Management Plan.

The authorities should ensure that any potential consideration to reintroduce the species to the property, including ex-situ for tourism purposes, is in line with international best practices of the IUCN Species Survival Commission[14]. See also Section 4.7 for further discussion on translocation and ex-situ management.

4.3.2 Monitoring of birds in Keoladeo National Park

As outlined in Section I, the property has long been recognised as internationally important for its congregation of overwintering waterbirds.

[14] See for example, the *IUCN Guidelines for Reintroductions and Other Conservation Translocations*; *IUCN Conservation Translocation Specialist Group*; *IUCN Species Survival Commission Guidelines on the use of ex-situ management for species conservation.*

At the time of its first international designation, as a Ramsar Site, in 1981, the Ramsar Information Sheet (Ramsar undated)[15] states "According to Sir Peter Scott Keoladeo Sanctuary is the world's best bird area."

The IUCN evaluation report of the nomination file (IUCN 1985) recognised the global status that the property had, primarily as a wintering site for waterfowl, but also for resident water birds to breed. It stated: *The park is primarily known as a major focal point for wintering waterfowl from Afghanistan, Turkmenistan, China and Siberia. Some 364 species of birds have been recorded including the rare Siberian Crane (total in 1985 - 41 birds). The most common waterfowl are gadwall, shoveler, common teal, tufted duck, pintail, white spoonbill, little cormorant, cormorant, painted stork, Asian open-billed stork, oriental ibis, spot-billed pelican, darter, common sandpiper, wood sandpiper, green sandpiper and plover. The Sarus crane, with its spectacular courtship dance, is also found here.* The evaluation also noted a rich assortment of land birds consisting of warblers, babblers, bee-eaters, bulbuls, buntings, chats, partridges and quails. There are many birds of prey including the osprey, peregrine, Pallas or ring-tailed fishing eagle, short-toed eagle and tawny eagle.

The rSOUV includes the following:

- It is an important wintering ground of Palaearctic migratory waterfowl and is renowned for its large congregation of non-migratory resident breeding birds.
- Due to its strategic location in the middle of Central Asian migratory flyway and presence of water, large congregations of ducks, geese, coots, pelicans and waders arrive in the winter.
- The park […..] also serves as a wintering area for other globally threatened species such as the Greater Spotted Eagle and Imperial Eagle.
- During the breeding season the most spectacular heronry in the region is formed by 15 species of herons, ibis, cormorants, spoonbills and storks, where in a well-flooded year over 20,000 birds' nest.

Three important points arise from this background:

- The OUV that underpins the inscription on the World Heritage List relies on the congregation of overwintering waterfowl and waders and the numbers of resident breeding waterbirds;
- The OUV is comprised of both the range of waterbird species and the number of individuals in each species;
- There are other values of the avifauna that are important, such as the overwintering numbers of globally threatened raptors, but it is the overall spectacle of waterbird species that is reflected in the OUV; and
- There is no explicit statement of attributes that identifies the components of the OUV that must be retained and, therefore, for which monitoring is vital.

It is critical, therefore, to be able to track both the number of species and changes in their population so that the status of the OUV is being monitored. For example, overall numbers may be maintained, but threatened species with particular habitat requirements may decline whilst non-threatened generalist species increase. Other factors should also be captured and considered. For example, there was a significant number of heronry nests in 'L block' (see map in Annex IV) near Sapan Mori (see Gupta, 2021, page 34), but this no longer exists and it is not known if the remaining heronry elsewhere in the property, considered to be B and D blocks, compensate for the loss of those nesting sites. The Management Plan contains the following statement, which is a cause for concern: "*Block L, which is also called the boating area, used to have an extensive heronry. But, mainly due to shortage of water and delay in filling up of the blocks has led to failure of heronries in block L."* (Gupta, 2021: page 34)

[15] The sheet is not dated but appears to be the justification for its designation in 1981.

4.3.3 Mission recommendations, Committee decisions and management responses

The missions conducted in 2005 and 2008 recommended the collection of data for both wintering and nesting birds (see Section I). The 2005 mission also suggested monitoring of the 'ecological character' of the property and the 2008 mission recommended that the data collected should enable the property's OUV to be monitored.

Decisions for at least a decade have mentioned the need for data to be collected on bird populations that would allow the property's OUV to be monitored. They contain reference to the gathering of appropriate data already underway, but the SOC reports suggest that there are contradictions in those data that mean it is difficult to draw meaningful conclusions (e.g. State of Conservation 2014, State of Conservation 2016). Most recently, in 2021, the Committee's Decision included "Further requests the State Party to provide recent bird census data and analyses, including population trends for both heronry and waterfowl, and also reiterates its request to the State Party to clearly document the long-term approach and methodology of systematic bird population monitoring in the pending revised Management Plan".

This indicates that, whilst raw data are collected and have been provided by the State Party, the following have not:

- A description of the long-term approach and methodologies that have been used for the heronry counts and the wintering waterfowl and wader counts. The description in the 2017 State Party SOC report is not sufficient to understand exactly what was done or allow the method to be replicated; and
- Analyses of the data gathered that show population trends.

These would then allow the status of OUV to be assessed on a regular basis.

4.3.4 Current situation and issues

At the start of the mission, the mission team was provided with a document (Rajasthan Forest Department, 2023) that provided commentary on the mission ToRs, that states: "*There are two main population estimates of birds that are carried out in the park –*

"Heronry estimate: Breeding of all heronry species except the painted stork begins in July and extends up to October depending on the onset of rain and time of release of water. Large heronries are located in "B" and "D" blocks. Total count of nest of all breeding birds in the heronry is done periodically and the census is done by bird experts;

"Waterfowl census: Total count of all the water bird species is done by walking along the dykes or boundary of each block. Bird population is estimated by counting the birds simultaneously in various blocks from vantage points using binoculars or spotting scope. Teams are formed for each path identified in the park in block wise. Every team has a forest staff and a bird expert to ensure the credibility of the data."

The mission was provided with raw data on heronry counts for 2018, 2020, 2021 and 2022 (there was no count in 2019). The data sheet contains nesting attempts for 17 waterbird species, most of which nest in the property's heronries. In contrast, the sheets for 2020, 2021 and 2022 suggest that only 4 or 5 species attempted nesting in each year. If correct, this is very alarming and may suggest a fundamental change in the nature of the property's heronries.

The mission was also provided with raw data on overwintering counts from 2016-2023 (except for 2021, which has a blank data sheet). The forms for 2016-2020 are headed Asian Water Bird Census (see 2017 State Party SOC) and contained the date of the count and helpful

contextual information. The 2022 and 2023 forms do not contain either date or contextual information.

An analysis of Painted Stork numbers from 1980 to 2015 (Dwevedi et al. 2021) concluded that there had been a more than 80% decline in numbers in this species, a key species in the heronry assemblage. Dwevedi et al. (2021) also suggested that the breeding population was stable at the end of the study, but a long way below the long-term mean, concluding that it was local hydrological conditions that were responsible, rather than climate. An inspection of this paper by the mission team suggests that the use of a Generalised Additive Model approach means that it would be useful to reanalyse this dataset to ensure that the findings of Dwevedi et al. (2021) are robust.

4.3.5 Monitoring of birds in Satellite Wetlands around Keoladeo National Park

The first mention of satellite wetlands and their potential importance in maintaining the OUV of the property appears to be in the 2014 SOC Report, which states: *The reported implementation of ecological monitoring programmes for satellite wetlands around the property should also be noted. Given the importance of these satellite wetlands for maintaining the values of the property, particularly in times of drought, it is recommended that the Committee encourage the State Party to continue to monitor and manage these sites.*

The 'reported implementation of ecological monitoring' derives from the 2014 SOC Report. Whilst the publicly available State Party SOC summary does not mention satellite wetlands, the full report states that 27 wetlands within 100km of KNP had been surveyed. It included, as an Annexure, the research paper, Bhadouria et al. (2012), which presents the findings of the field survey. This built on pilot work carried out in 2005 that surveyed 14 wetlands, including Ajan Dam (Mathur et al. undated).

What is not clear however, is the importance of these sites either for the species that they contain, or for KNP. This is because there is no detailed breakdown of numbers of individuals of species in the two key bird assemblages (heronry breeding species and overwintering waterfowl), or an understanding of their ecological connectivity to KNP. Given water shortages at some sites, and their effects on bird species mentioned in Bhadouria (2012), the importance of these sites in maintaining the OUV of KNP should be established before these satellite wetlands and their potential is incorporated fully in management planning or seen as 'insurance sites'. This is very important, given the prominence that these wetlands now have in current management thinking. At the start of the mission, the mission team was provided with a document (Rajasthan Forest Department, 2023) that provided commentary on the mission ToRs, that states:

> *In the recent past, due to the erratic pattern of rainfall in Bharatpur, populations of both migratory and resident water birds, which had been visiting the KNP were found to be moving to the nearby satellite wetlands. In this connection, regular monitoring programme launched to monitor these wetlands. Total 27 wetlands were identified for this monitoring programme. These wetlands are either on agriculture land or the dams which are created mainly for the water supply for irrigation purpose in agricultural fields of surrounding areas. They are ranging in distance from 4 to 125 km.*

The current Management Plan refers to satellite wetlands throughout and which states "*26 [cf 27 in the document cited above] satellite wetlands have been identified which are ecologically connected to the Park*" (see Gupta 2021, especially Chapter 4).

4.3.6 Conclusions

The waterbird assemblage is an important component of the OUV of the property, both resident species that breed in heronries and overwintering waterfowl and waders. It is not possible to determine what the current status of the bird species that make up these two

groups is, because of uncertainties over the approach and methodology, and no analysis has been carried out.

Particular uncertainties include:

Overall approach: It is unclear whether the count each year is intended to be a total count of all birds present, which is typically very difficult to achieve, or a sample of the population of each group of waterbirds (breeding and overwintering). This should have a direct influence on the design of data gathering and the field protocol. The statements above from Rajasthan Forest Department (2023) include both 'total count and estimate' in the summary description of both heronry and waterfowl counts.

Observers: the ability of the observers to identify the species and count them under difficult field conditions (e.g. at distance, in mixed flocks, when partially hidden) is not known, and is likely to vary between individuals. These are acknowledged issues in counting birds (e.g. Gregory et al. 2004). It is unclear whether the individuals have been consistent between years.

