सूचना का
अधिकार
RIGHT TO
INFORMATION

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

No. WII/RTI/CPIO/2021-22 (Qtr-II)/34

Date: 14 September, 2021

To,

Mr. Satyavir Singh Yadav
16, Harsh Vihar
Near Rani Bagh, Pitampura
Delhi - 110034

Sub.: Information under RTI Act, 2005–reg.
Ref.: (i) Your RTI Application No. --- dated 27 July, 2021
(ii) Our letter of even No. dated 13 August, 2021 and 25 August, 2021
(iii) Your letter No. --- dated 19 August, 2021
(iv) Your letter No. --- dated 03 September, 2021

Sir,

With reference to your letter(s) and RTI application cited above under RTI Act, 2005, this is to confirm that the additional fee Rs. 504/- via DD No. 343343 deposited by you towards the cost of providing the certified photocopies of requested documents under RTI Act, 2005 has been received for the following queries sought by you:

Information Sought under RTI	Reply
1. **Response to your query No. 1 (c)**	**Annexure-I:** Management Plan for Okhla Bird Sanctuary (2011-12 to 2021-22) (contains 232 pages)
2. **Response to your query No. 2 (a)**	**Annexure-II:** Report on Impact Assessment of Development of City Level Park at NOIDA, Sector 95 on Okhla Bird Sanctuary (contains 20 pages)

Reply for rest queries sought by you have been already provided to you vide our letter No. WII/RTI/CPIO/2021-22 (Qtr-II)/34 dated 25 August, 2021. If you are not satisfied with the aforesaid reply, you may appeal to the **Appellate Authority i.e. "Director, Wildlife Institute of India, Post Box 18, Chandrabani, Dehradun – 248 001, Ph. 0135-2640910".**

Thanking you,

Yours faithfully,

(Dr. Monali Sen, IFS)
N.O. & CPIO (RTI)

Encl.: as above.

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Management Plan for Okhla Bird Sanctuary (2011-12 to 2021-22)

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

GOVERNMENT OF UTTAR PRADESH

Management Plan for Okhla Bird Sanctuary

(2011-12 to 2021-22)

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Wildlife Institute of India

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Acknowledgements

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Chapter 1
Introduction to the wetland

1.1 NAME, LOCATION, CONSTITUTION AND EXTENT

The Okhla Bird Sanctuary (OBS) is located in National Capital Region, Delhi (NCR) at the point where the River Yamuna leaves the territory of Delhi and enters the neighboring state of Uttar Pradesh (Fig. 1.1). Geographically it is located with coordinates being: 28°32'56.3" N Latitude 77°18'56.6" E Longitude at Uttar Pradesh Side and 28°32'43.5" N Latitude and 77°18'41.7" E Longitude at Delhi Side. The most prominent feature of the site is a large lake created by the construction of a barrage on the Yamuna River adjoining Okhla village towards west and Gautam Budh Nagar towards the east.

It is a declared Bird Sanctuary and lies on the border of Okhla village in Delhi and Gautam Buddha Nagar district in UP. The Sanctuary area comes under the ownership of Irrigation Department (U.P.). On 8 May 1990, the U.P. Government declared 400 ha. of land as protected area as a bird Sanctuary under section 18 of Wildlife (Protection Act), 1972 (Government of Uttar Pradesh, Gazette notification No. 577/14-4-82/89 dated 08/05/1990) (Appendix I). The Sanctuary lies close to NOIDA Township and metropolitan Delhi. Two picnic spots namely Kalindi Kunj and Gautam Buddha Park exist closer to the Sanctuary. Both these picnic spots attract a large number of visitors. Some of them also visit the OBS. Visitors for the purpose of bird watching and recreation also visit the Bird Sanctuary throughout the year, mainly during the migratory season.

NOIDA (New Okhla Industrial Development Authority) is located in the administrative district of Gautam Buddha Nagar of Uttar Pradesh. NOIDA came into existence on 19 April 1976. It has a total area of 135,400 ha. Because of its proximity to Delhi and better infrastructure facilities as compared to other districts in Uttar Pradesh, it is proving itself to be the favorite and the most important investment destination for major companies/industries in India. At present major Industrial areas in the district are NOIDA, Greater NOIDA, Dadri and area along the Taj Express Highway. The city, which was created

under the U.P. Industrial Area Development Act, has first-class amenities and is considered one of the more modern suburbs of Delhi in the National Capital Region.

The western part of OBS extends into the territory of Delhi as the mid stream of river Yamuna is the inter-state boundary between the two states of UP and Delhi. However, the part of OBS extending into the state of Delhi is also under the possession of Irrigation department of Uttar Pradesh.

1.1.1 River Yamuna

The Okhla Reservoir was created by the construction of a barrage on River Yamuna. This reservoir is now a prominent wintering ground for waterbirds and a declared Bird Sanctuary. This section provides a brief description of River Yamuna as a source of water for the Sanctuary. The Yamuna River enters Delhi at village Palla and traverses a total distance of 48 km within the National Capital Territory of Delhi (NCTD) of which 26 km is upstream of the Wazirabad Barrage, which was built in 1957 by National Projects Construction Corporation Limited (NPCC) for storing water of Yamuna River for Wazirabad water treatment plant which supplies water to some parts of Delhi. The distance between Wazirabad barrage and Okhla Barrage is approximately 22 km.

The Yamuna River originates from the Yamunotri glacier in the State of Uttarakhand. The total length of the River is 1376 km. There are no notable tributaries bringing water to river Yamuna for a distance of around 250 km of its flow in the plains except for a seasonal stream called Som Nadi (joining it close to Saharanpur in UP) and heavily polluted river Hindon (joining it south of Greater NOIDA in UP) till the river Chambal meets the river Yamuna near Etawah (U.P.). Most of the water that it gets are either from the Hathnikund Barrage or from ground water accrual or the waste water drains joining the river from towns like Yamuna Nagar, Karnal, Panipat and Sonepat in Haryana and Saharanpur, Muzzafarnagar and Baghpat in U.P. The water from Okhla Barrage is extracted through the Agra canal situated downstream of Nizamuddin Bridge. It was commissioned in 1874. In the beginning, it was available for navigation, in Delhi, erstwhile Gurgaon, Mathura and Agra Districts, and Bharatpur State. Later, navigation was stopped in 1904 and the canal has since then, been exclusively used for irrigation purposes. At present, the canal does not flow in district

Gurgaon, but only in Faridabad, which was earlier a part of Gurgaon. The Canal receives its water from the Yamuna River at Okhla, about 10 KM to the south of New Delhi. The weir across the Yamuna is about 800-yard long, and rises seven-feet above the summer level of the river. From Okhla the Agra canal follows the high land between the Khari-Nadi and the Yamuna and finally joins the Banganga River about 20 miles below Agra. The notified OBS does not have any drain falling directly into the river. Shahdara drain runs parallel to the Sanctuary and meets the Yamuna River downstream (Fig. 1.2). Water diverted from the Hindon River at Hindon Barrage (2.5 km upstream of OBS) enters the Sanctuary as Hindon Cut.

1.2 APPROACH AND ACCESS

The OBS is easily accessible from both Delhi and NOIDA. It is on the east side of Afzal Ganj and Kalindi Kunj in Delhi and across the main road between NOIDA and Mayur Vihar to the south of DND Flyway. The entry to the Sanctuary is on the Amrapali road, which is connected to the NOIDA Express Highway in the NOIDA and to the Kalindi Kunj Marg and Road 13A in Delhi (Fig. 1.3).

1.3 STATEMENT OF SIGNIFICANCE

Wetlands consist of characteristic assemblages of species that interact with each other and the environment. These interactions within and between the biotic and abiotic components of wetland ecosystems lead to a flow of ecological functions that provide ecosystem services to the human society. Some of the ecological functions provide direct economic benefits whereas others provide indirect support and protection to an economic activity. OBS is providing significant ecosystem services in terms of groundwater recharge, erosion control, recreational values, educational value and aesthetic values. It performs important functions of a wetland amidst of metropolitan cities with the presence of 13 globally threatened bird species. It is recognized as an important bird area and a centre for conservation education and recreation.