Field protocol: a field protocol would usually state how the birds have been counted over time and space. For the timing, clarity is required on times of day when counts are undertaken and how long each count lasts, and to document these. There is no statement about how the observers have been spread across the property to count birds, and so which areas have been counted and where particular species are distributed each year.

Analysis: there was no indication that the raw data gathered each year were used to assess the state of conservation in the context of the OUV or to guide management interventions. The lack of an analysis of the implications of the failure of the heronry in L block on overall heronry numbers should be addressed as a matter of urgency. The data used by Dwevedi et al. (2021) should be reanalysed not using a Generalised Additive Model approach to understand what is happening with the Painted Stork breeding population, given that it is one of the key heronry species.

4.3.7 Recommendations

There is an overriding need for a monitoring programme that is scientifically sound and that can inform the management of the property so that the OUV is maintained and, where necessary, restored. Whilst there is a programme in place to count the overwintering and resident breeding waterbirds, this is not adequate to provide the necessary data to inform management, and addressing this remains a clear priority. It is also very important to have a clear statement about the Siberian Crane at KNP, as it has not occurred for 20 years and yet remains in the bird checklist and Management Plan. The following are necessary:

Recommendation 3: Ensure the current status of the Siberian Crane is accurately reflected in the monitoring and management of the property. This should reflect that there seems virtually no prospect of the species overwintering at the property without restoration of the flyway and co-ordinated transboundary management.

Recommendation 4: Establish a scientifically-based monitoring programme based on the attributes that convey the OUV to inform management of the property, as follows:

a) ***Review existing information as fully and analytically as possible.*** This should include documenting retrospectively the overall approach, the use of observers to count birds, and the field protocol and exporting if any meaningful analyses can be conducted on the raw count data generated so far. This should also include an assessment of the consequences for overall heronry numbers of the loss of the nesting trees in 'L block'.

b) ***Design a scientifically sound monitoring, analysis and reporting programme*** *and provide the necessary training for observers and those who would analyse and communicate findings.* There is an urgent need to put in place a scientifically designed monitoring, analysis and reporting programme that will provide information each year on the two key components of the avifauna that make up the OUV: breeding waterbirds in the heronries and the congregation of overwintering waterfowl and waders. At present there is no mechanism to provide scientifically robust information on the status of the property's OUV each year.

c) ***Consideration should be given to a wider ecological monitoring programme*** that would monitor ecosystem health, especially of the wetland. This would be extremely helpful in identifying key issues as early as possible and the success of management interventions, if indicators are chosen scientifically to provide information efficiently and effectively.

4.4 Issue 4: Effectiveness of controlling invasive species

This section addresses the fourth issue in the ToRs, to*: Assess the progress and effectiveness of controlling invasive species, including a review of the trends and methods used.*

Invasive alien species have been an issue at the property since at least 1990 (see Tables 4, 5 and 6). The species of particular concern over time have been noted as (see Gupta 2021):

- *Prosopis juliflora*
- *Eichornia crassipes* (water hyacinth)
- *Paspalum distichum* (Eincha)
- *Cyprus alopecuroides*
- Control of other weeds such as *Parthenium, Lantana camara* and *Ipomoea*
- *Clarias gariepirus* (African catfish)

The mission team paid particular attention to *P. juliflora*, as it seems now to be so widespread across the property. Information was provided on efforts to remove Water hyacinth and African catfish, and these are mentioned below, together with wider observations about the need to understand vegetation changes.

4.4.1 Mission recommendations, Committee decisions and management responses

The spread of the terrestrial invasive species and especially *P. julilflora* has been an issue since at least the first SOC report in 1990, and freshwater invasive species since 2006 (see Tables 1 and 2).

The 2008 Mission (UNESCO 2008) commented on the rapid spread of *P. julilflora* at the property and that thick impenetrable clumps had developed, both in open grassland and in dried out pools. Whilst it commended the park authorities in working with villagers to remove the species, and use it for firewood and wooden posts, it noted that the species "is extremely troublesome to eradicate". It concluded that, along with securing a reliable water supply, tackling the spread of the species was the highest priority for the property.

Decisions for at least a decade have mentioned the need for management of invasive species. Interestingly, the 2014 SOC report made an explicit reference to the interaction between management actions and the ecology of *P. julilflora* and Water Hyacinth. Specifically, it commented on the different responses that these two species have to changes in water levels and that this requires new information on the dispersal of these species so as to understand the impact of management actions, and whether they were sufficient to control the species. It also recommended that the State Party be encouraged to develop an adaptive invasive species control and eradication strategy in the new Management Plan. [This is the plan that was then due in 2014, which was signed off in 2021 and is dated 2017-2021]. The associated

Decision (Decision 38 COM 7B.66) urged the State Party to ensure that the control of invasive species is keeping pace with their dispersal under changing conditions of water supply.

It is stated that a range of actions, including in partnership with villagers, have been taken over the years, but it is not always clear what those actions were or what their impact on the population of the target invasive species has been, or indeed the wider ecosystem and thus the OUV of the property. For example, the 2022 State Party SOC reports:

> *State Forest Department is continuously working for the management of invasive species. Park has allotted a dedicated budget of Rs 20.0 lakh for the removal of Prosopis Juliflora. Removal of African Cat Fish is continuous process it is being implemented with help of local community (Rickshaw Pullers) and also through other methods. State gov.& also sanctioned budget is Removal of Prosopis Juliflora from different blocks is carried out through park management annual plan of operation (APO). This year a dedicated budget has been allotted in the Park's Annual Plan of Operations to remove Prosopis juliflora from the park. Further, by engagement of manual labour, returning invasive species in these areas will be removed every year.*

At the start of the mission, the mission team was provided with a document (Rajasthan Forest Department, 2023) that provided commentary on the mission ToRs that states that *P. juliflora* eradication is a priority for KNP. Table 4 gives the financial commitment and area to be cleared since 2016. The extent of this eradication, assuming that each year a different area was cleared, is 235ha, which is 8.18% of the property. There is no assessment of the impact of this work in terms of overall change in *P. juliflora*, although the mission considers that the situation would be worse without this action.

Table 4: Extent and cost (allocation and expenditure) for *P. juliflora* eradication in KNP since 2016-17 (source: Rajasthan Forest Department, 2023).

Year	**Budget allotment**		**Expenditure**		**Scheme**
	Physical	Financial	Physical	Financial	
2016-17	25ha	7.5 lakhs[16]	25ha	7.5 lakhs	CSS
2017-18	50ha	15.0 lakhs	50ha	14.97 lakhs	CSS
2018-19	50ha	15.0 lakhs	50ha	14.73 lakhs	CSS
2019-20	30ha	9.99 lakhs	30ha	9.98 lakhs	CSS
2020-21	25ha	8.25 lakhs	25ha	8.24 lakhs	CSS
2021-22	20ha	20.0 lakhs	20ha	20.0 lakhs	State Plan
	15ha	9.0 lakhs	15ha	6.18 lakhs	CSS
2022-23	20ha	20.0 lakhs	20ha	20.0 lakhs	State Plan

The request in the 2014 SOC report for an adaptive management approach to the eradication of invasive species is very important, as it makes clear the need for the impact of management actions to be monitored regularly (probably annually) and plans adjusted accordingly to have maximum impact.

Understanding the actions that have been taken is important, given the invasiveness of some species, especially *P. juliflora* and the way that it is reported to spread. For example, Mukherjee et al. (2017), in reporting on the spread of *P. juliflora* in the property, comment on the role of feral cattle in spreading the species and of the need to remove cut plants immediately, rather than stack them for later removal. This suggests that adaptive

[16] 1 lakh = Rs100,000.

management, including monitoring the impact of management is likely to be critical to developing an effective management strategy.

Water hyacinth and African catfish
Rajasthan Forest Department (2023) also contains information on work undertaken to eradicate water hyacinth and *Ipomea* (Table 5) and African catfish (Table 6).

Table 5: Extent and cost (allocation and expenditure) for water hyacinth and *Ipomea* eradication in KNP since 2016-17 (source: Rajasthan Forest Department, 2023).

Year	Budget allotment		Expenditure		Scheme
	Physical	Financial	Physical	Financial	
2016-17	25ha	7.5 lakhs	25ha	7.5 lakhs	CSS
2017-18	50ha	15.0 lakhs	50ha	14.99 lakhs	CSS
2018-19	50ha	15.0 lakhs	43ha	13.09 lakhs	CSS
2019-20	30ha	9.99 lakhs	30ha	9.98 lakhs	CSS
2020-21	--	--	--	--	--
2021-22	30ha	9.0	20ha	9.0 lakhs	CSS
2022-23					

Table 6: African catfish removal in KNP since 2009-2022 (source: Rajasthan Forest Department, 2023).

Year	No. removed
2009-10	3550
2010-11	26
2012-13	114
2014-15	7304
2015-16	40,117
2016-17	9277
2017-18	236
2018-2019	--
2019-2020	2159
2020-2021	9044
2021-2022	354
2022-2023	6499

4.4.2 Current situation and issues
P. juliflora remains a significant and, potentially, increasing threat to the property's integrity, despite management efforts, which seem to have covered 8.18% of the property since 2016. There is no formal assessment of the spread of the species and its impact on the OUV since inscription, but Mukherjee et al. (2017) carried out a survey of *P. juliflora* across the whole Park between September and November 2014 and compared that with a study carried out in the 1980s (as part of the Bombay Natural History Society's 10-year study [Vijayan, 1991] referred to elsewhere in the report, but which was not available to the mission). Mukherjee et al. (2017) concluded: "The comparison showed a significant decrease in dominance of the native tree species …… At present, the entire landscape of the semi-arid forest of KNP is spatially dominated by the invasive *P. juliflora*, which has replaced the dominance of the native trees and shrubs and is emerging as a major threat to the ecosystem." They present the comparison maps that are show here as Figure 1

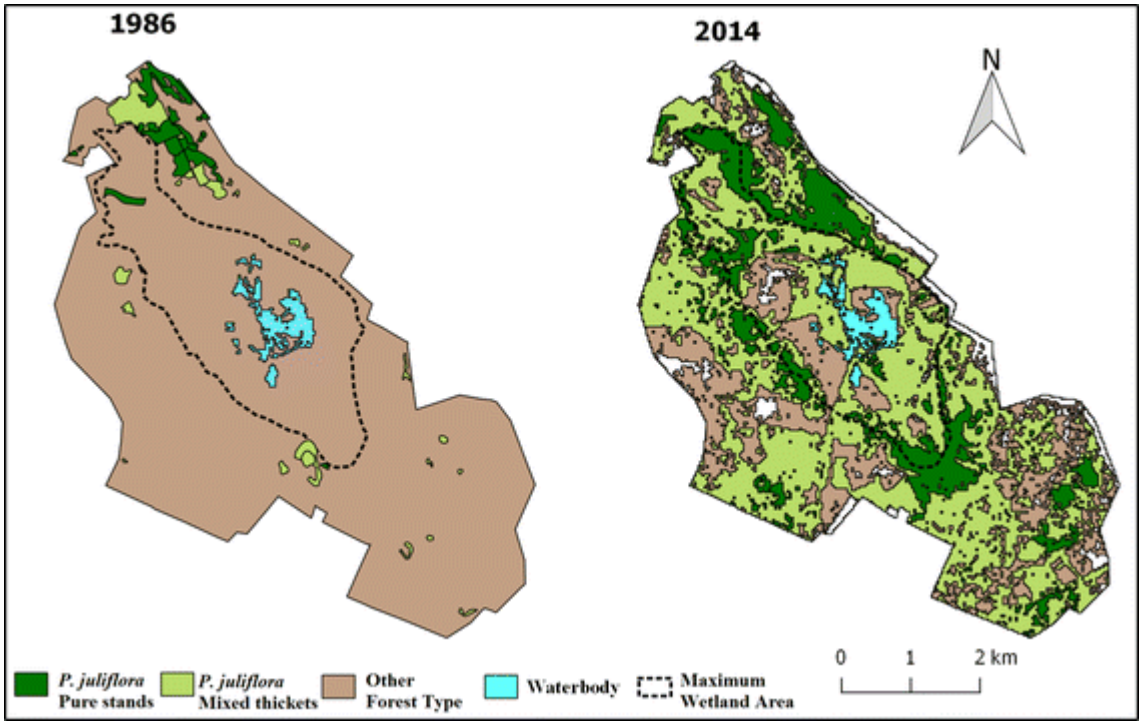

Figure 1: This is Figure 7 from Mukherjee et al. (2017) that has the legend "Spatial comparison of extent of *P. juliflora* (pure-stand and mixed-thickets) spread in Keoladeo National Park between 1986 and 2014. Other forest types include dry mixed deciduous *Acacia* and *Salvadora* forest (Champion and Seth, 1968). The 'waterbody' area depicts deepest regions of the park with year-round presence of water and 'maximum wetland area' includes regions with post monsoonal flooding."

4.4.3 Conclusions

The existing allocation of a dedicated budget in the Park's annual plan of operation is to be welcomed, especially for removing *P. juliflora*. The periodic work in partnership with Ecological Development Committees from neighbouring villages to remove *P. juliflora*, water hyacinth and African catfish is also positive. Despite this *P. juliflora* has increased both in extent and in density to the extent where it dominates the property's vegetation.

The mission team is not able to comment on the impact of management on other invasive species, other than water hyacinth removal appears to have been very positive. For other terrestrial plant species, there would seem to be a need to understand how species have spread, notably *Paspalum distichum*. This was commented as favoured by some waterfowl species, but creates an environment that is avoided by others.

4.4.4 Recommendations

P. juliflora has become a significant threat to the integrity of the site and the challenges in obtaining adequate water supply over the last 20 years appear to have made the conditions for the spread of the species more favourable. This, together with other vegetation changes requires urgent consideration and an over-riding need for a long-term adaptive management strategy.

Recommendation 5: Establish a long-term adaptive management strategy for invasive species that: a) takes into account the biological characteristics of *P. juliflora* that allow it to be so invasive; b) has a well-designed monitoring programme that allows the impact of management to be evaluated; c) allows management each year to be based on the results of monitoring; d) draws in scientific expertise where possible, such as the IUCN Species Survival Commission Invasive Species Specialist Group; and e) the eradication actions proposed in the current plan, mentioned in Committee Decision 44COM 7B.92 (see below) are reviewed

and harmonised with the needs of a long-term scientifically-based adaptive management strategy.

4.5 Issue 5: Progress towards revising the Management Plan

This section addresses the fifth issue in the ToRs, to*: Review the progress towards revising the Management Plan, including the strategy on invasive species and the monitoring system.*

4.5.1 Summary of the issue

The availability and content of a Management Plan has been the subject of Committee Decisions in 2011 (35COM 7B.14) and at each meeting since 2014 (38COM 7B.66, 40COM 7B.87, 42COM 7B.68, 44COM 7B.92). Initially these requested that electronic copies be provided to the Committee, but more recently, they have also requested inclusion of particular issues in the plan, specifically monitoring and management of *P. juliflora*.

Most notably, in 2018, the Committee Decision (42COM 7B.68) made an explicit request for the assessment of current management responses, as follows:

> *Also encourages the State Party to use the on-going revision of the Management Plan to assess the effectiveness of current management responses to the well-known challenges the property is facing as a basis for enhanced responses, and to obtain advice from the World Heritage Centre and IUCN as required, and further reiterates its request to the State Party to submit an electronic copy of the draft revised Management Plan to the World Heritage Centre, for review by IUCN;*

In 2021, Committee Decision 44COM 7B.92 welcomed the State Party's intention to incorporate an invasive species eradication strategy into the revised Management Plan, requested that it also addressed the water flow issues, and also requested the State Party to document clearly the long-term approach and methodology of systematic bird population monitoring in the revised Management Plan.

4.5.2 Current situation and issues

Whilst noting that in 2021 the Committee requested the State Party to submit the revised draft of the Management Plan to the World Heritage Centre for review by IUCN before finalization, the mission was informed that the 2017-2027 Management Plan was signed off in 2021 (Gupta 2021). This plan consists of two parts: Part I – The existing situation (or situation analysis) and Part II: Proposed management. Part I has the following chapters: Chapter 1 Introduction to the area; Chapter 2: Background Information and Attributes; Chapter 3 History of management and present practices; Chapter 4 Protected Area and the Interface Land Use Situation.

The Part II – Proposed management consists of the following chapters: Chapter 5 Vision, Objectives and Problems; Chapter 6 The Strategies; Chapter 7 Eco-tourism, Interpretation and Conservation Education; Chapter 8 Eco development; Chapter 9 Research, Monitoring and Training; Chapter 10 Organization and administration; Chapter 11 The budget; Chapter 12 The schedule of operations and miscellaneous regulations. Inputs and recommendations on the Management Plan from stakeholder consultations are annexed to the Management Plan.

The vision (or goal) of the Management Plan is defined as "to restore the Park to its full ecological glory by arresting degradation and rejuvenating all degrading areas by relevant interventions and maintain the wetland and allied ecosystem in their purest form…" In order to achieve the vision, eight management objectives have been set, which are summarized as follows:

1. To arrange more good quality water to restore wetland processes;
2. To restore various habitats to their earlier state (state of 1987 as benchmark);

3. To protect the Park effectively;
4. To maintain and develop ecotourism without affecting adversely;
5. To adopt a landscape level approach to conservation by collaborative interventions in the eco-sensitive zone as well as in satellite wetlands;
6. To change the attitude of local people through site specific eco-development activities;
7. To promote research-based park management and monitoring of ecosystem; and
8. To improve efficiency of park management.

For each objective, the plan identifies problems related to achievement of the objective and describes strategies to move forward. This provides a clear prescription for management activities during the lifetime of the plan. What is missing, however, is a very clear link to the OUV and addressing the specific management needs that would ensure that the property maintains its outstanding assemblage of overwintering birds and resident birds breeding in heronries.

There are some strong elements that will address some of the points raised in Decisions since 2012 (see Table 2) concerning engaging local communities and activities around the property through the development of an eco-sensitive zone (see Chapter 8 of the Management Plan) and a reconsideration of the water requirements of the park given changes in ecology and hydrology inside and around the park (see Section 6.4 of the Management Plan).

There are, however, some areas where the Management Plan could be strengthened so that the activities described are best directed towards enhancing and restoring the OUV. The most significant change here would be a statement of how the property's OUV translates into ecological outcomes for the property to be pursued by management. At present the vision in the Management Plan for the property (Gupta, 2021) refers to restoring it to its 'full ecological glory' and given the dynamic nature of an artificially created wetland, it would be very helpful to define what the desired state is, so that there can be consistency in management, and the impacts of management could be measured.

This would be greatly helped by a clear statement of attributes (see Recommendation 1). For example, given the range of overwintering species that congregated in the property at the time of inscription, it is clear that a range of wetland habitats is required, varying in vegetation cover, depth etc. The overall number of species counted could see the same number of individual birds from year to year, but mask the loss of some rarer and potentially more threatened species, whilst seeing an increase in common and more generalist species. This clear identification of species, where they are found in the property and the management needs of those places is not evident in the current Management Plan.

It would be very helpful if there was such a clear statement of the desired state for the property (ie defining what 'full ecological glory' would be) and that the management objectives were set quite explicitly to achieve that desired state. The Management Plan includes references to a number of 'theme plans' and this concept may allow management actions to be tied to clearly defined objectives that would allow the OUV to be conserved. At present, they seem activity orientated, rather that outcome orientated. For example, there is no 'theme plan' for ensuring that the habitat is suitable for the range of waterbirds that were present in the 1980s which are reflected in wording of the SOUV.

It is not clear how some of the actions contained within the plan will contribute to the conservation and enhancement of the OUV. For example, the section on reintroduction of wetland species mentions species that are not part of the OUV and so it is not clear how directing resources to, for example the establishment of enclosures, would enhance the OUV of the property (see ***Proposed wetland ex-situ conservation establishment*** in sub-section 4.7 below). Elsewhere in the Management Plan there are activities described that the mission

was told are not part of current management thinking, notably using treated waste water from Bharatpur City (see Recommendation 2).

The mission team was also made aware of the frequent changes in park leadership, with about 10 directors in the last 15 years. It is likely that greater consistency in the leadership would benefit the management and, therefore, the OUV of the property.