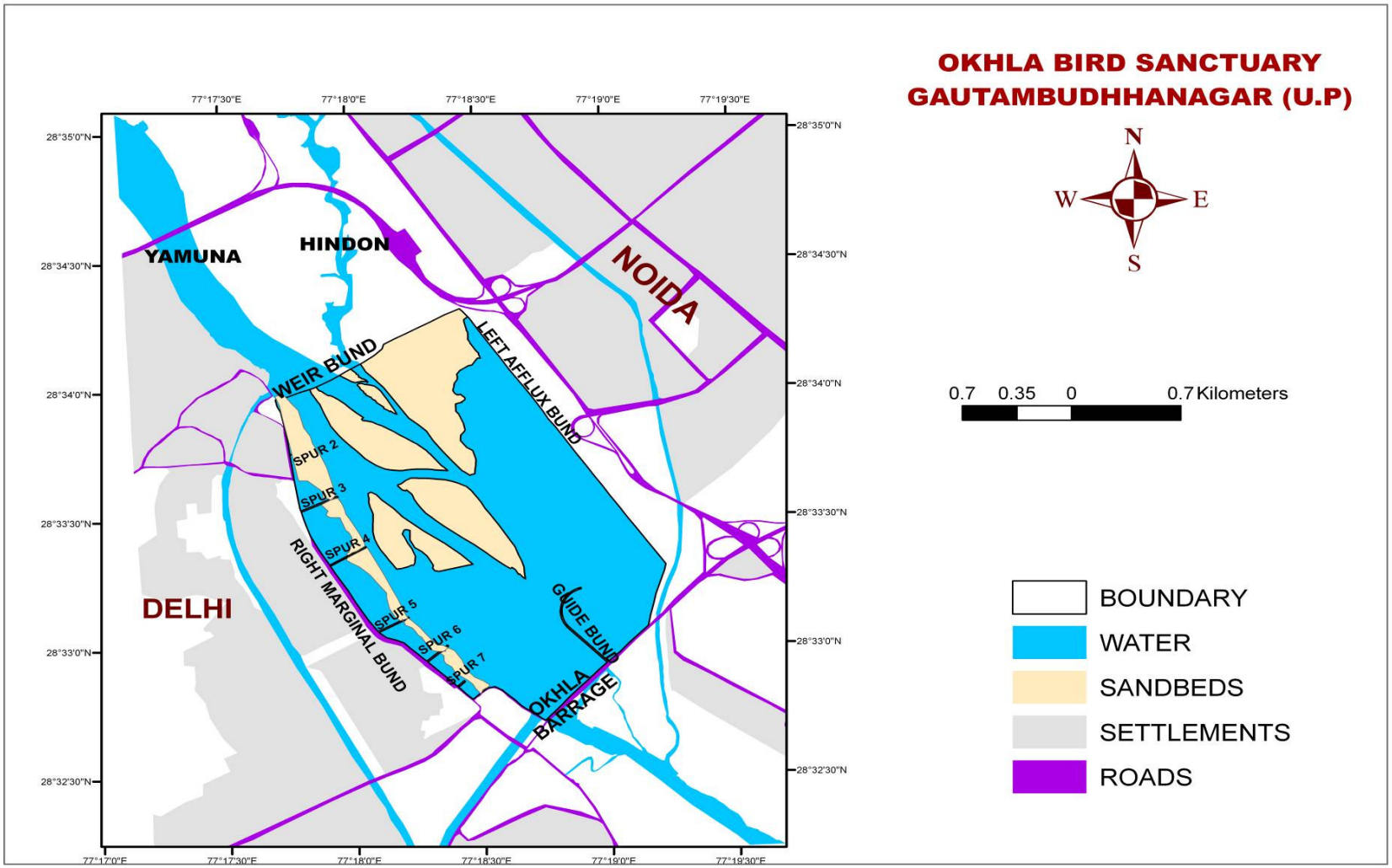


Fig. 1.1 Map showing location and boundary of OBS, NCR Delhi

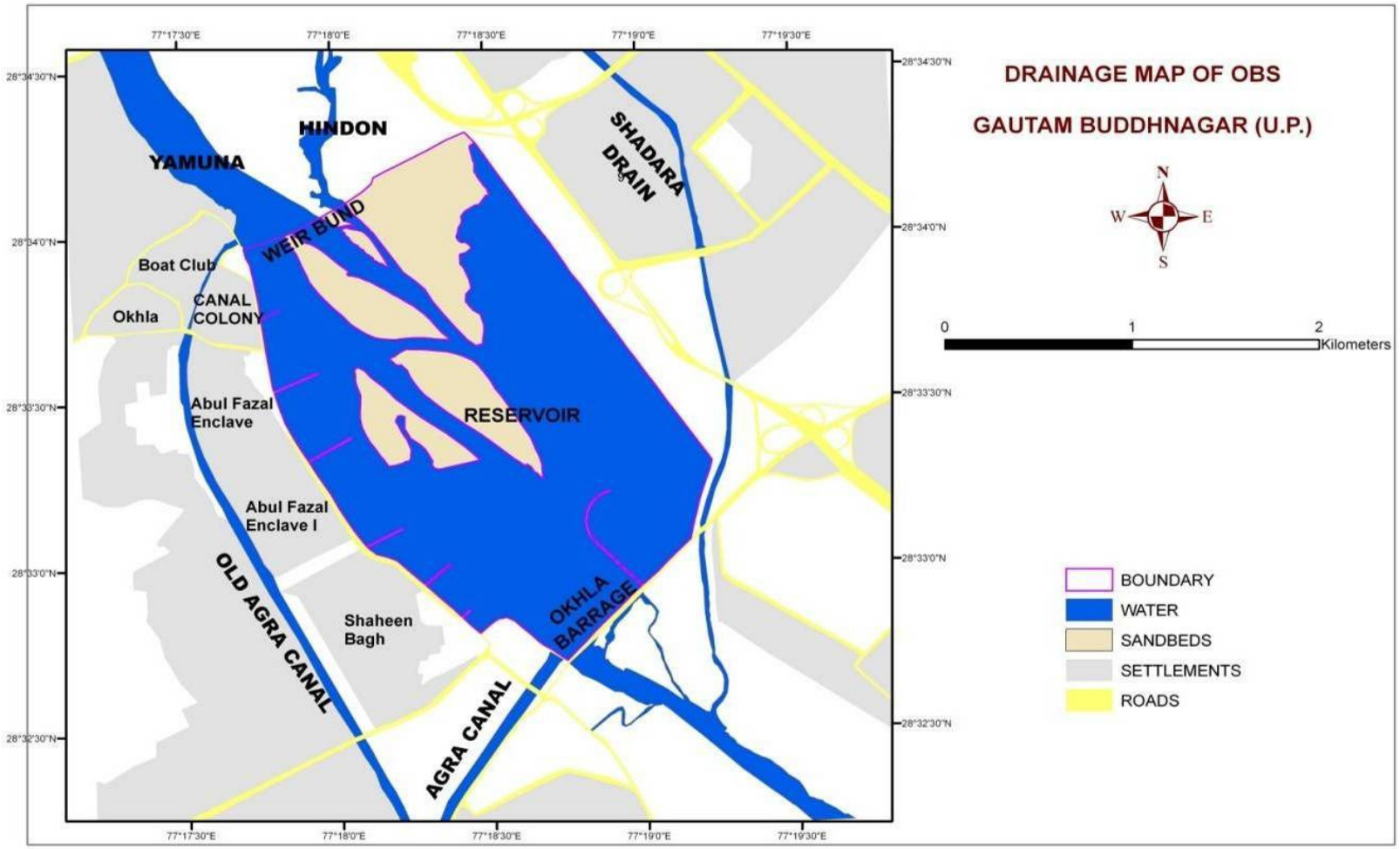


Fig. 1.2 Drainage system of OBS, NCR Delhi

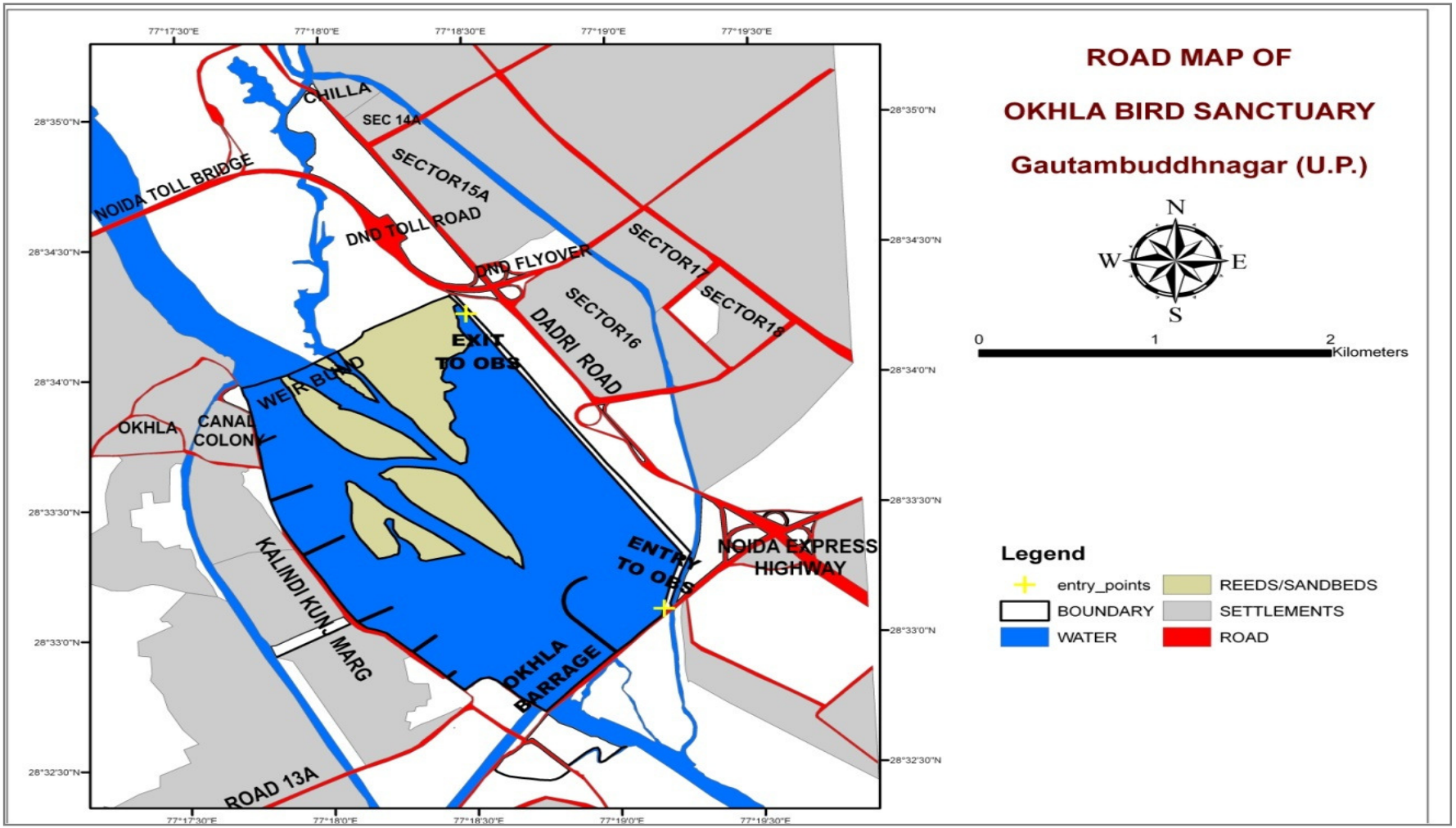


Fig. 1.3 Map showing roads surrounding OBS, NCR Delhi.

1.3.1 Biodiversity value

As per the inventory made by BNHS, out of 302 bird species, two are 'Critically Endangered'; 11 are 'Vulnerable'; seven species are 'Near Threatened' and one, Dalmatian pelican *Pelecanus crispus*, is 'Conservation Dependent'. According to the 2010 IUCN Red List, the checklist contains three each 'Critically Endangered' and 'Endangered', nine 'Vulnerable' and eight 'Near Threatened' bird species (Appendix II). The site is thought to hold around 20,000 water birds or more than 10,000 pairs of water birds in the winter. Okhla has been identified as an IBA in view of its bird life and the presence of globally threatened species. This site qualifies in A4iii IBA criteria (i.e. the site is known or thought to hold ≥ 20,000 waterbirds). The Sanctuary area on the Delhi side has also been assigned the IBA status on the basis of IBA criteria A1, A3 and A4i (Islam and Rahmani 2004).

Every year thousands of migratory birds visit this wetland of which most common species are Northern Shoveller (*Anas clypeata*), Gadwall (*Anas strepera*), Northern Pintail (*Anas acuta*), Common Teal (*Anas crecca*), Tufted Duck (*Aythya fuligula*), Common Pochard (*Aythya ferina*), Eurasian Wigeon (*Anus penelope*), Greylag Goose (*Anser anser*), Bar-headed Goose (*Anser indicus*) and Ruddy Shelduck (*Tadorna ferruginea*). The Garganey (*Anus querquedula*) is a scarce passage migrant. Large flocks of Greater Flamingos (*Phoenicopterus ruber*) are seen during late winter and early summer. It is also an important feeding ground for 300 to 500 Painted Storks (*Mycteria leucocephala*) that breed in Delhi Zoo (Urfi 1997, 2003). The Indian skimmer (*Rynchops albicolis*) that has declined all over its range (BirdLife International 2001), was found frequently in summer in the Yamuna river system in the mid 1970s (Ganguli 1975) but now it is a rare visitor to this wetland (Harris 2001).

1.3.2 Recreational value

OBS is one of the few respites from the urban conglomeration of NCR. The Sanctuary serves as the educational centre for the surrounding schools and colleges. The Sanctuary serves as one of the important sites for the bird watching, especially during migratory season. Because of its location in the urban landscape, it attracts tourists for its recreational and aesthetic values.

1.3.3 Flood control

Since the extent of the Okhla Barrage is narrower than width of the river, auxiliary structures in the form of embankments were constructed. The people residing very close to the flooding zones of Yamuna River had to be protected during high flood. Hence, embankments were constructed along the riverbank to prevent the river water from spilling over to the inhabited areas. At the western side of the Sanctuary is the 'right marginal bund' and to the eastern side is the 'left afflux bund'. To limit the movement of the meandering Yamuna and for attracting or deflecting the flow of the river towards or away from the riverbank, several spurs were constructed at right angles to the riverbank, projected into the river. There are seven spurs at the right marginal bund of the Sanctuary. A guide bund was also constructed on the southern boundary of the Sanctuary for the purpose of guiding the river flow past the diversion structure without causing damage to it and its approaches. Nevertheless, the adjacent low areas get flooded during heavy monsoon period. However, effects are much reduced due to the presence of these embankments**.**

1.3.4 Groundwater recharge

Ground water is a vital resource for agriculture, domestic water supply and industry. It is also single largest and most productive source of irrigation water and plays a critical role in maintaining agricultural production during droughts. Due to fast urbanization and reduction of agricultural zone, which could have acted as the percolation zone, the replenishing of this ground water is getting difficult and the consequence of which is evident as the scarcity of water in Delhi. Sprawling urbanization has already resulted in fall in ground water levels to the tune of about 30 m in some part of South, about 8 to 20 m in parts of South West District and 2 to 6 m in parts of Alipur and Kanjhawala Blocks in North and North West Districts of Delhi (Irrigation and Flood Control Department).

Floodplains in the Sanctuary recharge the ground water. As a result, the mean depth or water table becomes high in the post-monsoon season. Thus, good amount of water gets trapped in the aquifer. The availability of water can help agriculture or it can be used to extract the water for household consumption in NCR, Delhi (Kumar, 2001).

1.3.5 Fish production

The Sanctuary is rich in fish diversity. A total of 87 fish species belonging to 54 genera and 23 families have been reported from Okhla Barrage (WII 2002). Though fishing is prohibited in the Sanctuary, the surrounding buffer areas are given in lease by the Fishery Department for fishing which contributes significantly to income.

1.3.6 Biomass production

The villagers from the nearby areas of the Sanctuary are dependent on it for livestock grazing, wood and grass extraction. A large number of livestock especially goats, buffaloes and cows exclusively depend and get their fodder from the floodplain areas in and around the Sanctuary for seven months in the year when the flooding water recedes. Different plant species, which grow in the Sanctuary like, Saccharum sp., Typha species, are used by the local peoples for various purposes.

1.3.7 Pollution abatement

Roads with high traffic loads surround the Sanctuary. The green cover of the Sanctuary helps to reduce the air pollution of the surrounding environment and traps atmospheric carbon. It also acts as a green muffler to reduce the noise pollution. The toxic pollutants of the water which enter it through the domestic, industrial wastes and agricultural effluents are trapped by the aquatic vegetation of the Sanctuary, thus reducing the toxic load of the water.

1.3.8 Waste assimilation

The wastes from the surrounding landscape get accumulated in the wetland. The vegetation of the wetland traps the wastes and does not allow it to go further downstream. The pollutant thus is not spread to the surrounding land.

Chapter 2

Background information and attributes

2.1 BIOGEOGRAPHIC ZONE AND WETLAND TYPE

The Okhla Bird Sanctuary (OBS) is a man modified flood plain wetland situated within the National Capital Territory of India, which falls under the Bio-geographical province 7A. Construction of the Okhla Barrage across the River Yamuna has resulted in a small portion of the river to become a static water system. Out of 400 ha area of the Sanctuary, open water is around 273 ha, the reed beds and sandbeds (i.e. the islands) form 97 ha area, the roads, and bunds comprise of the rest 30 ha area. This statistics show that the water comprises 68.23% of the whole sanctuary area. This clearly states that we can consider the sanctuary as wetland.

2.2 BOUNDARIES

The Sanctuary has following boundaries (Fig. 2.1).

North: The Okhla Weir and Okhla Weir Bund forms the northern boundary of the Sanctuary. There is no fencing to demarcate the northern boundary. River Yamuna and Hindon Cut enter the Sanctuary from this side. A non-cemented road extends from the second checkpost towards the north and ends at the temple and banyan tree near the point where the Hindon Cut makes its entry to the Sanctuary. However, this section is near to the DND Flyover but there is no entry to the flyover from this side.

South: The Okhla Barrage and Tie Bund and Amrapali Marg, Shahadra drain forms the southern boundary. The Amrapali road is the connecting road between Delhi and NOIDA and hence carries heavy load of traffic. There is fencing covering most of the boundary of this side of the Sanctuary except some area between the Guide bund and the entry of the Sanctuary. The Amrapali Road leads to NOIDA Express Highway.

East: On the east, Left afflux bund forms the eastern boundary. The Left afflux Bund is the dyke that prevents the water from entering into the surrounding areas, which is being used as a road of nearly 2.5 km long. It extends from the entry gate of the Sanctuary towards south to the second check post. Construction of a park is going on along this bund road just next to the Sanctuary boundary. This park covers most of the 2.5 km stretch of the OBS in the eastern side.

West: The Right marginal bund forms the western boundary of the Sanctuary. Part of the right marginal bund is bounded by fence, which starts from the Canal Colony gate towards the north till Kalindi Kunj Park in the south of this bund. Remaining one-third of the bund is bounded by the wall of the Canal Colony in the northern side. There are seven spurs located within the fencing on the right marginal bund except the spurs 1 and 2, which are included inside the wall fencing of the canal colony. The fencing runs parallel to the sanctuary and Kalindi Kunj Road in the western side of the sanctuary.

2.3 ALTITUDE/TERRAIN TYPES

In general, the area of the Sanctuary is a vast alluvial plain with a gentle southeastern slope. The terrain is generally flat. There is an irregularity on the surface being formed by the riverbeds and high banks. The altitude of OBS is about 200 m above the sea level.

2.4 GEOLOGY, ROCK AND SOIL

Delhi, the capital of India is bounded by the Indo-Gangetic alluvial plains in the North, East and West and by Aravali hill ranges in the South. OBS falls in the Indo-Gangetic alluvial plains. The Reservoir mainly contains sediments, composed of the silt load carried by the river Yamuna. The sediment is black in colour with slightly alkaline in nature.

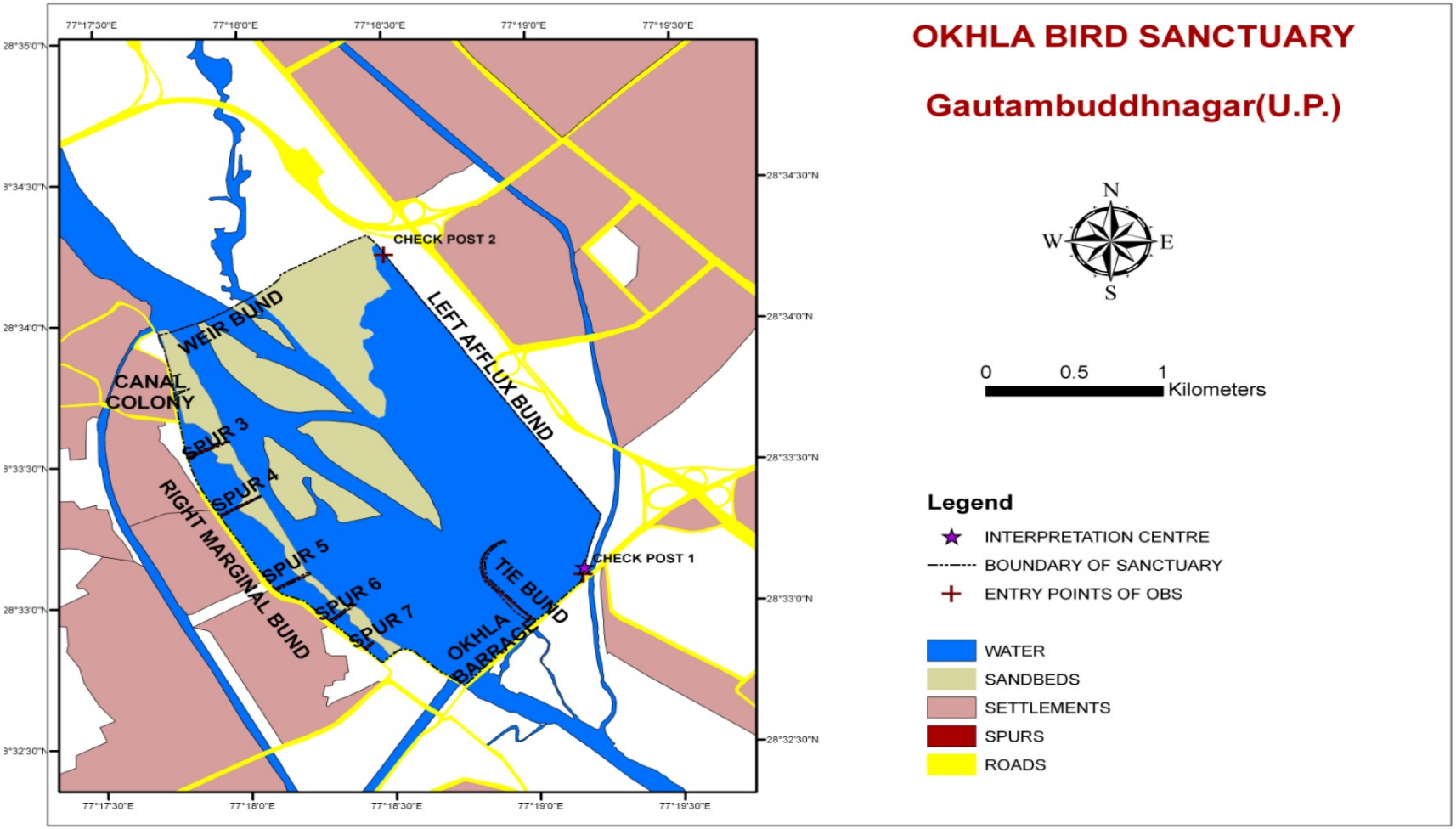


Fig. 2.1 Okhla Bird Sanctuary: boundary details

The bedrock of the whole Okhla region including the industrial area (NOIDA) is mainly composed of Alwar quartzites with interbeds of Mica schist. The quartzite are pinkish to grey in colour, hard, compact, highly jointed, fractured and weathered. The alluvium thickness in this region varies from 100 to 200 m and the depth to bedrock varies from 38 to 45 m below land surface.

2.5 CLIMATE/ TEMPERATURE (YEAR ROUND PATTERN)/ RAINFALL

There are three distinct seasons as follows:

- Winter season : November to March
- Summer season : April to June
- Monsoon season : July to September

The area has a typical North Indian sub-tropical climate with distinct summer and winter months. Summers are hot and more or less dry. During summer months, the temperature varies from a maximum of 40° C to a minimum of 29° C. The hottest months are between April and July. The area has a pleasant autumn and spring and a cold winter with often-foggy weather. Temperature varies from a maximum of 21° C to a minimum of 5° C, during the winter months (Fig. 2.2). The month of January is the coldest. Monsoon starts in the month of July and lasts until September. Much of the precipitation is received through the Southwest Monsoon. Monthly average of rainfall and other important meteorological factors are given in the Appendix III. Annual patterns of rainfall, evapotranspiration, humidity and wind speed of NCR Delhi are provided graphically below (Fig. 2.3, 2.4 and 2.5).

2.6 HYDROLOGICAL FEATURES

2.6.1 Source of water

The major water source for the Sanctuary is the Yamuna River that has a large catchment area of around 6,93,000 ha. Its catchment is heterogeneous in landscape and it includes a part of Himalayas. Apart from Yamuna water, there is an enormous amount of sewage from Delhi urban area dumped into this system. The slope of the catchment is in the north-south direction, which conforms to the general southward drainage of this region.

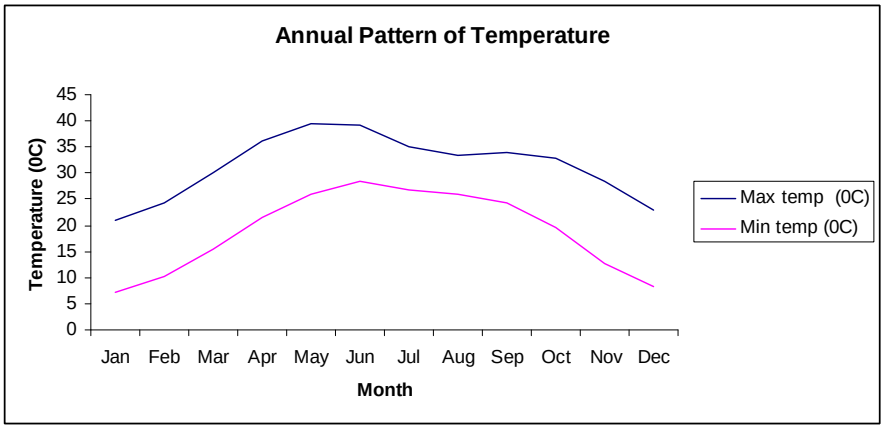


Fig. 2.2 Annual pattern of temperature of Delhi

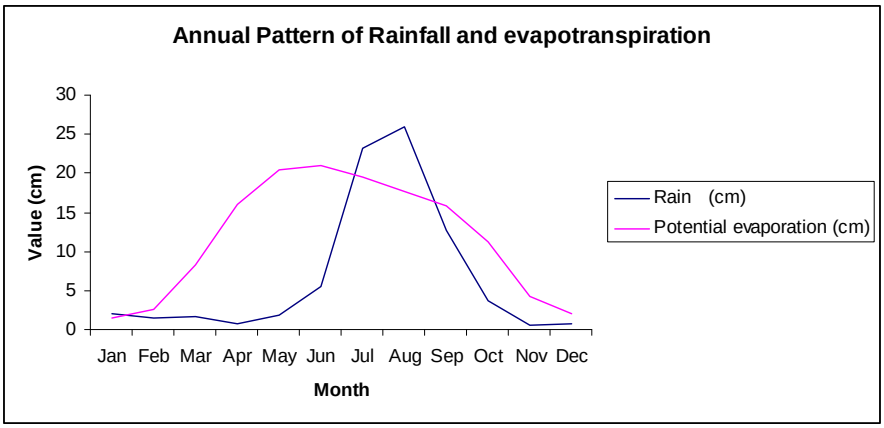


Fig. 2.3 Annual pattern of rainfall and evapotranspiration of Delhi

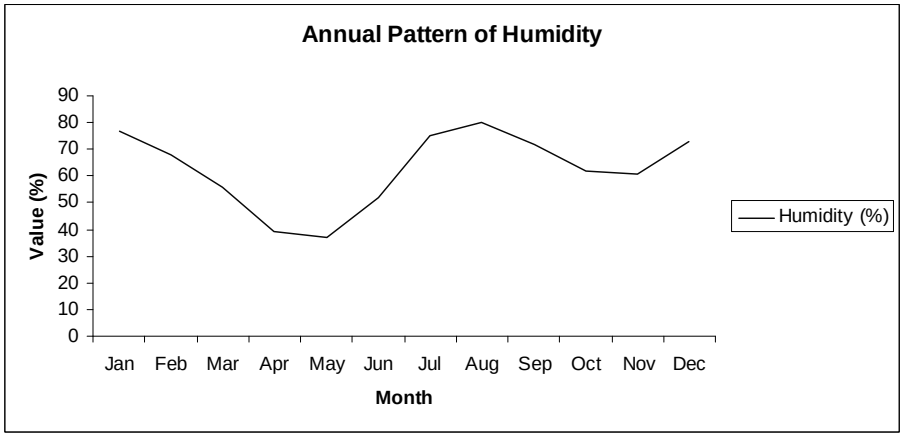


Fig. 2.4 Annual pattern of humidity of Delhi

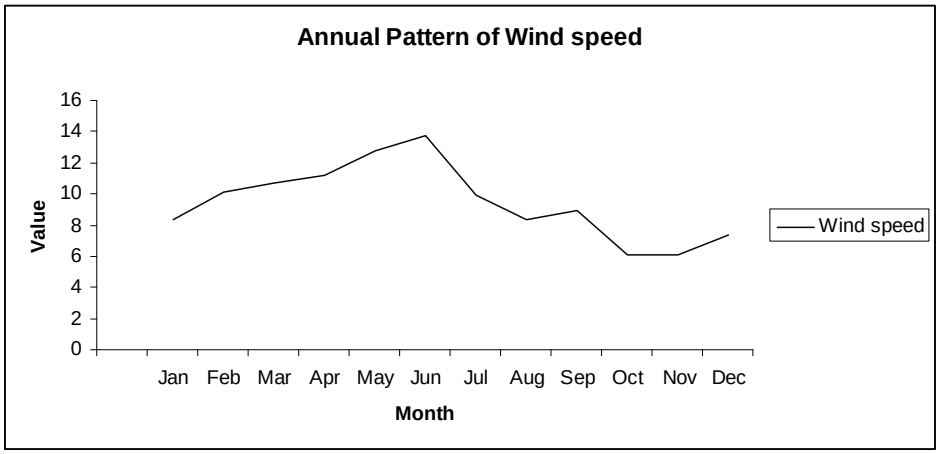


Fig. 2.5 Annual pattern of wind speed in Delhi

The major sources of surface water entering the study area (inputs) are: (i) water released from the Wazirabad Barrage (catchment water); (ii) water discharged from Hindon barrage; (iii) run off generated from Delhi area; and (iv) sewage falling into the river. The major sources of outflows as surface outflow (water for irrigational purposes through Agra Canal and excess water released downstream) and small amount of water goes through infiltration and evapotranspiration (Fig. 2.6). The potential water source from catchments is 15, 1617 m.cu.ft. To maintain the water level at 5 m depth throughout the year, this Sanctuary just requires 983 m.cu.ft of water. However, the calculated runoff from the catchments is not reaching the Sanctuary directly. Since the Wazirabad Barrage from upstream is regulating the water entering in to the Sanctuary, actual amount of runoff, which has been reaching the Sanctuary, could be lesser than what was calculated. The water budget for this wetland is calculated without using the data on sewage water input. Since the non-availability of rainfall data for the entire catchments, climate data of Delhi was used to calculate the runoff, water balance equation is:

$dV = (Q_{cat} + P_{lake}) – (E + Q_{out} + L)$

i.e. dV= Total annual inlet (excluding sewage from urban area) - annual outlet

i.e. dV = (151618 – 143422) = 8196 m.cu.ft (approximately)

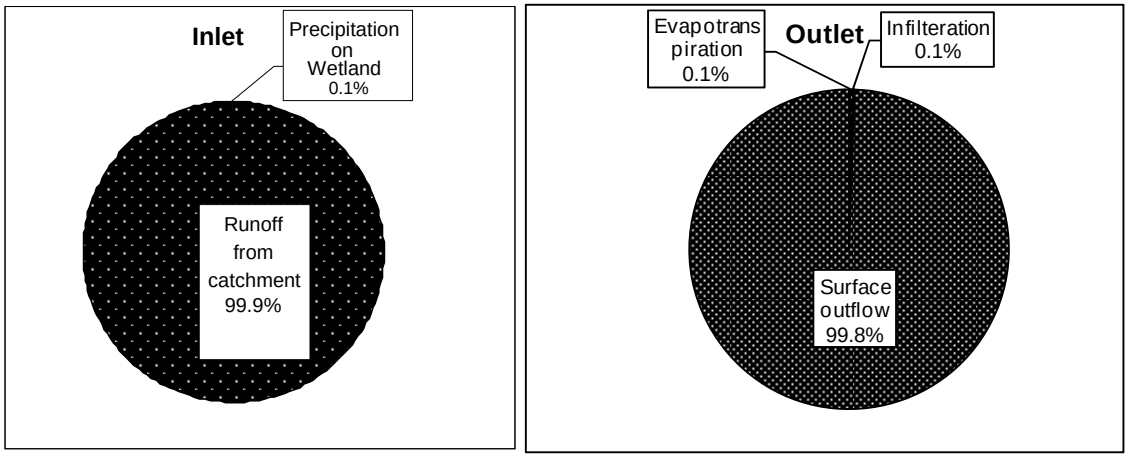


Fig. 2.6. Composition of major inlets and outlets water of Okhla (WII, 2002)

2.6.2 Total inflow and out flow

The major water sources are river Yamuna and Hindon Canal. Besides, numerous drains discharge their untreated water in the 22 km stretch of Yamuna between Wazirabad and Okhla. Water level in this wetland is maintained by the Okhla Barrage and an upstream barrage (Wazirabad). Agra canal takes out water from this wetland to agriculture fields. Excess amount of water is released again to downstream of Yamuna River through Okhla Barrage. The barrage is under the control of Uttar Pradesh Irrigation Department. During the dry period, i.e. from January to June, the Okhla Barrage discharges a steady volume of 101 cusecs of water regularly. But during the peak monsoon period the discharge may increase to as much as 1,10,000 cusecs on a single day. The annual pattern of inlet and outlet of water sources for Okhla wetland is shown in Fig. 2.7.

2.6.3 Bathymetry

For bathymetry the total study area was divided into 50 m x 50 m grids. In each grid, water depths were taken using GARMIN 160 C Fish Finder. The depths recorded were classified into four depth ranges viz <1 m, 1.1- 2 m, 2.1- 3 m and >3 m. It was seen that water in 20% of the grids has the depth below 1m range and 45% of the grids has the depth range of 1.1-2 m (Fig 2.8 and 2.9). This gives an indication of the fact that the wetland is facing severe threats due to siltation. Being a one-time exercise with no past data to compare with, the present exercise has now set a baseline against which future comparisons could be made. This may be of special significance to study the dynamics of siltation in the reservoir. During the study period, it was observed that most of the wetland area is shallow.