4.5.3 Conclusions

There is a Management Plan in place that runs until 2027. It was signed off in 2021, four years after the last plan concluded. It is strong in some areas, notably the over-riding challenge for the property, which is obtaining a reliable supply of enough appropriate water. The work needed to tackle invasive species is also well articulated. What would be a significant step forward is linking the impact of these actions to the specific ecological outcomes needed to conserve the OUV of the property and ensuring that management is adaptive and based on a strong monitoring regime. Identifying indicators that link the impact of management actions to the attributes that convey the OUV would provide excellent insights on the impact of management against either baseline data or targets that would help ensure the OUV.

4.5.4 Recommendations

The over-riding need is to ensure that all actions described in the Management Plan are contributing explicitly and directly to the conservation of the OUV, rather than other purposes, such as broader wildlife conservation objectives, such as reintroduction. At present the priorities for management would seem to be: a) securing water: b) vegetation management, both of invasive alien species and of other dominant species that are changing the character of important places for waterbirds: c) heronry management; and d) monitoring overwintering breeding waterbirds. A strategic approach to management planning, focussed on clear outcome goals would ensure that there is a very strong and clear link between management actions and the desired state of the property. It would also be very helpful if there was less change in the leadership of park management.

Various management resources are available to the State Party, noting that an update of the Managing Natural World Heritage manual is currently underway through the IUCN/ICCROM World Heritage Leadership programme.

Recommendation 6: Review the 2017-2027 Management Plan with an explicit focus on the management of the OUV of the property. This review should identify where there are gaps in addressing challenges facing the property's OUV in the short-term (before 2027) so that any urgent management needs can be identified. The next management planning process should start in good time to deliver a plan that explicitly links actions to attributes that convey the OUV, before the current plan expires in 2027. The 40th anniversary of inscription in 2025 provides an ideal opportunity to launch a new plan that describes the management to conserve and enhance attributes, once identified.

4.6 Issue 6: Disposal of cattle carcasses near the property

This section addresses the sixth issue in the ToRs, to: *Review the current status of discussions to prevent the disposal of cattle carcasses near the property, which may have potential impacts on its OUV.*

This concern appears based on third party and media reports captured in the 2018 SOC report. The State Party responded in its 2022 SOC report that the Bharatpur civil administration had banned the disposal of carcasses adjacent to the property and that the dumping ground was being monitored. The mission team was advised that this had occurred at one site by the park boundary (near Mallah village) and it was not evident that it had been

of sufficient scale to pose any threat to the property. There was no evidence that this was an ongoing issue.

4.7 Issue 7: Any other relevant conservation issues that may impact on the OUV of the property

This section addresses the seventh issue in the ToR*s: In line with paragraph 173 of the Operational Guidelines, assess any other relevant conservation issues that may impact on the OUV of the property, including the conditions of integrity and protection and management.*

4.7.1 The need for holistic management planning

There has been significant progress in securing the water supply to the property to address the most immediate threat to the existence of the OUV. Although the issue is not resolved, the amount of water being supplied each year has increased in recent years. However, the long periods of limited, or no, water appear to have resulted in a significant change in the property's ecological character and integrity. Addressing this change is best considered in a holistic approach that joins together the main issues facing the property and which comprised the mission's ToRs. For example, the supply of water (amount, timing and where it is located in the property) is inextricably linked to both the vegetation communities and the spread of *P. juliflora*, and the status of the overwintering and breeding waterbirds.

The explicit integration of the OUV into the Management Plan would provide an overarching focus for management. An initial chapter in the Management Plan should identify the attributes, their current status and make any references to how they have changed, or are believed to have changed since 1985.

The current management planning process appears to tackle each issue, and management tasks, in silos, and a more strategic approach is now important, if not critical, to ensure that the property's OUV is conserved. The OUV as identified at the time of inscription does not exist in the same form now, given the loss of the Siberian Crane, and uncertainty about the numbers of the more specialised and less numerous waterbirds and a seemingly smaller heronry. Therefore, it may be time to consider a 'reset' that acknowledges the current status of the property and prioritises actions that will support the restoration of attributes that convey the OUV. The 40th anniversary of the property's inscription may be an opportunity for such a reset through an management process that is explicitly focused on the OUV.

4.7.2 Proposed wetland ex-situ conservation establishment

The property's Management Plan includes the following statement:

> *The Management Plan proposes to explore all possible to re-introduce animals and birds that have got eliminated in recent past or are present in very small numbers.*
>
> *Some of the suggested species are –Blackbucks (Antelope cervicapra), hog deer, swamp deer, rhino, Smooth coated otter (Lutra perspicillata)*
>
> *Reintroduction of Siberian crane can also be attempted even if the bird is needed to be kept in partially controlled conditions. Avenues of captive breeding can also be explored on the lines of GIB[17] project*.

The mission team was given a concept note that was prepared in 2021 for a Proposed Wetland ex-situ Conservation Establishment and which states that such an establishment would aim to: "rejuvenate the biodiversity of Keoladeo National Park thereby boosting its ***outstanding***

[17] GIB is not explained, but is assumed to mean Great Indian Bustard *Ardeotis nigriceps.*

universal values[18]." The target species are: Otter, Fishing Cat, Hog Deer and Blackbuck. Whilst these are all interesting species to consider, three issues should be considered before the project continues:

1. the contribution of these species to the property's OUV, which is not clear, given that the focus of the SOUV on wetland bird species. The concept note acknowledges that the blackbuck is not a wetland species;
2. whether suitable ecological conditions would be available to support self-sustaining population of these species, given that the Establishment is intended to serve as a 'transition, augmentation and rewilding centre'. The reasons that caused these species to become extinct need to be tackled and given that these are stated in the concept note to include erratic water supply and invasive species, these substantial issues must be adequately addressed before any reintroductions are attempted; and
3. given the management challenges in securing the ecological conditions in the property required to restore the OUV, it would be helpful to consider if this is the most appropriate use of resources.

There are very helpful sources of guidance provided by IUCN:

- IUCN Species Survival Commissions Guidelines on the use of ex-situ management for species conservation; and
- IUCN Guidelines for Reintroductions and Other Conservation Translocations
- The IUCN Conservation Translocation Specialist Group can be found here.

4.7.3 Research needs

KNP is an artificially created wetland that has suffered significantly from an erratic and often insufficient water supply for many years. Consequently, a strong research focus is needed to inform management, both in terms of what action is needed and where, but also in terms of what ecological outcomes should be sought, and how progress towards them should be measured. For example, since inscription, the property's vegetation has changed considerably, and this has almost certainly affected the status of the OUV. This has not been assessed, however, and would require comparison with baselines from the 1980s. Such baselines, seem to exist through the Bombay Natural History Society's decade long hydrobiology report. Comparison with that report may allow changes to be quantified in a way that would then permit changes in the property's integrity to be assessed.

At present research falls under the remit of one of the ranges (see Section II). The Range Officer post is presently vacant, and research (including monitoring) is being overseen by a Forester who the mission was informed would be retiring in the next year. The decision on any replacement as research lead is yet to be made. The Management Plan (Gupta, 2021) has a Chapter dedicated to Research, Monitoring and Training, with two objectives:

> "*To promote scientific and ecological research or studies that will help the park management in assessing the physical and biological resources, planning for conservation of these resources and monitoring the ecosystems*
>
> *"To arrange adequate infrastructure and specialized wetland trained manpower for efficient management of the Park*"

The first of these in particular makes clear the need for research to guide management and all efforts should be made to deliver the research needed to ensure that the status of the OUV can be assessed adequately, and that the research needed to inform management is undertaken and communicated.

4.7.4 Conclusion

[18] The emphasis is that given in the concept note.

The dynamic nature of the wetland system together with the significant challenges in obtaining sufficient adequate water for the last 20 years has seen changes in the property that almost certainly have affected the OUV beyond the loss of the Siberian Crane. The key challenges are recognised and significant steps have been taken to address the existential issue of water supply, but there remains a gap between management needs to retain and restore the OUV and actions being planned and implemented. There is a clear need to ensure that the OUV and associated attributes, feature more significantly in the Management Plan, as the overarching focus. It is not clear how the proposed establishment of a wetland ex-situ conservation programme will contribute to the OUV at present. Enhanced research capability could significantly increase the likelihood that the OUV could be restored through appropriate monitoring and guiding adaptive management.

Recommendation 7: Ensure management planning and decision-making is focused specifically on the OUV of the property, including that planned activities explicitly and transparently contribute to its protection and management. *This will help shape the research necessary to inform management and monitor progress. In the short-term, the planned establishment of an ex-situ management programme for four species of mammal should be reconsidered*, *specifically whether it would be appropriate and the best use of resources given other urgent management priorities in the context of the OUV.*

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 The property and its challenges

The 2,873 ha KNP was inscribed on the World Heritage List in 1985 under natural criterion (iv), which is referred to since 2005 as criterion (x)[19]. Noting that at the time of inscription there was no requirement under the Operational Guidelines to prepare a Statement of Outstanding Universal Value (SOUV), the original nomination justifies inclusion on the World Heritage List under natural criterion (iv) - as a habitat of rare and endangered species, noting "The park is a wetland of international importance for migratory waterfowl. It is the wintering ground for the rare Siberian crane and is habitat for large numbers of resident nesting birds."

In 2012, the retrospective SOUV was adopted (Decision 36 COM 8E)**:**

> *The Keoladeo National Park is a wetland of international importance for migratory waterfowl, where birds migrating down the Central Asian flyway congregate before dispersing to other regions. At time of inscription it was the wintering ground for the Critically Endangered Siberian Crane, and is habitat for large numbers of resident nesting birds. Some 375 bird species have been recorded from the property including five Critically Endangered, two Endangered and six vulnerable species. Around 115 species of birds breed in the park which includes 15 water bird species forming one of the most spectacular heronries of the region. The habitat mosaic of the property supports a large number of species in a small area, with 42 species of raptors recorded.*

Since the time of inscription, several issues affecting the property have been identified in SOC reports provided to the World Heritage Committee between 1990 and 2021, and related Committee Decisions. A summary review of key factors affecting the property that have been raised consistently in SOC reports since inscription, and in Decisions over the last decade

[19] Until the end of 2004, World Heritage sites were selected on the basis of six cultural and four natural criteria. With the adoption of the revised *Operational Guidelines for the Implementation of the World Heritage Convention*, only one set of ten criteria exists. It is important to note that natural criterion (iv) at the time of inscription equates to current criterion (x) (see https://whc.unesco.org/en/criteria/).