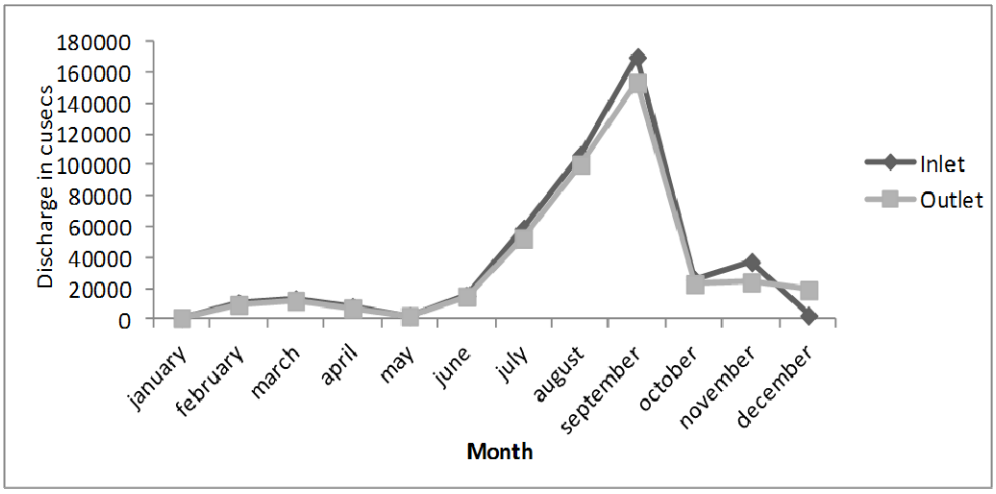


Fig. 2.7 Annual pattern of inlet and outlet of water sources for Okhla Reservoir

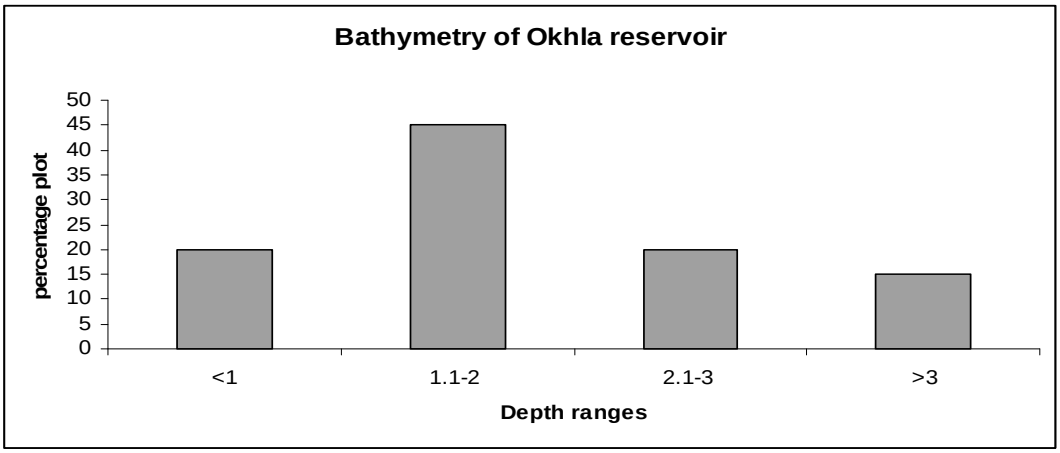


Fig. 2.8 Water Depth Characteristic of Okhla Bird Sanctuary

2.6.4 Annual water level changes – changes in water regime

The water level in the Okhla reservoir remains more or less similar throughout the year. Difference in water level can be observed mainly between monsoon and non-monsoon seasons. This is achieved by regulating the water-flow in the reservoir primarily by manipulating the opening of sluice gates at the two outlets viz. Yamuna River and Agra canal. As per the information provided by the U.P. Irrigation Department, the water level in non-monsoon seasons is maintained at 200.7 m above msl which becomes 201.35 m above msl during the monsoon period. Such variations in water regime result in the formation of variety of habitats in OBS. During the migratory season (winter), these habitats get exposed

due to low water level in the wetland, thus providing congregation sites for different species of waterbirds. Water release from Okhla Barrage depends mainly on the discharge made from the Wazirabad Barrage situated 22 km upstream from Okhla.

2.6.5 Physico-Chemical Characteristics

The Delhi segment of the Yamuna River i.e., from Wazirabad Barrage to Okhla Barrage is worst in terms of water quality. After entering in to Delhi (river enters at Palla in Delhi some 26 km upstream), the river is tapped at Wazirabad through a barrage for drinking water supply to Delhi. Whatever water flows downstream of Wazirabad barrage is the untreated or partially treated domestic and industrial wastewater contributed through several drains along with the water transported by Haryana Irrigation Department from Western Yamuna Canal (WYC) to Nazafgarh Drain and the Yamuna River. There are 19 major drains, which discharge treated and untreated waste water/sewage of Delhi and Haryana (Fig. 2.10) into the river. From Uttar Pradesh a similar discharge is released through Hindon Cut into Yamuna at the Sanctuary boundary on the northern side.

Water pollution especially during summer is believed to be one of the major issues that affects the integrity of the Sanctuary. However, pollutants level in the Sanctuary at any given time depend upon the inflow and outflow of water, which is controlled by the Irrigation Department. The Central Pollution Control Board (CPCB) has been monitoring the water quality of the Yamuna at the upstream of Wazirabad and at Okhla. Upstream of Wazirabad, the Dissolved Oxygen (DO_2) level is 7.5 mg/l and Biochemical Oxygen Demand (BOD) level is 2.3 mg/l, whereas, downstream at Okhla, the DO level declines to 1.3 mg/l with the BOD at 16 mg/l, indicating considerable deterioration of water quality in the stretch due to discharge of sewage and industrial effluents (Fig. 2.11). The prescribed ambient water quality in terms of DO is 5mg/l or above, and 3mg/l or below in terms of BOD.

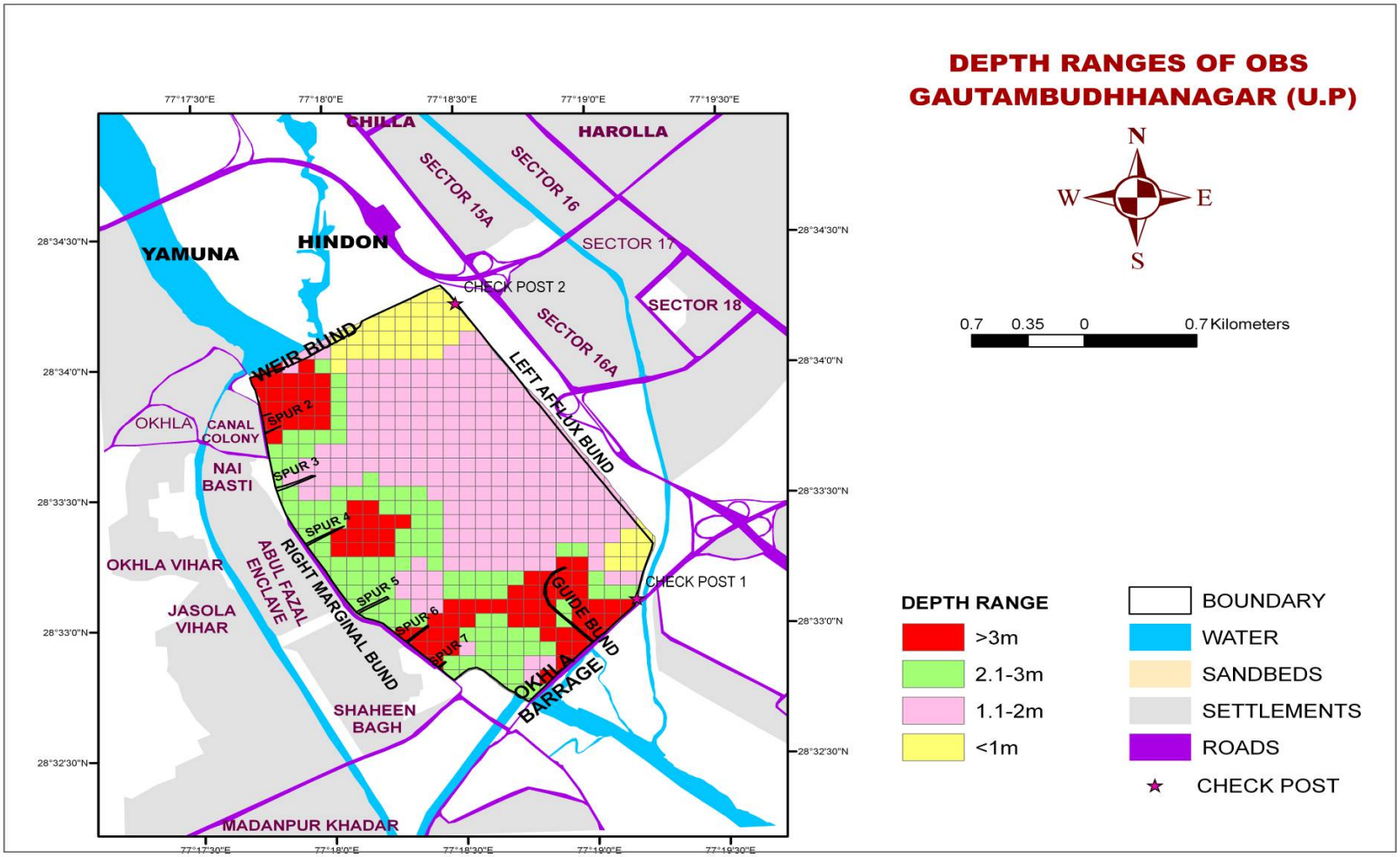


Fig. 2.9 Map showing water depth characteristic of Okhla Bird Sanctuary

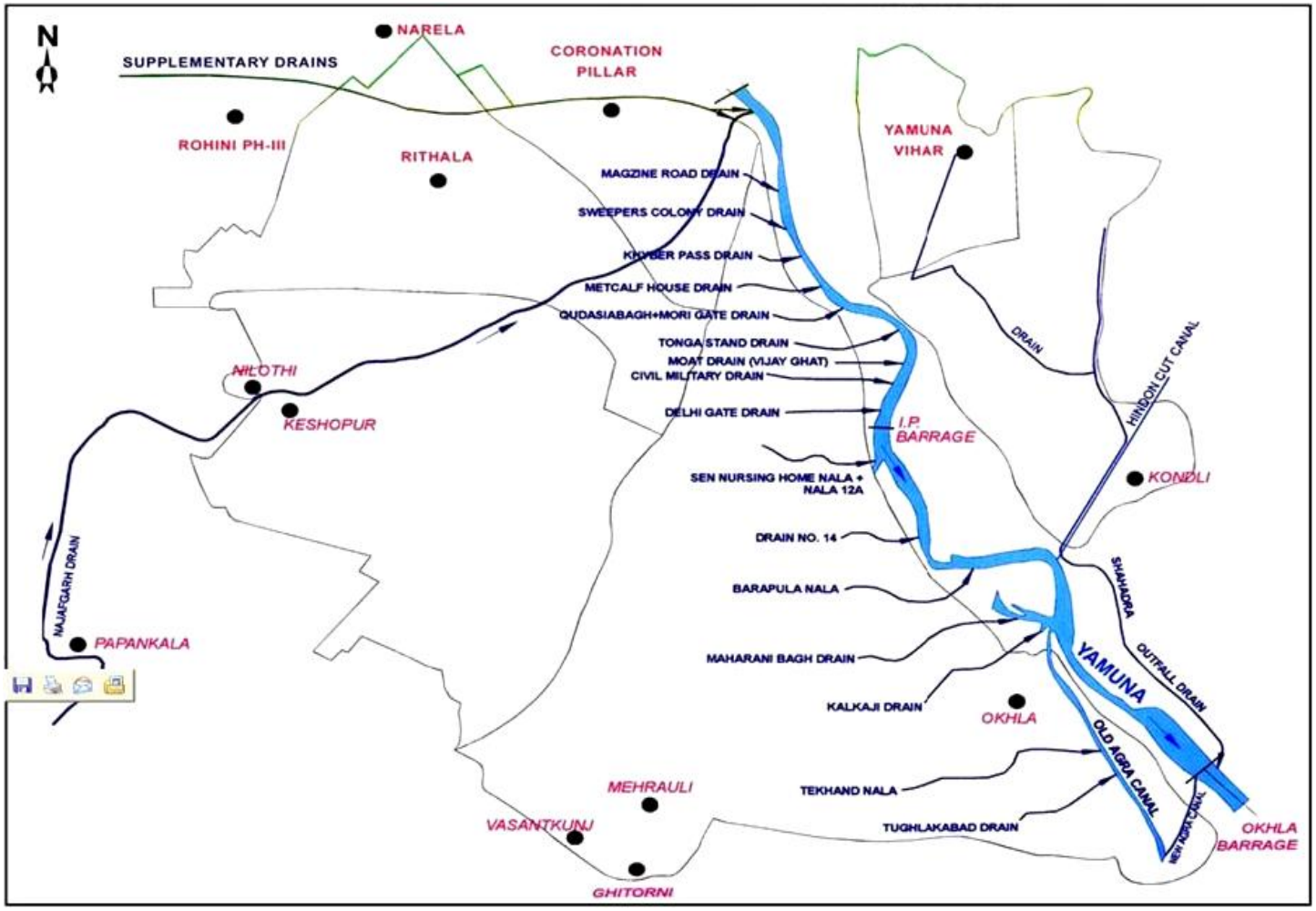


Fig. 2.10 Map showing drains entering into the Yamuna River stretch between Wazirabad barrage and Okhla barrage

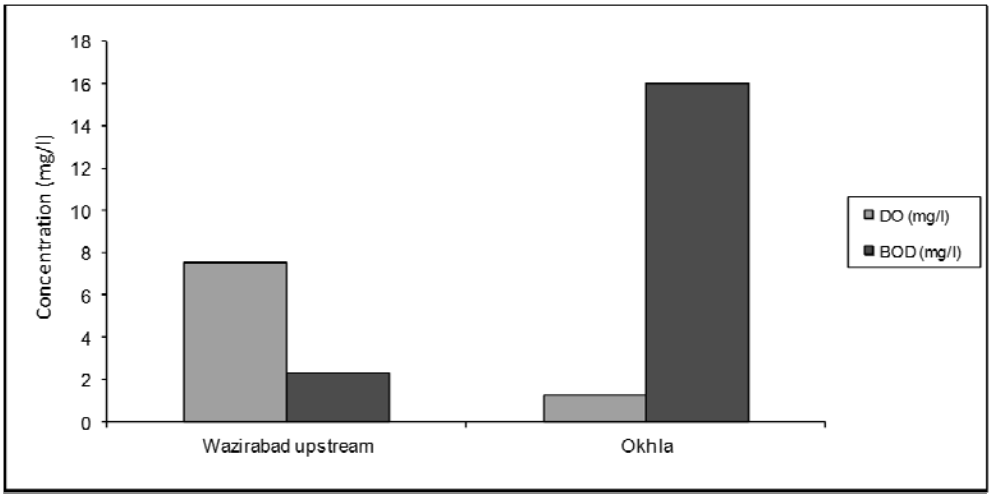


Fig. 2.11 Comparison of dissolved oxygen (DO) and BOD concentrations in Yamuna water at upstream Wazirabad and Okhla

The coliform count at Wazirabad is 8,506/100 ml whereas at Okhla, it increases to 3, 29,312/100 ml, as against the prescribed standard of 500/100 ml. Fauna dependent on fish, particularly birds are also depleting and most of the waders are no more seen on the Yamuna river (Kumar 2002). Delhi generates approximately 3000 million liters/day of wastewater of which domestic wastewater makes up 80%. Because of inadequate treatment capacities, less than 50% of the wastewater generated is treated (TERI water workshop 2002)

The physico-chemical characteristics of Okhla water were measured by doing onsite analysis of some physical parameters, collecting water samples at ten sites and analyzing them at Wildlife Institute of India laboratory (Fig. 2.12). Onsite analysis of Okhla water showed that the water is highly turbid, alkaline and has dissolved oxygen level less than 2 mg/l (Table 2.1). Even, at some points the dissolved oxygen levels were found to be less than 1 mg/l.

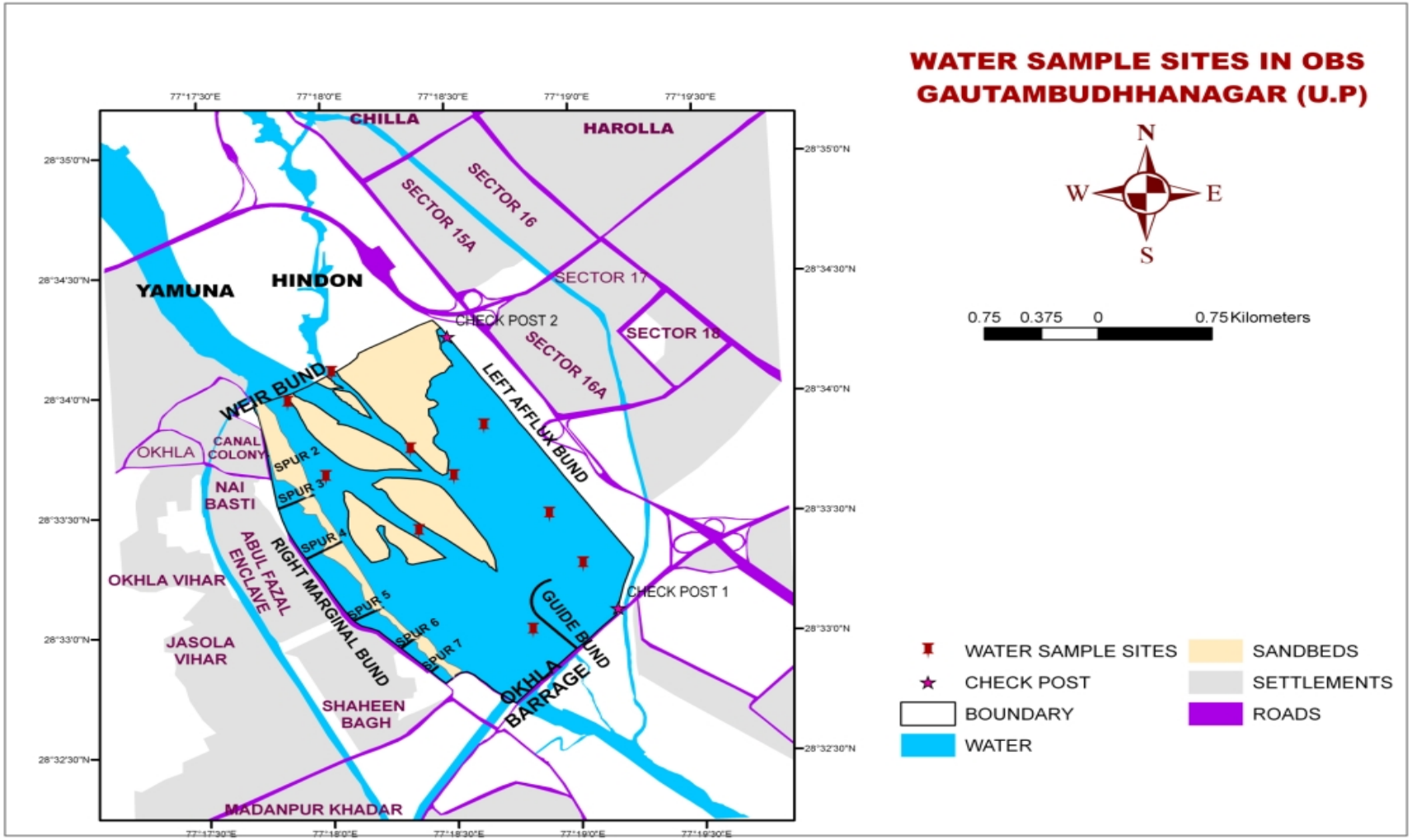


Fig. 2.12 Water sampling sites in OKhla Bird Sanctuary

Table 2.1 On-site Water Quality Data of Okhla Bird Sanctuary collected during 2010.

Site	Temp	DO(ppm)	SpC(mS)	pH	Salinity (PSS)	Turbidity (NTU)%
1	27.915	0.58	1.83	8.55	0.94	77.285
2	27.67	0.78	1.1085	8.775	0.56	85.05
3	27.655	0.69	0.5075	8.87	0.26	56.65
4	27.58	1.89	1.1285	9.045	0.57	52.65
5	28.075	1.09	0.8115	9.14	0.43	47.3
6	28.34	0.765	1.2815	9.045	0.66	74.4
7	28.155	0.745	1.16	9.14	0.765	63.3
8	28.38	0.75	1.4705	9.135	4.475	71.35
9	28.53	1.925	0.458	9.225	0.215	42.2
10	28.02	1.905	0.4555	9.22	0.21	51.7
Mean±S.E.	**28.032 ±0.103**	**1.112 ±0.178**	**1.02115 ±0.145**	**9.0145 ±0.0689**	**0.9085 ±0.403**	**62.1885 ±4.518**

Earlier studies revealed that concentrations of the heavy metals i.e. Cd, Cr, Cu, Fe, Ni, Pb and Zn were above the permissible limits through out the stretch (Hasanat 2002). The arsenic level in Yamuna river water while leaving Delhi at Okhla barrage was 0.080 ppm that is about 60% rise in level before entering into Delhi (Lalwani et.al 2005). Analysis for the heavy metals in the present study showed that concentrations of cadmium (Cd) and lead (Pb) are more than the permissible limits according to WHO guideline value (1998) for cadmium and lead in water (0.003 mg/liter and 0.001 mg/l, respectively). The concentrations of Zn, Cr, Ca and Mg are well below the permissible limit (Table 2.2). Change in concentrations of Cd, Cr, Pb and Zn during March, April and May, 2010 is provided in Fig. 2.13 below.

Table 2.2 Heavy Metal Concentrations in Okhla water in March, April and May 2010

Month	Cd (mg/l)	Cr (mg/l)	Pb (mg/l)	Zn (mg/l)	Cu (mg/l)	Ca (mg/l)	Mg (mg/l)
March	0.047	0.023	0.136	0.023	0.005	29.821	10.711
April	0.169	0.011	0.146	0.02	0	33.064	12.784
May	0.089	0.015	0.175	0.112	0	39.606	14.231
Mean±SE	**0.101 ±0.035**	0.016 ±0.003	**0.152 ±0.011**	0.051 ±0.030	0.001	34.163 ±2.877	12.575 ±1.021

Uttar Pradesh's vast agricultural fields are also significant contributors to pollution. Agricultural runoffs from Uttar Pradesh enter Sanctuary through Hindon Cut only. There are plans to increase more areas under agriculture; this means more abstraction of river water and greater use and subsequent runoff of fertilizers and pesticides into the river Yamuna.

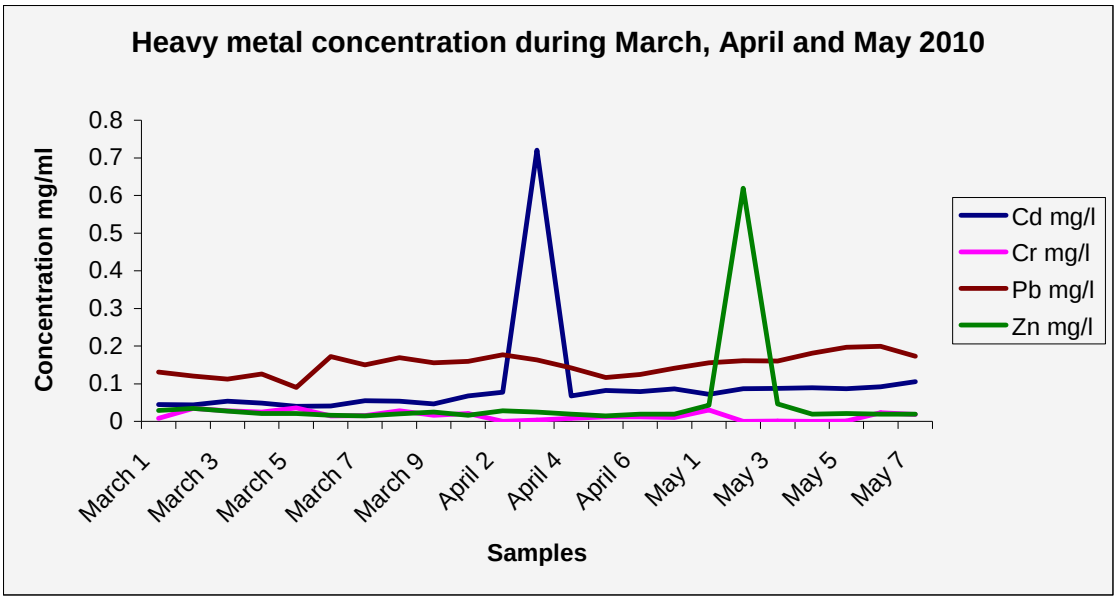


Fig. 2.13 Change in concentrations of Cd, Cr, Pb and Zn during March, April and May, 2010

2.7 GENERAL ECOLOGICAL FEATURES INCLUDING FLORA AND FAUNA

OBS being located in the Central Asian Flyway of migratory birds is an ideal wintering as well as transits ground for migratory birds. This Wetland of 400 ha area provides heterogeneous habitats for numerous migratory waterfowls many of which use this wetland as a stop over during their migration. As a result, it was declared as Wildlife Sanctuary for Birds on 8 May, 1990, by the Uttar Pradesh government under the Wildlife (Protection) Act, 1972. This Bird Sanctuary was created to protect the bird diversity in the area and also conserve the ecosystem functions as one of the most important wetland in this highly urbanized landscape.

2.7.1 Vegetation

Plant diversity of this Sanctuary during summer 2010 comprises 188 plant species belonging to 54 families. Broad classification of vegetation revealed that 19 aquatic, 148 terrestrial and 21 were amphibious plant species. The checklist of vegetation identified in 2010 is given in Appendix IV. Of the 54 families, Poaceae has the highest number of species (19 species) followed by Asteraceae (17 species), Fabaceae (15 species) and Cyperaceae (14 species).

2.7.1.1 Aquatic vegetation types and extent

The aquatic vegetation of the area is primarily dominated by three communities such as *Eichhornia – Salvinia - Spirodela* in open water areas, *Alternantherea - Paspalum – Ipomoea* in relatively shallow water areas and *Phragmites – Typha- Saccharum- Arundo* in draw down areas. Like other wetlands, aquatic weeds have always been a part of important management issues for this Sanctuary. *Eichhornia* and *Typha* can be considered as the two major weeds replacing other floral communities of the Sanctuary. Extent and abundance of weeds in the Sanctuary was highly dynamic depending upon hydrological parameters. In the present study, extent of weeds increased from 20% in December to 70% in May. It was observed that the extent of weeds particularly the aquatic species proliferated more on the advent of summer season. However, the trend may change with the flushing of water in regular interval, as it is totally under the control of the irrigation department.

Hydrilla - Najas – Nymphaea communities found in deep water with mud reported in the earlier study of 2002 could not be observed due to high water level in the barrage throughout the study period.

The water body inside the Sanctuary has five major Islands containing reed beds of *Typha, Phragmites, Saccharum* and *Arundo* (Fig. 2.14). Random plots were laid on these islands to get rough estimates of the extents of major amphibious plant species. Two Typha species were identified, *T. angustifolia* and *T. elephantina*, which showed the maximum frequency of occurrence among the reeds. *Alternantherea* showed the maximum extent among all the amphibious species (Table 2.3) (Fig. 2.15).

Table 2.3 Percentage of occurrence of major amphibious plant species of Okhla Bird Sanctuary.

Sl. No.	Plant Species	% Plots
1	*Alternantherea sp.*	75.0
2	*Typha angustifolia*	40.0
3	*Paspalum distichum*	33.0
4	*Typha elephantina*	30.0
5	*Sacharum munja*	28.3
6	*Phragmites karka*	26.2
7	*Arundo donax*	12.4
8	*Saccharum spontaneum*	12.2
9	*Ipomoea fistulosa*	6.5

2.7.1.2 Vegetation type and composition in the catchments

Of the 188 plant species, 32 species were trees, 10 species were shrubs and 107 species were herbs. Besides, 16 species of grasses, 14 species of sedges and 9 herbaceous climber species were also identified. A similar study was conducted by WII in this wetland in 2002. A significant change was observed in the vegetation structure between 2002 and 2010 in the Sanctuary that might be due to plantation which took place after 2002 and varying nature of river system. The change might also be due to difference in sampling method and time and extent of sampling between the two periods. The detailed vegetation characteristics of OBS in the 2010 have been provided in Table 2.4.

Table 2.4 Vegetation characteristic of Okhla Bird Sanctuary in 2010

Vegetation type	Number of species
Total number of plant species	188
Total number of plant family	54
Aquatic plant species	19
Terrestrial plants species	148
Amphibious plants species	21
Grass species	16
Herb species	120
Shrub species	10
Sedge species	14
Tree species	32
Climber species	09

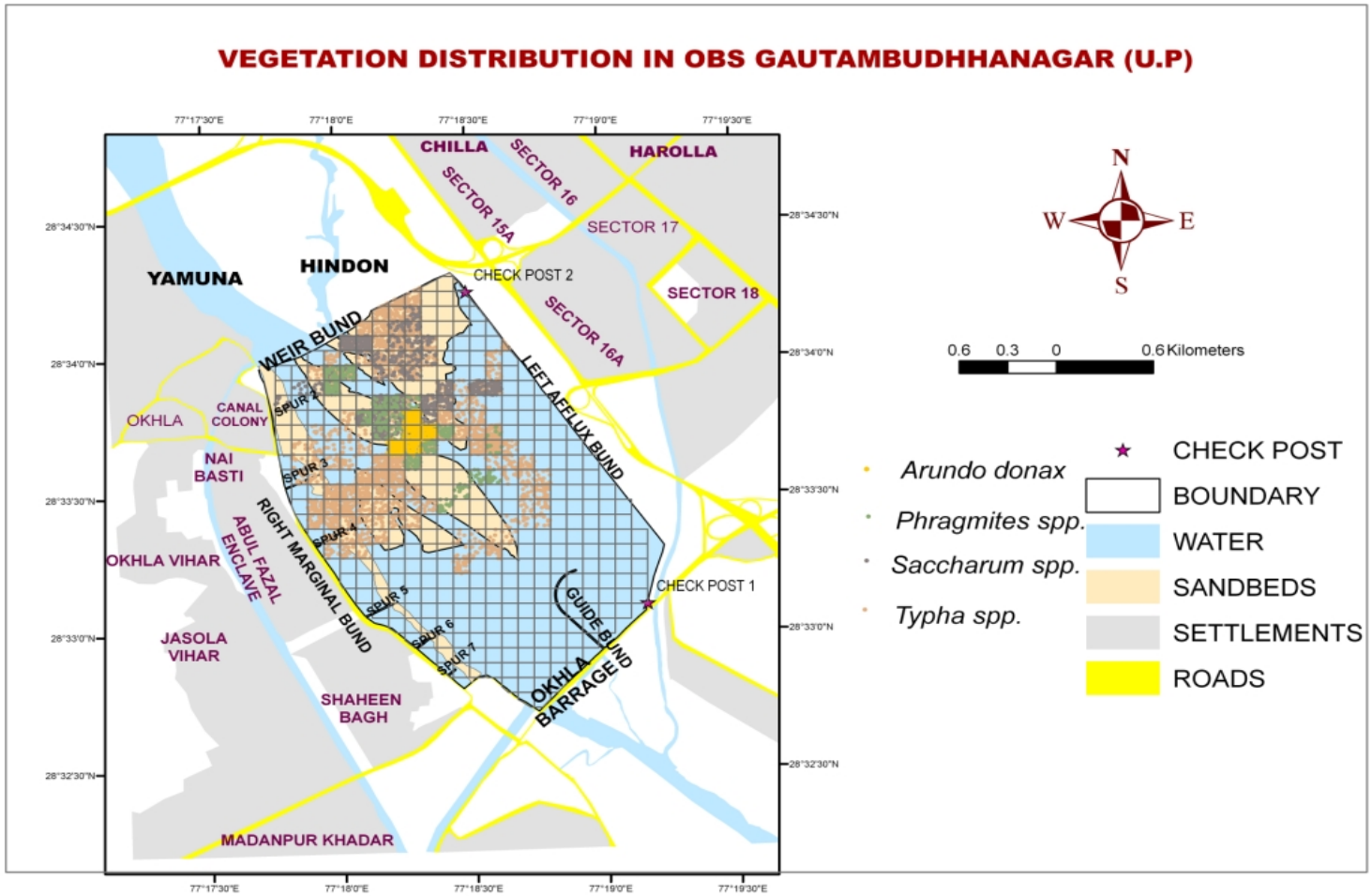


Fig. 2.14 Map showing distribution of important grass species in Okhla Bird Sanctuary