(see Tables 1 and 2), as well as by the previous missions, provides important context. These are summarized into the following six key themes:

g) provision of sufficient suitable water to the property;
h) invasive species, both terrestrial and freshwater;
i) involvement of the local community, first suggested to help with the management of invasive species and more recently stated explicitly as stakeholders in development of an Eco-Sensitive Zone and its management plan;
j) management planning and availability of an up-to-date Management Plan;
k) monitoring of the ecological status of the property, notably its bird populations; and
l) the decline and disappearance of the Siberian Crane.

5.2 State Party responses

The State Party has recognized in the current 2017-2027 Management Plan (see page 57) that the ecology of KNP has been degraded severely, especially over the past three decades. This is considered to be due to a reduction in quantity and quality and timing of the water supply to the park, an increase in the spread of invasive alien species, and changing agricultural practices in the surrounding areas and further reduction in biodiversity and local extinction of species such as blackbuck *(Antilope cervicapra).* The State Party has responded to these threats by:

- seeking to resolve the existential challenge of providing sufficient water and there are now three sources that may provide water to the KNP;
- seeking to address invasive species, including with local community involvement. Each of the principle invasive species present quite different management challenges and have different ecological consequences;
- annual counts of overwintering birds and heronries were initiated in 2016 with the involvement of volunteers;
- the notification to declare a 500 – 1500m Eco-Sensitive Zone around the property was adopted by the Ministry of Environment, Forest and Climate Change in July 2019;
- a Management Plan for the period 2017 – 2027 was signed off in July 2021, with the vision "to restore the Park to its full ecological glory by arresting degradation and rejuvenating all degrading areas by relevant interventions and maintain the wetland and allied ecosystem in their purest form in 1987…"

5.3 The mission

At its 42nd session in Manama, Bahrain (June/July 2018), the World Heritage Committee requested the State Party of India to invite an IUCN Reactive Monitoring mission to the property "to assess its state of conservation and progress made in addressing issues of water provision and invasive species" (Decision **42 COM 7B.68**). The mission request has been reiterated in Committee decisions since.

The mission was requested to review the state of conservation of the property, and notably by carrying out the following tasks (see full Terms of Reference in Annex II):

1. Assess the progress as well as the current and planned mechanisms to sustain adequate water supply (quality and quantity) to the property, which is considered crucial for maintaining its Outstanding Universal Value (OUV);
2. Review the current status of the two sewage treatments plants in Bharatpur city and the water quality monitoring mechanism that are in place for the sewage treatment plants;
3. Review the existing monitoring of bird populations in the property, including the long-term approach and methodology and assess the population trends of the migratory bird species which underpin the OUV of the property;
4. Assess the progress and effectiveness of controlling invasive species, including a review of the trends and methods used;

5. Review the progress towards revising the Management Plan, including the strategy on invasive species and the monitoring system;
6. Review the current status of discussions to prevent the disposal of cattle carcasses near the property, which may have potential impacts on its OUV;
7. In line with paragraph 173 of the *Operational Guidelines*, assess any other relevant conservation issues that may impact on the OUV of the property, including the conditions of integrity and protection and management.

5.4 Conclusions

At the time of inscription, the Siberian Crane was of significant conservation concern, and the Park was thought to be the only wintering ground of the species' Central Asian population. This population was very small in the early 1980s and bred in northern West Siberia and migrated across the Russian Federation, Kazakhstan, Uzbekistan, Turkmenistan, Afghanistan, and Pakistan, before arriving at the wintering grounds in KNP. The last pair of Siberian cranes wintering in KNP was recorded in the winter of 2001/2002 and it is now considered possibly extinct in India, as well as Afghanistan, Pakistan and Turkmenistan (BirdLife International 2023).

The Siberian Crane has remained in the checklist of birds at the property throughout this time and is still listed as present between November and March, and the current Management Plan states that there is a possibility of housing and developing a population of Siberian cranes at KNP, in controlled conditions, for the benefit of tourists and education and awareness of the public.

The mission notes that there is no clear list of attributes that convey the OUV of the property. This makes it difficult for the management authorities to be able to monitor the state of conservation of the OUV, and to ensure that appropriate measures are in place to facilitate the effective management of the property. It is therefore recommended that this be remedied as a matter of urgency, so that future management can be directed very clearly at restoring these attributes.

The wetland of KNP lies in a natural depression that was first managed intensively to attract waterbirds in about 1850. This has created a system of lakes and sluices within the property to manage water levels and water supply to the property has increasingly become an issue. Traditionally water came from Ajan Dam, which impounded water from inundations of the Gambhir and Banganga rivers and lies about 500m southwest from the KNP boundary. Almost since inscription in 1985, water supply to KNP has been a significant issue because of variable rainfall and increasing demand for water for agriculture and domestic purposes. This posed a potentially existential crisis for KNP between about 1997 and 2010 when the Park received very little water and in four years, none.

The State Party has sought additional sources of water and now there is a system of drainage canals and pipelines bringing water from two new water sources (the National Chambal Sanctuary via the Chambal Pipeline, and the Kosi Depression, via the Govardhan Drain), in addition to that from the Gambhiri River via Panchna and Ajan Dams. This has increased the water supply to the Park since 2011, although it has been variable between years and rarely reaches the amount of 550mcft that has been considered necessary. This figure seems to have been derived during a decade long project conducted by the Bombay Natural History Society during the 1980s (see Anonymous, 1997 for a summary of the research undertaken during that time and a publication list). The KNP authorities consider that 650mcft is needed during the monsoon and 100mcft at other times of the year (Gupta, 2021).

Efforts to secure further water supply continue to maximize the likelihood that sufficient water is obtained each year. There are also efforts to enhance the storage capacity in the Park, including development of a peripheral canal.

The status of the ground water level at present is not clear and requires clarifying along with the impact of agriculture on adjacent land on water levels in the Park throughout the year.

The waterbird assemblage represents an important component of the OUV of the property, both resident species that breed in heronries and overwintering waterfowl and waders. However, it is not possible to determine the current status of the bird species that make up these two groups, because of uncertainties over the approach to monitoring and methodology used, and no analyses have been carried out. Particular uncertainties include the overall approach (total count or sample of the population), the experience, training and variability of observers, the field protocol used, and the analysis and communication of results.

The invasive species *P. juliflora* has become a significant threat to the integrity of the site and the challenges in obtaining adequate water supply over the last 20 years appear to have made the conditions for the spread of the species more favourable. This, together with other vegetation changes requires urgent consideration with an over-riding need for a long-term adaptive management strategy. The mission team is not able to comment on the impact of management on other invasive species, other than water hyacinth removal appears to have been very positive. For other terrestrial plant species, there would seem to be a need to understand how species have spread, notably *Paspalum distichum*. This was commented as favoured by some waterfowl species, but creates an environment that is avoided by others.

The current 2017-2027 Management Plan for the property was signed off in 2021, four years after the last plan concluded. It is strong in some areas, notably securing a reliable supply of enough appropriate water, which is the over-riding challenge for the property. The work needed to tackle invasive species is also well articulated. Identifying indicators that link the impact of these actions to the attributes that convey the OUV would provide excellent insights on the impact of management against either baseline data or targets that would help ensure the OUV. The dynamic nature of the wetland system together with the significant challenges in obtaining sufficient adequate water for the last 20 years has seen changes in the property that almost certainly have affected the OUV beyond the loss of the Siberian Crane. The key challenges are recognised and significant steps have been taken to address the existential issue of water supply, but there remains a gap between management needs to retain and restore OUV and the actions being planned and implemented. There is a clear need to ensure that the OUV and associated attributes, feature more significantly in the Management Plan, as the overarching focus.

The concern over cattle carcass disposal adjacent to the property, appears based on third party and media reports captured in the 2018 SOC report. The State Party responded in its 2022 SOC report that the Bharatpur civil administration had banned the disposal of carcasses adjacent to the property and that the dumping ground was being monitored. The mission team was advised that this had occurred at one site by the park boundary (near Mallah village) and it was not evident that it had been of sufficient scale to pose any threat to the property. There was no evidence that this was an ongoing issue.

It is not clear how the proposed establishment of a wetland ex-situ conservation programme will contribute to the OUV at present. The authorities should ensure that any potential consideration to reintroduce the species to the property, including ex-situ for tourism purposes, is in line with international best practices of the IUCN Species Survival Commission[20]. See also Section 4.7 for further discussion on translocation and ex-situ management.

[20] See for example, the *IUCN Guidelines for Reintroductions and Other Conservation Translocations*; *IUCN Conservation Translocation Specialist Group*; *IUCN Species Survival Commission Guidelines on the use of ex-situ management for species conservation.*

Enhanced research capability could significantly increase the likelihood that the OUV could be restored through appropriate monitoring and guiding adaptive management.

5.5 The mission recommendations

Recommendation 1: Develop a clear list of attributes that convey the OUV to inform the long-term monitoring, protection and management of the property.

Recommendation 2: Secure a long-term strategic solution to water supply. The demand for water for agricultural and domestic purposes in the region is increasing and will continue to do so. Indeed, water is becoming a political issue and water budgeting is necessary in some contexts. Therefore, high level discussions between key stakeholders are increasingly critical to gain the political support and co-operation between departments to ensure adequate suitable water is supplied each year to the property. This is vital to prevent further deterioration in the ecological status of Keoladeo National Park and to restore the natural hydrological processes. In order to inform discussions on this, the following should be assessed rapidly:

a) ***Clarify water requirements.*** The 550mcft per year figure, identified in the 1980s as a sufficient level of water supply to the property, should be reviewed to ensure that: a) the methodfor calculating this figure is still agreed, given the current understanding of wetland hydrology; and b) the figure is still appropriate given changes in the property over 40 years and management objectives for restoring the Park (e.g. considering siltation, increasing dryland, absence of wetland processes during drought years). The figures proposed in the Management Plan of 650mcft during the monsoon and 100mcft during the rest of the year should also be considered.
b) ***Consider water quality from different sources***. There is a widespread perception that the primary water source from Ajan Dam remains the best option for KNP, and this water comes from within the water system that the property lies in. This may be very important, given that Kumar and Vijayan (1989) state that of 40 species recorded in KNP between 1982 and 1985, only six bred there, the rest entered KNP when water was released from Ajan Dam. In addition, there appears to have been no consideration so far of the potential for invasive freshwater species to enter the Park from sources outside the river system (i.e. Chambal and Govardhan Drain) that KNP lies in. This should be explored.
c) ***Water releases.*** Whilst a strategic solution is being sought, ensure that enough water is released to account for loss along drainage canals so that sufficient water reaches the property. The KNP authorities estimate considerable loss between discharge and arrival in the property.
d) ***Hydrological processes.*** There is clearly a pressing need to understand the present hydrological status of KNP, given the significant lack of water over a sustained period of time and especially between 1997-2011, and the reliance of the park's OUV on these ecological processes for sustaining both overwintering waterfowl and resident breeding birds. There may well be a very strong ecological baseline available through the Bombay Natural History Society research project in the 1980s (see Vijayan 1991 and references in Anonymous, 1997) and this report should be secured and compared with the present situation to guide future management actions.
e) ***Sewage Treatment Plants.*** The mission team was assured that water from the two plants in Bharatpur City were no longer being considered as options to supply water to the property. At present, there are significant concerns about the risks from using treated sewage water. Water from these plants should not be made available to the property unless there is clear research evidence that the property's hydrological integrity will not be compromised.