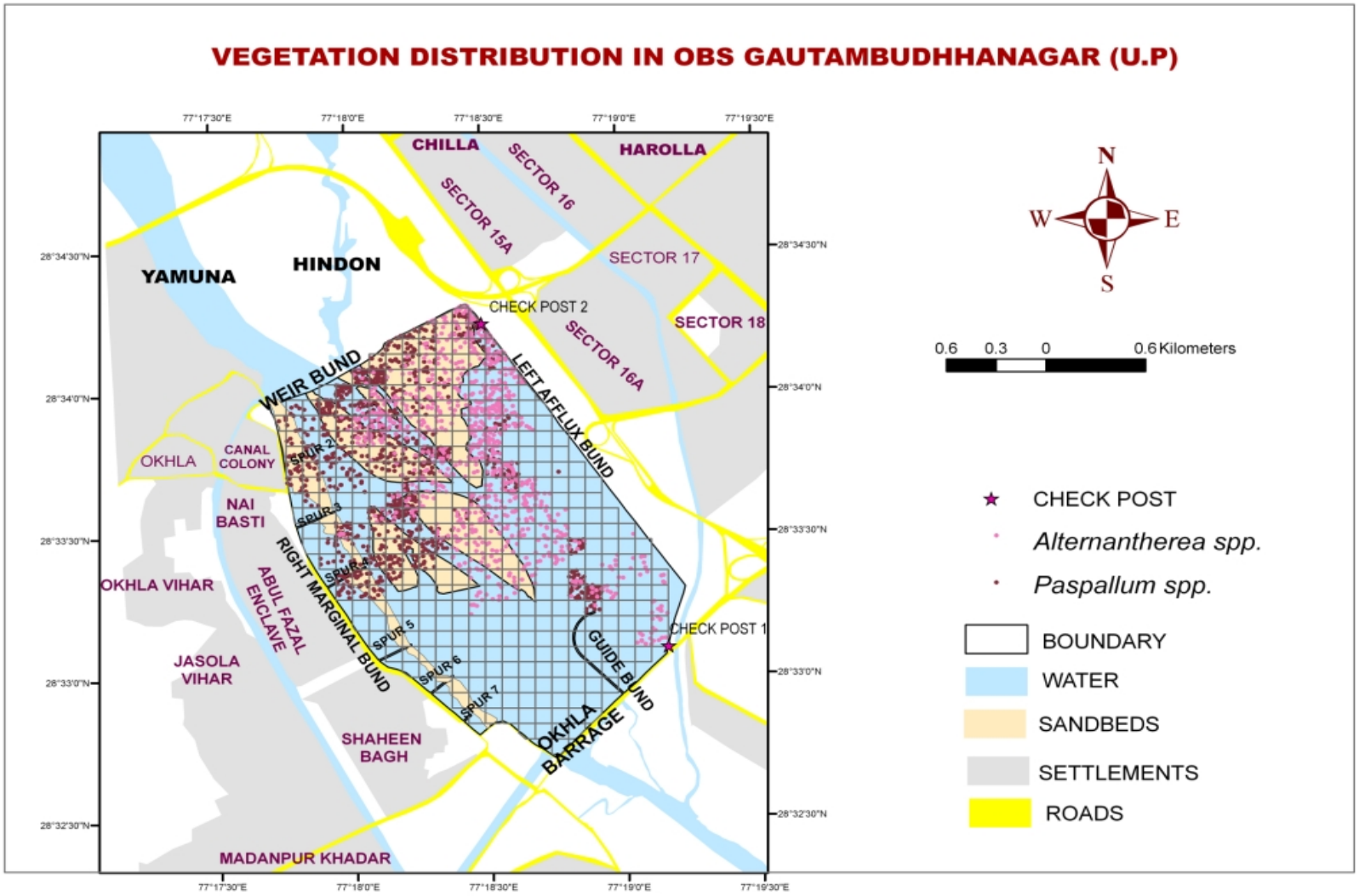


Fig. 2.15 Map showing extent of *Alternantherea* sp. and *Paspallum* sp. in Okhla Bird Sanctuary

To study the terrestrial vegetation, plots were laid at regular interval on the narrow patch of land surrounding the water body. *Prosopis juliflora, Leucaena leucocephala, Dalbergia sissoo, Morus alba* and *Zizyphus mauritiana* occurred most frequently among the trees observed largely around the Sanctuary. Distribution of major vegetation types in the Sanctuary is provided in Fig. 2.16. A list of major trees, their frequency of occurrence (plants occurring in number of plots) and their densities (tress/ha) have been provided in Table 2.5. It was observed that *Leucaena* is the most occured species of the Sanctuary followed by *Prosopis*, *Dalbergia* and *Morus.*

Table 2.5 Major tree species of Okhla Bird Sanctuary with their frequency of occurrence

Sl. No.	Family	Species	Frequency	Trees/ha
1	Mimosaceae	*Prosopis juliflora*	78.57	142.86
2	Mimosaceae	*Leucaena leucocephala*	35.71	192.86
3	Fabaceae	*Dalbergia sissoo*	32.14	85.71
4	Moraceae	*Morus alba*	32.14	57.14
5	Rhamnaceae	*Zizyphus mauritiana*	25.00	32.14
6	Meliaceae	*Azadirachta indica*	17.86	17.86
7	Caesalpiniaceae	*Bauhinia purpurea*	17.86	21.43
8	Bombacaceae	*Bombax ceiba*	14.29	14.3
9	Mimosaceae	*Albizia lebbeck*	10.70	39.26
10	Mimosaceae	*Pithecellobium dulce*	10.70	21.43
11	Fabaceae	*Erythrina sp.*	7.14	7.14
12	Moraceae	*Ficus religiosa*	7.14	7.14
13	Ulmaceae	*Holoptelea integrifolia*	7.14	10.71
14	Moraceae	*Ficus bengalensis*	3.57	3.57
15	Bignoniacea	*Kigelia pinnata*	3.57	3.57
16	Fabaceae	*Parkinsonia aculeata*	3.57	3.57
17	Fabaceae	*Pongamia glabra*	3.57	3.57

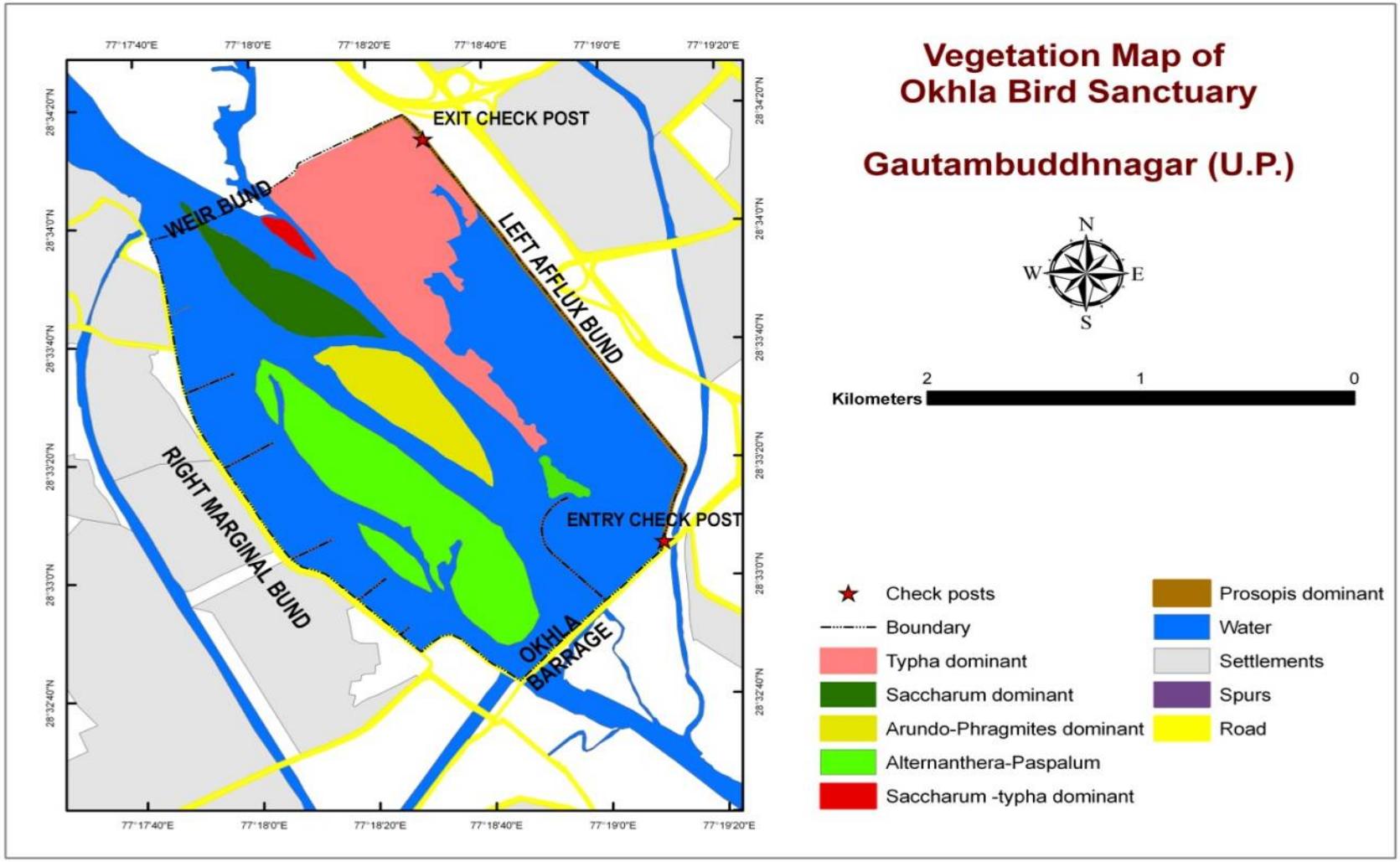


Fig. 2.16 Vegetation Map of Okhla Bird Sanctuary.

2.7.1.3 Species and communities of conservation importance

Among the listed flora of OBS none of the species are of conservation importance. Being a bird Sanctuary, conservation of plant species and communities important for bird nesting and feeding are of prime concern. Such as for terrestrial birds, indigenous plant species like *Ficus* sp., *Morus alba, Sizigium cumini, Acacia nilotica, Zizyphus* sp. etc. should be planted and conserved. For bird species like prinias, munias, stonechat, bluethroat, francolins etc., bushes and long grasses along the bank should be maintained properly. For waterbirds, aquatic communities like *Hydrilla* - *Najas* – *Nymphaea* etc., are very important. Even some *Typha* patches should also be maintained for geese, ducks, herons etc.

2.7.2 Fauna

The OBS is an important site for breeding and wintering waterbirds, with 14,000–20,000 waterbirds recorded every winter. As many as 302 species of birds have been reported from several records resulting from fieldwork since 1989 (Urfi 2003) (Appendix V). Of these 302 species, 124 species are aquatic and rest 178 species are terrestrial. According to the IUCN Red List 2010, checklist of Okhla includes three Critically Endangered (CR) species viz. White-rumped Vulture (*Gyps bengalensis*), Indian Vulture (*Gyps indicus*) and Sociable Lapwing (*Vanellus gregarious*), three Endangered (EN) species viz. Baer's Pochard (*Aythya baeri*), Egyptian Vulture (*Neophron percnopterus*) and Greater Adjutant (*Leptoptilos dubius*), nine Vulnerable (VU) species viz. Baikal Teal (*Anas formosa*), Sarus Crane (*Grus antigone*), Indian Skimmer (*Rynchops albicollis*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*), Greater Spotted Eagle (*Aquila clanga*), Lesser Adjutant (*Leptoptilos javanicus*), Bristled Grassbird (*Chaetornis striata*), Finn's Weaver (*Ploceus megarhynchus*) and Dalmatian Pelican (*Pelecanus crispus*) and eight Near Threatened (NT) species viz. Ferruginous Pochard (*Aythya nyroca*), Black-bellied Tern (*Sterna acuticauda*), Grey-headed Fish Eagle (*Ichthyophaga ichthyaetus*), Darter (*Anhinga melanogaster*), Black-headed Ibis (*Threskiornis melanocephalus*), Painted Stork (*Mycteria leucocephala*), Blacknecked Stork (*Ephippiorhynchus asiaticus*) and Black-tailed Godwit (*Limosa limosa*). Of these, one Endangered (*Neophron percnopterus*) and six Near Threatened species (*Aythya nyroca*, *Sterna acuticauda*, *Anhinga melanogaster*, *Threskiornis melanocephalus, Limosa limosa* and *Mycteria leucocephala*) were observed in this study period (Appendix II). During the present field study, we recorded a total of 132 species, out

of which 60 species were aquatic and 72 species were terrestrial birds. Of the 60 water birds major or abundant species include Northern Shoveler (*Anas clypeata*), Eurasian Wigeons (*Anas penelope*), Common Teals (*Anas crecca*), Northern Pintails (*Anas acuta*), Common Coots (*Fulica atra*), Brown-headed (*Chroicocephalus brunnicephalus*) and Black-headed Gulls (*Chroicocephalus ridibundus*).

2.7.2.1 Birds

Out of total 302 species, 79 species were recorded as winter visitors, 8 species were summer visitors, 11 species were passage migrants, 6 species were local migrants and 12 species were reported occasionally. Besides, the list also contains 45 species which were reported as vagrants. Of the aquatic species, 44 were winter visitors and one species was summer visitor.

During the field survey, we recorded a total of 132 bird species, of which 60 species were aquatic and the rest 72 species were terrestrial. Of the 132 species, 40 species were winter visitors, 2 species were summer visitors, 4 species were passage migrants, 2 species were local migrants and the rest 84 species were residents (Appendix VI).

Total counts of 37 species of waterbirds had been done at fortnightly between November 2009 and March 2010. Among these, species whose counts were quite high throughout the counting period include Northern Shoveler, Eurasian Wigeon, Common Teal, Northern Pintail, Common Coot, Brown-headed and Black-headed Gulls (Appendix VII). These 37 species belong to 12 families, of these; the members of the family Anatidae (82%), Laridae (8%) and Rallidae (7%) dominated in terms of total number of birds (Table 2.6). Waterbird count in the year 2002-03 done by WII is also given in table 2.7. Graphical representation of various families of water birds in OBS in 2002-03 and 2010 is provided in Fig. 2.17 and Fig. 2.18, respectively. On 17th December, 2009, a total of 10,435 water birds were counted that was the maximum count in 2009 and 2010 migratory season. However, in January 2010, the number drastically reduced to almost half the number. This low number might be due to release of more water from the upstream, resulting in higher water level in the Okhla. Birds in Okhla were largely seen congregating or preferring shallow parts of the wetland rather

than deep water. These shallow water birds might have avoided the wetland due to sudden increase in water level during January 2010. A comparison was made between the 2002 and 2010 water bird data, to detect the change in bird population between the two study periods. For this, three maximum counts of number of birds belonging to nine families for the above mentioned years were taken and Paired samples T-test was performed (Table 2.8). The results of the test showed that the population of Anatidae (ducks and geese), Ciconiidae (storks), Ardeidae (egrets and herons) and Phalacrocoracidae (cormorants) in the Sanctuary have changed significantly ($p = <0.05$) between 2002 and 2010. Among these, Anatidae (migratory) and Ardeidae (local migrants) have shown an increasing trend and the members of the family Ciconidae and Phalacrocoracidae showed a significant decreasing trend, both of which are local migrants. The members of the family Laridae represented by gulls, largely scavengers and the Rallidae (coots and moorhens), dense aquatic vegetation dwelling species showed a decreasing trend though not significant that could be related to local factors. The change in migratory bird population is often related to the status of source population, rainfall and local habitat status. The conclusion drawn from this comparison is indicative, the long term monitoring of bird population in the Sanctuary and relating it to regional and local environmental parameters as well as habitat management practices in the Sanctuary could yield a better understanding of the status of bird population in the Sanctuary.

For terrestrial bird species, monthly point counts were done in the narrow patch of land surrounding the wetland between December 2009 and March 2010. The density of birds per hectare and cluster sizes of 51 terrestrial bird species was estimated using the software DISTANCE 5.0 (Appendix VIII). The analysis showed that densities of some urban species, like common myna, pied starling, house sparrow etc. were quite high compared to other species, which seems quite obvious for this Sanctuary surrounded by urban developments on every side.

2.7.2.2 Associated fauna

So far, a total of 87 fish species belonging to 54 genera and 23 families have been reported from OBS (Appendix IX) (WII 2002). However, only walking catfish (*Clarias batrachus*), olive-green snakehead (*Ophiocephalus punctatus*) and spiny eel (*Mastacembelus pancalus*) were observed during the study period. 6 species of anurans belonging to 3 families and 5 genera, 11 species of turtles, 13 species of snakes, and 4 species of lizards, and 30 species of mammals belonging to 14 families have also been reported from this Sanctuary (Appendix X, XI. and XII). A population of nearly 20 Nilgais (*Boselaphus tragocamelus*) was recorded from the Sanctuary during the study period. Family-wise distribution of fishes, amphibians, reptiles and mammals are graphically shown in Fig. 2.19, 2.20, 2.21 and 2.22 respectively.

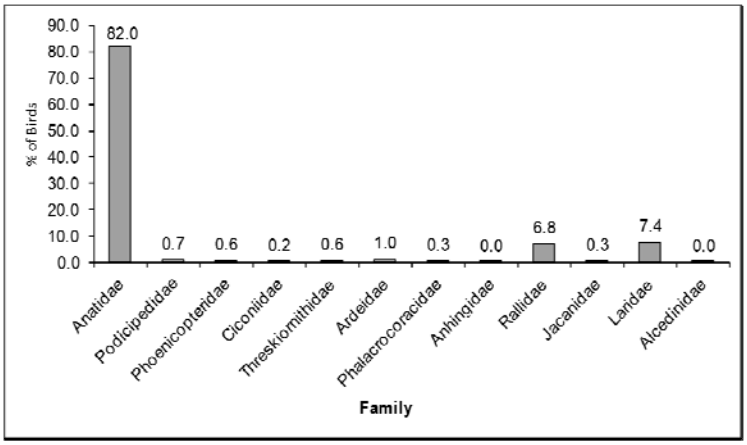


Fig. 2.17 Representation of the various families of water birds in Okhla Bird Sanctuary in 2002-03

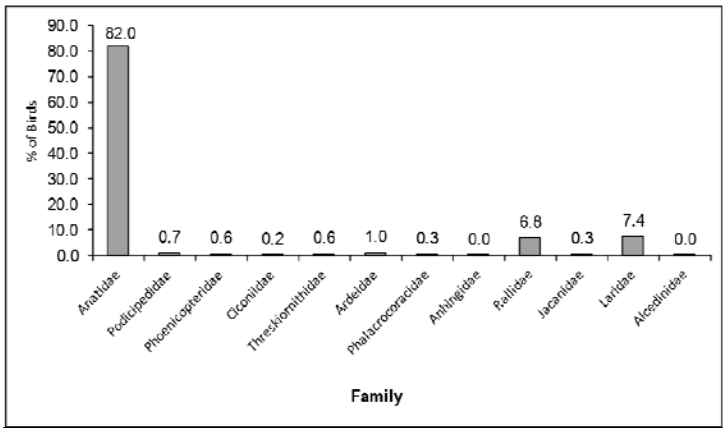


Fig. 2.18 Representation of the various families of water birds in Okhla Bird Sanctuary in 2009 and 2010

Table 2.6 Family wise counts of water bird species of Okhla Bird Sanctary in 2009 and 2010

Sl. No.	**Family**	**14/11/09**	**9/12/09**	**17/12/09**	**6/1/10**	**19/1/10**	**9/2/10**	**21/2/10**	**7/3/10**	**17/3/10**
1	Anatidae	627	5033	9294	4733	4704	7122	7841	5886	3524
2	Podicipedidae	25	38	52	54	73	62	65	26	35
3	Phoenicopteridae	0	0	18	21	26	76	92	58	42
4	Ciconiidae	7	11	35	17	14	16	19	7	3
5	Threskiornithidae	4	27	66	57	19	61	57	30	35
6	Ardeidae	37	37	82	58	61	88	115	78	59
7	Phalacrocoracidae	18	24	25	17	35	18	23	10	12
8	Anhingidae	1	2	2	1	2	2	1	1	1
9	Rallidae	148	181	369	281	525	584	706	898	353
10	Jacanidae	7	14	18	12	33	36	34	12	10
11	Laridae	61	125	472	528	476	1200	694	671	187
12	Alcedinidae	2	1	2	2	1	3	2	2	2
Total		**937**	**5493**	**10435**	**5781**	**5969**	**9268**	**9649**	**7679**	**4263**

Table 2.7 Family wise status of common water bird species of Okhla Bird Sanctuary in 2002-03

Sl. No.	Family	31/12/02	20/1/03	28/1/03	27/2/03	28/2/03	9/3/03	18/3/03	19/3/03	20/3/03	3/5/03
1	Anatidae	2452	3447	4487	4785	6832	3088	2998	3219	3686	122
2	Ardeidae	47	0	91	53	12	10	41	27	32	52
3	Charadriidae	60	43	45	78	0	0	0	0	0	0
4	Ciconiidae	28	6	20	26	14	84	49	51	47	16
5	Laridae	2012	49	850	3500	6000	11	882	765	750	0
6	Phalacrocoracidae	3	38	56	6	2	32	32	35	23	2
7	Phoenicopteridae	24	49	25	26	3	59	65	72	54	0
8	Podicipedidae	1	56	110	6	120	61	26	21	28	40
9	Rallidae	1067	869	691	1227	1725	238	986	364	826	4
10	Threskiornithidae	41	40	40	56	27	60	35	6	28	8
11	Anhingidae	0	1	2	0	0	3	6	6	4	2
12	Jacanidae	0	0	0	0	0	4	2	0	0	0
13	Dendrocygnide	0	6	0	0	0	0	0	0	0	0
Total		**5735**	**4604**	**6417**	**9763**	**14735**	**3650**	**5122**	**4566**	**5478**	**246**

Table 2.8 Family wise status of bird population in the Sanctuary between 2002 and 2010

Family	Mean ± SE 2002	Mean ± SE 2010	t stat	df	Sig. (2-tailed)
Anatidae	5368 ± 737.04	8085.67 ± 638.83	-15.41	2	0.004
Podicipedidae	97 ± 18.23	66.67 ± 3.28	1.84	2	0.21
Phoenicopteridae	65.33 ± 3.76	75.33 ± 9.82	-1.64	2	0.24
Ciconiidae	61.33 ± 11.35	23.67 ± 5.70	6.65	2	0.02
Threskiornithidae	52.33 ± 5.78	61.33 ± 2.60	-1.58	2	0.254
Ardeidae	65.33 ± 12.84	95 ± 10.15	-9.33	2	0.01
Phalacrocoracidae	43 ± 6.56	28 ± 3.51	4.91	2	0.039
Rallidae	1339.67 ± 198.13	729.33 ± 91.39	2.48	2	0.131
Laridae	3837.33 ± 1163.53	855 ± 172.63	2.98	2	0.097

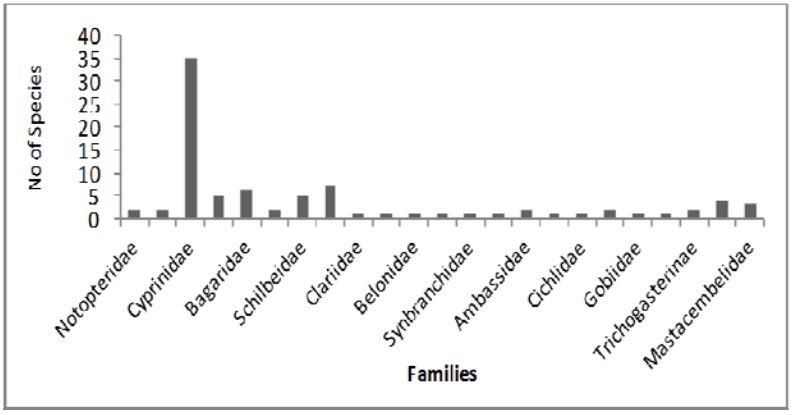


Fig. 2.19 Family wise distribution of common fish species in Okhla Bird Sanctuary

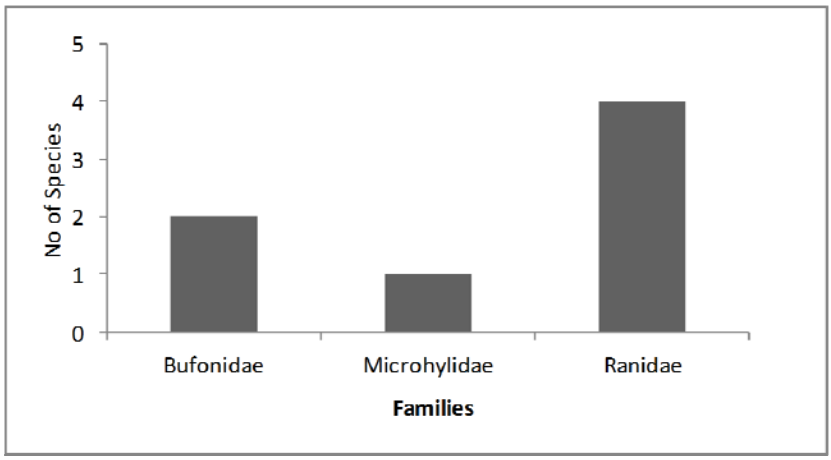


Fig. 2.20 Family-wise distribution of Amphibians reported from Okhla Bird Sanctuary

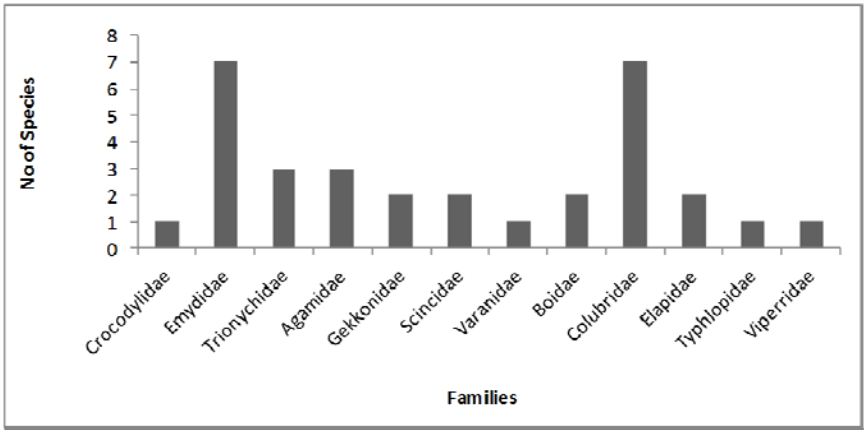


Fig. 2.21 Family wise distribution of Reptiles reported from Okhla Bird Sanctuary

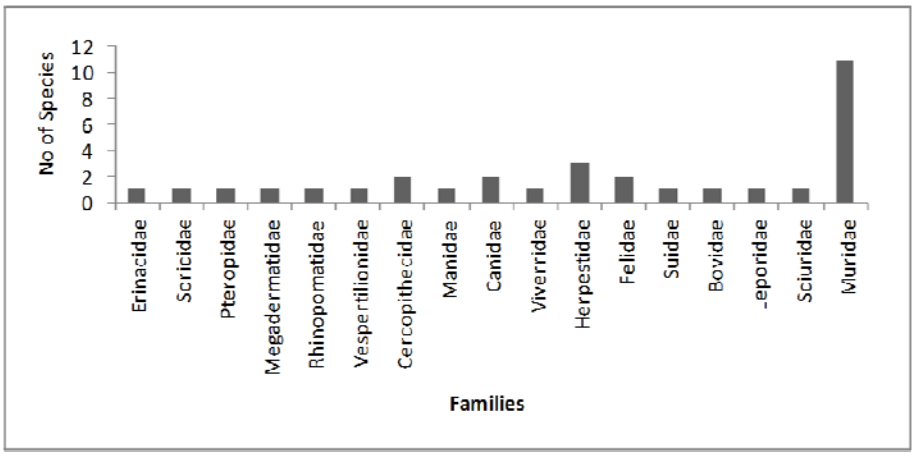


Fig. 2.22 Family-wise distribution of Mammals reported from Okhla Bird Sanctuary

2.7.3 Limiting factors

The presence and success of an organism or a group of organisms depends upon a complex of conditions. Any condition that approaches or exceeds the limits of tolerance is said to be a limiting condition or a limiting factor. Limiting factors are things that prevent a population/system from growing any larger. Food is not the only factor that may limit population growth. For example, there may be enough food to support a thousand birds in a certain area, but only suitable nesting sites for one hundred are available. Therefore, limiting factors vary according to the ecosystems. At any given time in a particular ecosystem, productivity is constrained by a single or a group of metabolically essential factors that are present in least supply relative to the potential biological demand.