Recommendation 3: Ensure the current status of the Siberian Crane is accurately reflected in the monitoring and management of the property. This should reflect that there

seems virtually no prospect of the species overwintering at the property without restoration of the flyway and co-ordinated transboundary management.

Recommendation 4: Establish a scientifically-based monitoring programme based on the attributes that convey the OUV to inform management of the property, as follows:

a) ***Review existing information as fully and analytically as possible.*** This should include documenting retrospectively the overall approach, the use of observers to count birds, and the field protocol and exporting if any meaningful analyses can be conducted on the raw count data generated so far. This should also include an assessment of the consequences for overall heronry numbers of the loss of the nesting trees in 'L block'.
b) ***Design a scientifically sound monitoring, analysis and reporting programme*** *and provide the necessary training for observers and those who would analyse and communicate findings.* There is an urgent need to put in place a scientifically designed monitoring, analysis and reporting programme that will provide information each year on the two key components of the avifauna that make up the OUV: breeding waterbirds in the heronries and the congregation of overwintering waterfowl and waders. At present there is no mechanism to provide scientifically robust information on the status of the property's OUV each year.
c) ***Consideration should be given to a wider ecological monitoring programme*** that would monitor ecosystem health, especially of the wetland. This would be extremely helpful in identifying key issues as early as possible and the success of management interventions, if indicators are chosen scientifically to provide information efficiently and effectively.

Recommendation 5: Establish a long-term adaptive management strategy for invasive species that: a) takes into account the biological characteristics of *P. juliflora* that allow it to be so invasive; b) has a well-designed monitoring programme that allows the impact of management to be evaluated; c) allows management each year to be based on the results of monitoring; d) draws in scientific expertise where it is possible, such as the IUCN Species Survival Commission Invasive Species Specialist Group; and e) the eradication actions proposed in the current plan, mentioned in Committee Decision 44COM 7B.92 (see below) are reviewed and harmonised with the needs of a long-term scientifically-based adaptive management strategy.

Recommendation 6: Review the 2017-2027 Management Plan with an explicit focus on the management of the OUV of the property. This review should identify where there are gaps in addressing challenges facing the property's OUV in the short-term (before 2027) so that any urgent management needs can be identified. The next management planning process should start in good time to deliver a plan that explicitly links actions to attributes that convey the OUV, before the current plan expires in 2027. The 40th anniversary of inscription in 2025 provides an ideal opportunity to launch a new plan that describes the management to conserve and enhance attributes, once identified.

Recommendation 7: Ensure management planning and decision-making is focused specifically on the OUV of the property, including that planned activities explicitly and transparently contribute to its protection and management. *This will help shape the research necessary to inform management and monitor progress. In the short-term, the planned establishment of an ex-situ management programme for four species of mammal should be reconsidered*, *specifically whether it would be appropriate and the best use of resources given other urgent management priorities in the context of the OUV.*

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VII. ANNEXES

7.2 Annex I: retrospective Statement of Outstanding Universal Value

Adoption of retrospective Statement of Outstanding Universal Value (SOUV), WHC-12/36.COM/8E, p. 39-40 (See also https://whc.unesco.org/en/list/340/)

Property	**Keoladeo National Park**
State Party	**India**
Id Nr	**340**
Date of inscription	**1985**

Brief synthesis
Keoladeo National Park, located in the State of Rajasthan, is an important wintering ground of Palaearctic migratory waterfowl and is renowned for its large congregation of non-migratory resident breeding birds. A green wildlife oasis situated within a populated human-dominated landscape, some 375 bird species and a diverse array of other life forms have been recorded in this mosaic of grasslands, woodlands, woodland swamps and wetlands of just 2,873 ha. This 'Bird Paradise' was developed in a natural depression wetland that was managed as a duck shooting reserve at the end of the 19th century. While hunting has ceased and the area declared a national park in 1982, its continued existence is dependent on a regulated water supply from a reservoir outside the park boundary. The park's well-designed system of dykes and sluices provides areas of varying water depths which are used by various avifaunal species.

Due to its strategic location in the middle of Central Asian migratory flyway and presence of water, large congregations of ducks, geese, coots, pelicans and waders arrive in the winter. The park was the only known wintering site of the central population of the critically endangered Siberian Crane, and also serves as a wintering area for other globally threatened species such as the Greater Spotted Eagle and Imperial Eagle. During the breeding season the most spectacular heronry in the region is formed by 15 species of herons, ibis, cormorants, spoonbills and storks, where in a well-flooded year over 20,000 birds nest.

Criterion (x): The Keoladeo National Park is a wetland of international importance for migratory waterfowl, where birds migrating down the Central Asian flyway congregate before dispersing to other regions. At time of inscription it was the wintering ground for the Critically Endangered Siberian Crane, and is habitat for large numbers of resident nesting birds. Some 375 bird species have been recorded from the property including five Critically Endangered, two Endangered and six vulnerable species. Around 115 species of birds breed in the park which includes 15 water bird species forming one of the most spectacular heronries of the region. The habitat mosaic of the property supports a large number of species in a small area, with 42 species of raptors recorded.

Integrity
This is the only park in India that is completely enclosed by a 2 m high boundary wall that minimises the possibilities of any encroachment and biotic disturbances, but there is no possibility of a buffer zone. As the wetlands of Keoladeo are not natural, they are dependent on the monsoon and on water pumped in from outside, traditionally provided from the "Ajan Bandh" reservoir. The water shortage caused by the erratic rainfall in the region is being addressed by initiating two large water resources projects that will bring water from permanent water sources in the region. There has been some concern expressed over possible air and water pollution effects from the adjacent city of Bharatpur, but these effects are unknown at present.
Through eco-development activities in the surrounding villages, the grazing of cattle within the park has been minimised and the local communities are also engaged in participatory resource conservation, which includes removal of invasive alien species. Keoladeo attracts many visitors who are taken for bird watching in bicycle rickshaws by trained local guides from surrounding villages, which provides additional livelihoods as well as reduces noise pollution.

A recently started conservation programme for the 27 satellite wetlands surrounding this park has further enhanced the protection of the migratory waterfowl arriving in the Central Asian flyway to winter in Western India.

Protection and management requirements
The property has effective legal protection under the provisions of Wildlife (Protection) Act, 1972 and Indian Forest Act, 1927. The site is managed by the Rajasthan Forest Department with the support of local communities and national and international conservation organizations, and a Management Plan has been developed for the protection and management of the property.

The major threats to the property are the water supply (both quantity and quality); invasive vegetation (*Prosopis*, *Eichhornia*, *Paspalum*); and inappropriate use of the property by neighbouring villages. These issues are being dealt with through the Management Plan, and two projects have been developed to bring a permanent solution to the water crisis. Invasive alien species have been removed through cooperative arrangements with the surrounding populations. The 2 m high boundary wall that surrounds the park virtually eliminates the threats of poaching or pollution, and there is no encroachment or habitations inside the park. Noise pollution from the adjoining Bharatpur city and National Highway are minimal. Due to stringent legal environmental regulations in India, all proposed developmental activities have to be subjected to a stringent environmental assessment process

7.2 Annex II: Terms of Reference including World Heritage Committee Decisions

TERMS OF REFERENCE

IUCN Reactive Monitoring mission
Keoladeo National Park – India
1-4 February 2023

At its 42nd session in Manama, Bahrain (June/July 2018), the World Heritage Committee requested the State Party of India to invite an IUCN Reactive Monitoring mission to Keoladeo National Park World Heritage property "to assess its state of conservation and progress made in addressing issues of water provision and invasive species" (Decision **42 COM 7B.68**).

The State Party of India invited an IUCN mission to the property in its correspondence on 20 November 2020 but was postponed due to the COVID-19 pandemic.

At its extended 44th session (Fuzhou (China)/Online meeting, July 2021), the World Heritage Committee requested the mission "to take place prior to the next session of the Committee, to assess its state of conservation and the progress made in addressing issues of water provision and invasive alien species" (Decision **44 COM 7B.92**).

The mission will review the state of conservation of the property, and notably by carrying out the following tasks:

1. Assess the progress as well as the current and planned mechanisms to sustain adequate water supply (quality and quantity) to the property, which is considered crucial for maintaining its Outstanding Universal Value (OUV);
2. Review the current status of the two sewage treatments plants in Bharatpur city and the water quality monitoring mechanism that are in place for the sewage treatment plants;
3. Review the existing monitoring of bird populations in the property, including the long-term approach and methodology and assess the population trends of the migratory bird species which underpin the OUV of the property;
4. Assess the progress and effectiveness of controlling invasive species, including a review of the trends and methods used;
5. Review the progress towards revising the Management Plan, including the strategy on invasive species and the monitoring system;
6. Review the current status of discussions to prevent the disposal of cattle carcasses near the property, which may have potential impacts on its OUV;
7. In line with paragraph 173 of the *Operational Guidelines*, assess any other relevant conservation issues that may impact on the OUV of the property, including the conditions of integrity and protection and management.

The State Party should facilitate necessary field visits to key locations in relation to the above objectives. The mission should hold consultations with the Indian authorities at the national, regional and local levels. In addition, the mission should hold consultations with a range of relevant stakeholders, including representatives of the management authority, non-governmental organisations (NGOs), and relevant scientists and experts. The State Party should facilitate and organize the above-mentioned site visits and the meetings with the above-mentioned stakeholders.

In order to ensure adequate preparation of the mission, the State Party should provide the following items, if available, to the World Heritage Centre as soon as possible, and preferably no later than one month before the mission:

a) Details of the final Eco-Sensitive Zone notification around the property, and the Zonal Master Plan;
b) Data since 2016 on the water releases to the property from the Panchna Dam, the Chambal Pipeline Project, the Govardhan Drain and any other sources;
c) Recent data and trend on monsoon rainfall in the region;
d) Recent data on the quality of water supplies to the property;

e) Time-sequenced monitoring data on the population trends of migratory bird species wintering in the property, including heronry and waterfowl;
f) The latest version of the Management Plan for the property, which incorporates a strategy to address invasive alien species;
g) Any other material related to the property's state of conservation that may be available and would facilitate the mission's work.

Please note that additional information may be requested from the State Party and key stakeholders during the mission.

Based on the assessment of available information and discussions with the State Party representatives and stakeholders, the mission will develop recommendations to the World Heritage Committee regarding the status of the property and provide guidance on further recommended actions for the conservation of the property's OUV, including its conditions of integrity. It should be noted that recommendations will be provided in the mission report, and not during the course of the mission.

The mission will prepare a report on the findings and recommendations of this Reactive Monitoring mission as soon as possible after the completion of the mission, following the standard format, for review by the World Heritage Committee at its next session.

World Heritage Committee, Extended 44th session (Fuzhou (China)/Online meeting, 2021)

Keoladeo National Park (India) (N 340)
Decision: 44 COM 7B.92

The World Heritage Committee,
1. Having examined Document WHC/21/44.COM/7B,
2. Recalling Decision **42 COM 7B.68**, adopted at its 42nd session (Manama, 2018),
3. Regrets that the State Party did not invite the IUCN Reactive Monitoring mission requested in its Decision **42 COM 7B.68**, and reiterates its request to the State Party to urgently invite this mission to the property, to take place prior to the next session of the Committee, to assess its state of conservation and the progress made in addressing issues of water provision and invasive alien species;
4. Expresses its utmost concern that the issue of insufficient water delivery remains unresolved to date and, noting the State Party's efforts towards improving water flow to the property, strongly urges the State Party to decide on a sustainable and reliable solution to secure and sustain the 550 mcft annual minimum water flow to the property required to sustain its the basic ecological function, including through concrete measures to ensure adequate flow from Panchna, Chambal and Govardhan projects;
5. Requests the State Party to ensure that a stringent water quality monitoring mechanism is in place before any effluent is diverted from the sewage water treatment plants in Bharatpur city into the property, so as to avoid any contaminated water being diverted to the property, and to ensure there is no negative impact on its Outstanding Universal Value (OUV);
6. Welcomes the issuance of a final notification declaring an Eco-Sensitive Zone around the property and the State Party's assurances that a consultative process is ongoing for the development of a Zonal Master Plan, and encourages the State Party to consider formalizing the Eco-Sensitive Zone as a World Heritage buffer zone by submitting a proposal for a Minor Boundary Modification, in accordance with Paragraph 164 of the *Operational Guidelines*;
7. Also welcomes the State Party's continued efforts to address invasive alien species within the property and its intention to incorporate an eradication strategy into the revised Management Plan, which should also address the abovementioned water flow issues, and also requests the State Party submit an electronic copy of the revised draft to the World Heritage Centre by **1 February 2022** for review by IUCN before it is finalized;
8. Further requests the State Party to provide recent bird census data and analyses, including population trends for both heronry and waterfowl, and also reiterates its request to the State Party

to clearly document the long-term approach and methodology of systematic bird population monitoring in the pending revised Management Plan;

9. Also noting the potential health risks to wildlife and people caused by the disposal of cattle carcasses near the property, requests furthermore that the State Party immediately prevent any further disposal;
10. Requests moreover the State Party to submit to the World Heritage Centre, by **1 December 2022**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 46th session.

World Heritage Committee, 42nd session (Manama, 2018)
Keoladeo National Park (India) (N 340) Decision: 42 COM 7B.68
The World Heritage Committee,

1. Having examined Document WHC/18/42.COM/7B,
2. Recalling Decision **40 COM 7B.87**, adopted at its 40th session (Istanbul/UNESCO, 2016),
3. Reiterates its utmost concern that new data shows that, in 4 out of 7 recent years, water provision to the property has remained well below the 550 million cubic feet recommended by the 2008 mission as a minimum to sustain its wetland values, and strongly urges the State Party to identify and implement solutions to sustain adequate and reliable long-term water supply to the property and its satellite sites;
1. Welcomes the continued efforts to combat invasive species within the property but reiterates its request to develop an adaptive invasive species control and eradication strategy for the property and to integrate this strategy into the revised Management Plan;
2. Also welcomes the further progress accomplished towards the establishment and issuance of a final notification declaring a 500-metre strip of Eco-Sensitive Zone (ESZ) around the property, and also reiterates its request to the State Party to ensure full stakeholder consultation prior to finalizing the notification, and during the subsequent development of the Zonal Master Plan;
3. Further welcomes the survey data provided on bird species in the property and its satellite wetlands, and requests the State Party to engage in systematic monitoring of bird populations in the property based on a clearly identified long-term approach and methodology, which should be clearly documented in the pending revised Management Plan;
4. Also encourages the State Party to use the on-going revision of the Management Plan to assess the effectiveness of current management responses to the well-known challenges the property is facing as a basis for enhanced responses, and to obtain advice from the World Heritage Centre and IUCN as required, and further reiterates its request to the State Party to submit an electronic copy of the draft revised Management Plan to the World Heritage Centre, for review by IUCN;
5. Also requests the State Party to invite an IUCN Reactive Monitoring mission to the property to assess its state of conservation and progress made in addressing issues of water provision and invasive species;
6. Further requests the State Party to submit to the World Heritage Centre, by **1 December 2018**, a written clarification of the current situation regarding the reported disposal of cattle carcasses near the property, including possible impacts on the property's OUV;
7. Requests furthermore the State Party to submit to the World Heritage Centre, by **1 December 2019**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 44th session in 2020.

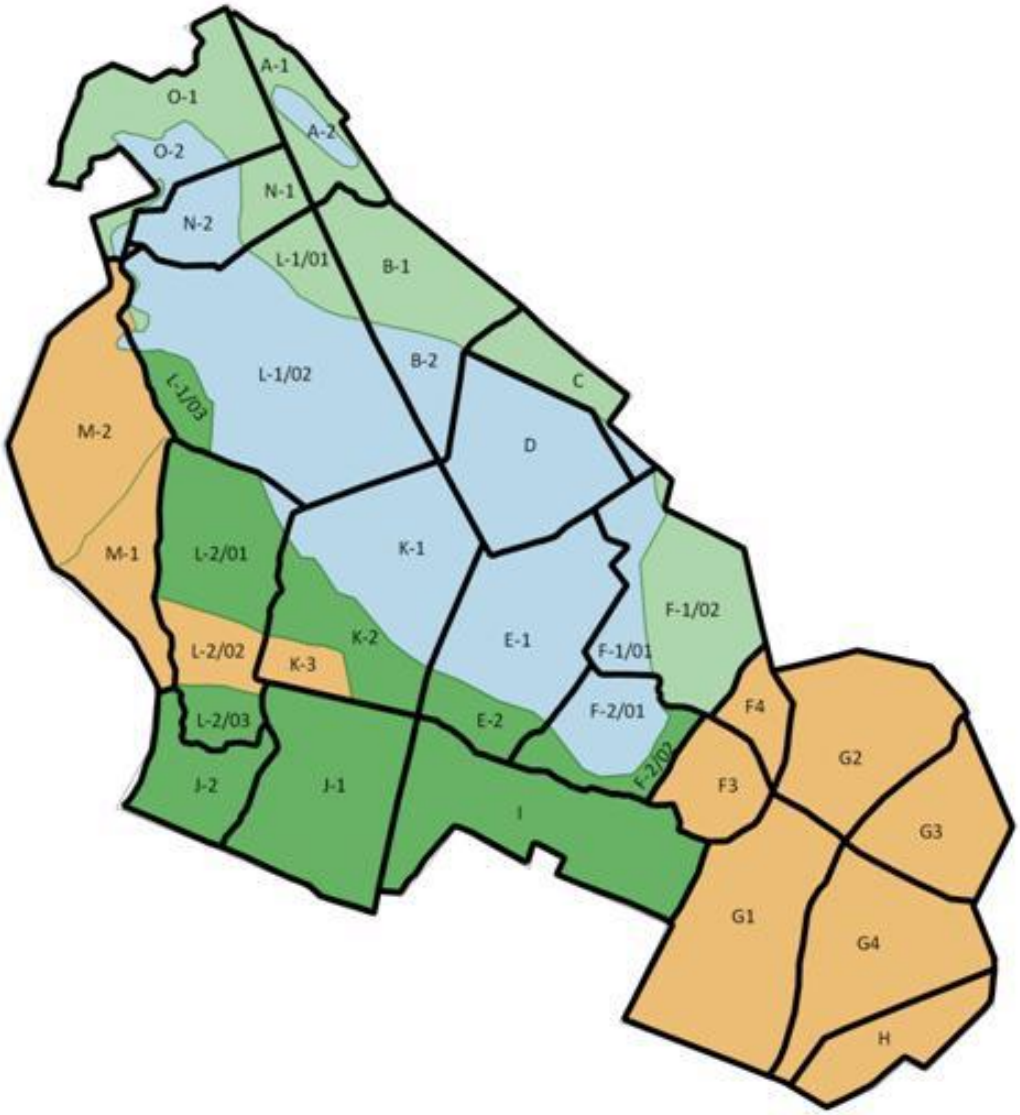
7.3 Annex III: The mission programme and list of people met

Date	Programme activities implemented	List of people met
February 13, 2023	Arrivals in India: Mr Chimed-Ochir Bazarsad at 05:15 Prof Philip McGowan at 08:55	Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India, developed mission program and accompanied the whole mission
February 13, 2023	Meeting with Officials of MoEF&CC, New Dehli Time: 12:00 -13:00 Meeting with Officials of Archaeological Survey of India (ASI), New Delhi Time: 15:00h -16:00	Mr. Rohit Tiwari, Inspector General (IG) of Forest (WL) Dr. Sunil Sharma, Joint Director (WL) Smt. V Vidyavathi, Director General (ASI) Shri Janhwij Sharma, Additional Director General, ASI (Conservation, World Heritage) Mr Gajanan L Katade, Deputy Superintending Archaeologist Ms Kanchan Rai, Deputy Superintending Archaeologist Ms Neha Pandey, ASI
	Travel to Bharatpur Time: 16:30 – 20:00	By rented car accompanied by Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India
February 14, 2023	Visit the Keoladeo National Park Time: 7:00 – 9:00	Accompanied by Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India
	Meeting with Officials in Keoladeo National Park Time: 10:00 – 13:00	Mr. Nahar Singh, Deputy Conservator of Forest (DCF) Wildlife (WL) Mr. Sedu Ram Yadav, Chief Conservator of Forest (CCF) Wildlife Mr. Narayan Singh Naruka, Assistant Conservator of Forest (ACF)
	Visit peripheral road, entry points of water supply into Park, Chiksana canal, Invasive species eradication work, Heronry and Wetland Blocks in the Park Time: 14:00 – 18:00	**Accompanied by:** Mr.Narayan Singh Naruka, Assistant Conservator of Forest (ACF) of KNP Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India Mr. Ranno, Driver, KNP
February 15, 2023	Visit of KNP by boat Time: 6:30 – 9:00	**Accompanied by:** Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India Mr Dharam Singh, Ranger In-charge of KNP
	Visit pumping station of Govardhan project Time: 9:00 – 13:00	**Accompanied by:** Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India
	Park Visit Ghana canal at Ajan bandh, Dholpur- Bharatpur drinking water pipeline project, and Chambal Sanctuary Time: 14:00 – 18:00	Mr Harvindar Singh, Assistant Forest Guard, National Chambal Sanctuary Visit Shri Lachhiram, Boatman, National Chambal Sanctuary

February 16, 2023	Meeting with Nature guide and Rickshaw pullers in Keoladeo National Park Time: 10:00 – 11:00	Mr.Mohan Singh Mr.Harish Sharma Mr.Din Dayal Mittal Mr.Tarun Singh Mr. Pritam Singh Mr.Vishnu Singh
	Meeting with other stakeholders in Keoladeo National Park Time: 11:00 – 13:00	Mr. Lal Singh, Retd DCF, Keoladeo National Park Mr. Pushpendra Singh Katela Mr. Banay Singh, Water Resource Deprtment, Govt pf Rajasthan Mr. Pushpendra Singh, Asst Engineer, Public Health and Engineering Department (PHED) Mr.Vikram Singh- Ecological Development Committee (EDC) Chairman, Nagalakhori village Mr. Ratiram, EDC Chairman, Ramnagar village
	Visit Keoladeo National Park Time 14:00 – 17:00	Accompanied by: Mr Randheera, Guide Keoladeo National Park Mr Brijendra Singh, Guide, Keoladeo National Park
February 17, 2023	Travel from Bharatpur to New Delhi (10:00-2:30) and de-briefing meeting with the officials of MoEF&CC Time: 16:00 – 17:00	Dr Sunil Sharma, Joint Director (WL) Sh Arindam Singh Tomar, Principal Chief Conservator of Forest and Chief Wildlife Warden (PCCF & CWLW) through online Dr. Bhumesh Singh Bhadouria, Wildlife Institute of India
February 18, 2023	Departure: Mr Chimed-Ochir Bazarsad at 06:55 Prof Philip McGowan at 21:25	

7.4 Annex IV: Map of the property

Whilst noting that the official map of the property remains that which was submitted at the time of inscription (available at https://whc.unesco.org/document/103324), the following map is taken from the Management Plan (Gupta, 2021) and shows the blocks widely referred to by managers and researchers.



7.6 Annex V: Annual amount of water received from external sources in KNP and rainfall

Annual water supply received in KNP (in mcft) during 1976-2022 and rainfall (in mm) in Bharatpur 2004-2008 and 2102-2022. Sources: External water sources - Gupta, 2021, page 134 and Rajasthan Forest Department, 2023 and rainfall data - Shekhawat et al., 2010 for 2004-2008 and https://www.timeanddate.com/weather/india/bharatpur/climate for 2012 onwards)

Nr	Year	Received in Ajan Dam from Panchna Dam	Ajan Dam	Chambal pipeline	Govardhan pipeline	Total water from external sources	Annual rainfall (mm)
1	1976		514.0			514.0	
2	1977		282.6			282.6	
3	1978		283.7			283.7	
4	1979		283.7			283.7	
5	1980		514.5			514.5	
6	1981		514.5			514.5	
7	1982		345.8			345.8	
8	1983		514.5			514.5	
9	1984		345.8			345.8	
10	1985		345.8			345.8	
11	1986		62.0			62.0	
12	1987		141.3			141.3	
13	1988		485.4			485.4	
14	1989		184.8			184.8	
15	1990	639.7	469.7			469.7	
16	1991	739.3	469.7			469.7	
17	1992	1219.0	584.0			584.0	
18	1993	1037.2	484.7			484.7	
19	1994	1140.3	516.7			516.7	
20	1995	758.0	180.3			180.3	
21	1996	735.0	432.7			432.7	
22	1997	350.3	180.4			180.4	
23	1998	881.4	296.6			296.6	
24	1999	920.2	343.6			343.6	
25	2000	146.2	142.2			142.2	
26	2001	288.7	183.6			183.6	
27	2002*	3.5	0			0	
28	2003	624.1	288.7			288.7	
29	2004	20.7	18	Dholpur-Bharatpur drinking water pipeline from Chambal river completed in 2011		18	608
30	2005	480.0	480.9			480.9	1041
31	2006	0	0			0	373.5
32	2007	0	0			0	539
33	2008	556.0	556.4		Govardhan pipeline from completed in 2012	556.4	786
34	2009	0	0			0	
35	2010	310.0	216.0			216.0	
36	2011	0	14.1	297.0		311.1	
37	2012	390.0	234.0	310.0	8.0	552.0	793.1
38	2013	635.0	411.7	81.0	186.0	678.7	689.6
39	2014	0	0	188.0	3.0	191.0	558.0
40	2015	0	0	100	290	390.0	647.9
41	2016	650.0	457.6	35.0	137.3	629.9	718.9
42	2017	190.0	0	175.0	0	175.0	435.8

43	2018	715.0	10.0	5.0	695.9	710.9	1095.7
44	2019	392.5	0	25.0	350.0	375	574.2
45	2020		0	64.0	525.3	589.3	762.0
46	2021		225.0	25.0	250.0	500.0	1012.4
47	2022**		132.0	18.0	165.9	315.9	779.9

* *The increase in height of the Panchna Dam across the Gambhir River during the years 2002-2003*

** *Data until October 2022*

****Annual average precipitation in Bharatpur 599.7 mm (source: https://www.timeanddate.com/weather/india/bharatpur/climate)*

7.7 Annex VI: Maps and photographs and other graphical material required to illustrate issues

All photographs ©IUCN/Philip McGowan

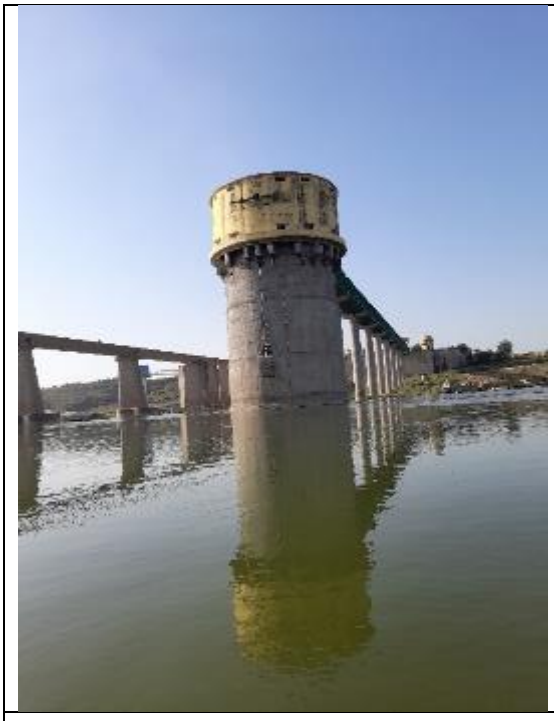
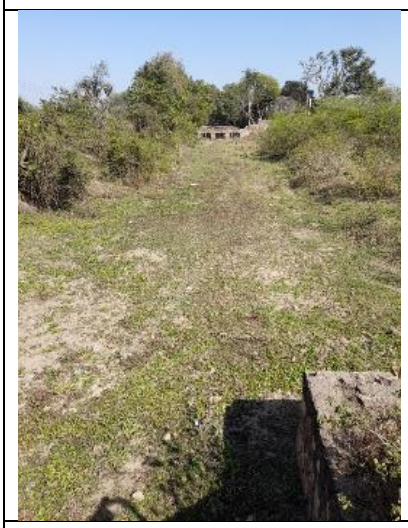
	Bar-headed Geese and Sarus Crane
	Sambar Deer

	Chital on mounds created for heronry trees
	Spoonbill feeding
	Painted stork, Bar-headed Geese and other species.

	Heronry trees in D Block
	Heronry trees in D Block
	Abandoned heronry trees in L Block at Sapan Mori

	Woodland in Koladhar with large stand of invasive *Prosopis juliflora* in the distance, on the right hand side of the picture.
	Tall stands of *Vetiveria zizanioides* in Koladhar
	Dense mats of *Paspalum* mixed with other aquatic plants in L Block, behind Shanti Kutir

	Stands of *Vetiveria* zizanioides [at wetland edge on western side of L Block.
	Feral cattle.
	
Govardhan Drain at Santhruk, which runs from the Kosi Depression to the Yamuna, before being pumped into pipes to KNP.	Pumps at Santhruk that pump water from Govardhan Drain to KNP.

	Tower that draws water from the Chambal River in the national Chambal Sanctuary
	Bharatpur Drinking Water pipeline with Ajan Dam behind. The canal that takes water to KNP lies below the pipeline and the downpipe from the pipeline to the right of the picture. Water can be released from the pipeline into the canal through this downpipe.
	Canal from Ajan Dam leading to the sluice gates at the KNP boundary wall.

	Cultivated land in Ajan Dam.
	Rich agricultural land adjacent to the Aghapur checkpost.
	Boundary wall with new perimeter road below and proposed canal for retaining water.