Generally, for aquatic ecosystems, limiting factors include temperature of water, turbidity, dissolved oxygen, nutrient content and sometimes salinity.

In this section, some crucial factors, which pose severe threats to the ecosystem of OBS, have been considered as limiting factors. Changes in the level of these factors may create havoc to the biodiversity of this Sanctuary. These factors are described below:

2.7.3.1 Developmental Activities

Due to its location amidst the metropolitan city, OBS faces various anthropogenic pressures from the surrounding human habitation. The most notable of these activities are the developments in the vicinity, which have replaced much of the greeneries in the adjacent areas. These greeneries might have acted as buffers to the Sanctuary. The urban greeneries perform numerous functions, which include removal of air pollution, sequestration of atmospheric carbon dioxide, hydrologic benefits, energy conservation, and improves aesthetics (McPherson et al., 1994; McPherson, 2004). Habitats surrounding the Sanctuary, were used to be the promising nesting and feeding sites for birds. Status of developmental activities around the Sanctuary is discussed in section 3.2 of chapter 3 of the management plan.

2.7.3.2 Water quality

The quality of water in the Sanctuary is a limiting factor. As discussed earlier in section 2.6.5, the Yamuna water entering the Sanctuary is extremely polluted due to waste discharges from 19 major drains between Wazirabad and Okhla. Agricultural and industrial wastes from Uttar Pradesh also enter the Sanctuary through Hindon Cut at the Northern boundary. Therefore, dissolved oxygen (DO_2) level considered as one of the limiting factors for wetland ecosystem, is very low (below 1 mg/l at some points) in the water. The Biological Oxygen Demand (BOD) is as high as 16 mg/l, indicating considerable deterioration in the water quality. Such low DO_2 and high BOD level has resulted in the flourishing of hypoxia tolerant species and thus the overall biodiversity of the region is deteriorating.

2.7.3.3 Invasive plants/weed infestation

Weed infestation has always been a major problem for any ecosystem. It destroys habitats preferred by different animals in an ecosystem. High growth rate of weed limits the growth of important native plant species. Weeds competitively exclude other plants thus reducing the species diversity. A total of ten major weeds were identified in OBS during the study, of which four species were amphibious (*Typha angustifolia, Typha elephantinum, Alternantherea sessilis* and *Ipomoea fistulosa*), two were purely aquatic (*Eichhornia crassipes* and *Salvinia auriculata*) and four were terrestrial species (*Parthenium hysterophorus, Lantana camara, Cannabis sativa* and *Argemone Mexicana*). The extent of weeds increased from 20% in December to almost 70% in May (Fig. 2.23). It was observed that the extent of weeds particularly the aquatic species proliferated more on the advent of summer season. This may be due to the increased nutrient level in water during summer. At present, OBS is facing serious threats from the rapid proliferation of the two most important weeds, T*ypha* and *Eicchornia*. Percentage coverage of different weeds is provided graphically below in Figure 2.24 and 2.25.

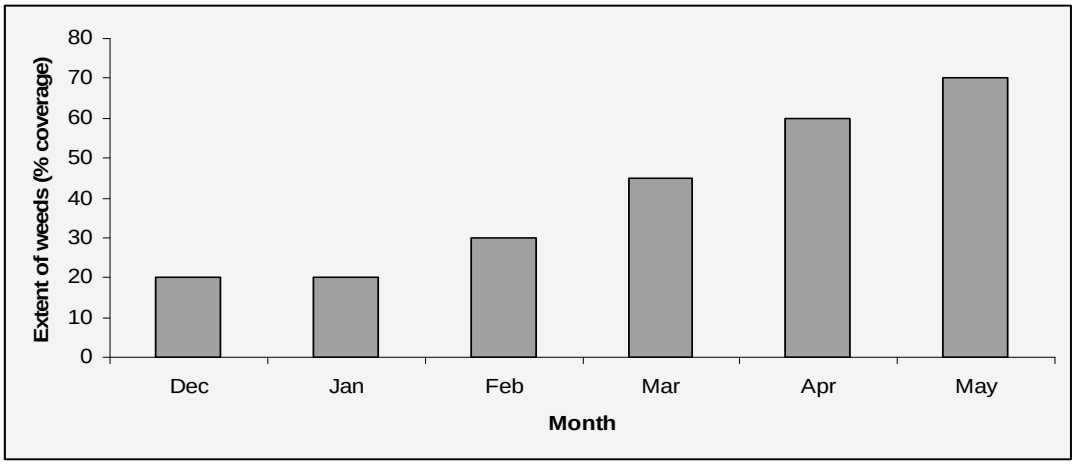


Fig. 2.23 Extent of weeds in the Okhla Bird Sanctuary in different months between December 2009-May 2010

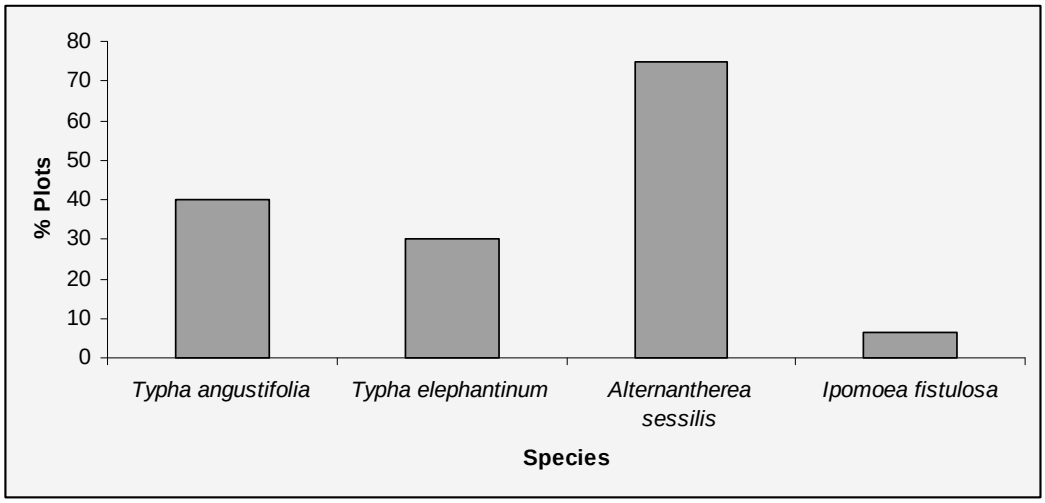


Fig. 2.24 Extent of major amphibious weeds

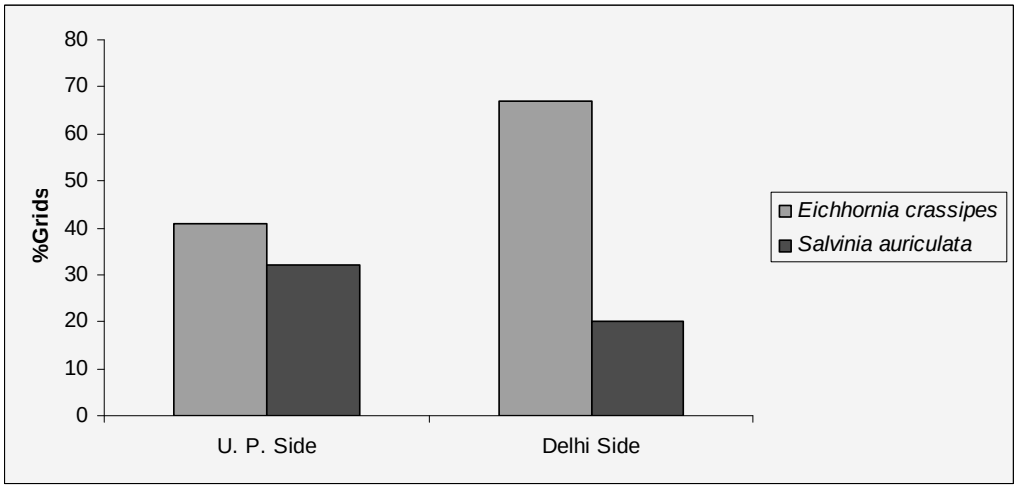


Fig. 2.25 Extent of major aquatic weed species

It was observed that the extent of *Eichhornia* was more in Delhi side than U. P. side of the Sanctuary, which may be due to the fact that Delhi side is comparatively less managed than the U. P. side.

Highly fluctuating biomass of the weeds is a major threat to the Sanctuary. It is believed that high intensity of aquatic weeds may enhance the evapotranspiration rate, which would put more pressure on water level, which is already at low. Moreover, expansion of weeds during winter and summer seasons pose threat to the habitats of water birds and other aquatic native vegetations.

2.7.3.4 Draining of water at inappropriate time

This wetland is a man-made reservoir, which was built basically to meet the demand for the agricultural and domestic purposes. Therefore, irrigation department of U.P. releases water according to the mentioned purposes. Hence, the water level in the reservoir is not maintained according to the ecological requirement of flora and fauna, especially birds. It was observed that during the migratory season the water level of the reservoir was often very high that affecting the suitable congregation sites for birds.

2.8 MAJOR FUNCTION AND VALUES

2.8.1 Direct values

Under this method, the wetland should be valued for all direct benefits of lake generated by market pricing. The only direct benefit from the Sanctuary is revenue generated from the tourists (Table 2.9). Based from data collected from forest department, revenue generated for the years 2008, 2009 and March 2010 is as follows:

Table 2.9 Revenue generated from foreign and Indian tourists from 2007 to 2010

Year	Foreign tourist	Indian tourist	Total revenue (Rs.)
2007-08	195	3296	194790
2008-09	260	5286	289060
2009-March 15, 2010	239	4649	288570

2.8.2 Indirect use value

OBS is providing significant ecosystem services in terms of groundwater recharge, erosion control, recreational values, educational value and aesthetic values. The barrage is the source of water for the irrigation and domestic purposes. Being the only bird Sanctuary in densely populated Delhi and NOIDA, the recreational and aesthetic values are highly valued by the residents as well as tourists and hence a major tourist attraction. These indirect values although acknowledged by ecologists; are unaccounted by ecologists; and are entirely ignored by the urban planners. Economic evaluation of these functions should be made for such fragile wetlands, which are exposed to tremendous anthropogenic pressure from the surrounding human habitations. The whole stretch of Yamuna floodplain in Delhi

experiences severe threat from habitat conversion. To address the value of ecological functions provided by wetland, annual per hectare Economic value of selected ecological services of the Yamuna floodplain at NCR, Delhi, has been calculated (Table 2.10)(Kumar, 2001). Estimation of this value, which is a kind of cost inflicted on society will prove instrumental in performing cost-benefit analysis of conversion effort of this Floodplain area for other uses.

Table 2.10 Annual Economic value of selected ecological services of the Yamuna floodplain at NCR, Delhi

Ecological function	**Value (Mean Rs. In Lakh/ha)**
Water recharge benefits to Agriculture	0.002
Water recharge benefits to households	0.172
Nutrient Retention (N,P,K)	0.001
Biological productivity - Fishery	0.135
Biological productivity Fodder	0.054
Biological productivity - Thatch	0.002
Biological productivity - Vegetables	0.006
Wildlife habitat and recreation	0.075
TOTAL	0.447

Chapter 3

History of management and present practices

3.1 GENERAL SITE STATUS

Okhla Bird Sanctuary (OBS) was declared a Sanctuary under section 18 of the Wildlife (Protection) Act, 1972 vide Gazette notification no. 577/14-4-82/89 dated 08.05.1990 of U.P. government (Appendix I). It is a protected area, which falls in the states of Delhi and Uttar Pradesh. The area of OBS falling in the territory of Delhi is under the possession of UP irrigation department. The BirdLife International and the Bombay Natural History Society (BNHS) have identified it as an Important Bird Area (IBA). According to BNHS, the site is thought to hold around 20,000 water birds or more than 10,000 pairs of waterbirds of one or more species in the winter.

3.2 LEGAL STATUS AND LAND TENURE IN THE SURROUNDING AREA

OBS falls under the authority of National Chambal Project Division, Agra, U.P. However, presently the administrative power has been shifted temporarily to Divisional Forest Officer, Gautam Buddha Nagar (Appendix XIII). The land is under the tenureship of Irrigation Department of Uttar Pradesh. As per the available information, the land outside the northern boundary of the Sanctuary has been given on lease by the Irrigation Department to the NOIDA (New Okhla Industrial Development Authority), the land outside the southern boundary is also under the Irrigation Department, on which local people of nearby Chhalera village grow vegetables during winter and summer months. As found during the study, the land of the OBS falling in the territory of Delhi, even though under the tenureship of UP irrigation department was relatively difficult to administer by the National Chambal Project Division of UP as the other enforcement related department in this region belong to the Govt. of Delhi and consequently there is a lack of coordination. Forest department of Delhi has negligible presence in the area. The details of the status of the land are given in Appendix XIV.

3.3 LEASES

There is no land on lease inside the Sanctuary. However, the fishing leases in surrounding areas are released by the Assistant Engineer Office (first head works phase), Agra Canal, Okhla, and New Delhi regularly. The interested parties for the fishing lease need to submit an amount of Rs 25,000 as security deposit to the Executive Engineer, head works phase, Agra Canal, as security deposit, which is returned to them after auction, except to the successful candidate. The leases are given for a period of one year and the information about the auction is released on leading newspapers and UP Government website. However the area for lease is not fixed and keeps on changing each year. As per recent release of auction on 28 January 2010, the areas for fishing lease auctioned were as follows:

1. Upstream 500 feet from GT road Ghaziabad Barrage Bridge on Hindon River
2. Downstream from Hindon River GT Road Ghaziabad Bridge up to a point 50m above Hindon barrage.
3. From Hindon Barrage downstream leaving 50m till 350 m (approx) Irrigation department.
4. From Canal Hindon Cut head until UP border.
5. From old Hindon Cut canal till Mohand.

Large amount of sand was once mined from Yamuna River between the spurs 1 and 2 in the northwestern section of the sanctuary and is now collected along the west bank of Yamuna River inside the Sanctuary (near spur 1, 2 and 3). No lease is given for sand mining in present date.

3.4 DEPENDENCY ON WETLAND

Okhla Bird Sanctuary is a small manmade wetland ecosystem surrounded by densely populated human habitations of Delhi and NOIDA**.** There is virtually no village near the Sanctuary, but people of surrounding areas enter into the Sanctuary for various purposes. An initial reconnaissance survey was conducted in November 2009 to identify all the

entry/exit points on the Sanctuary boundary for monitoring whomever uses the Sanctuary, for what purpose, and in what way they affect the Sanctuary or get affected by creation of Sanctuary. Based on this survey and discussions with the Sanctuary staff about the status of protection, the boundary was divided into four sections and further into sub-sections (Fig 3.1). Table 3.1 gives details of the sections and sub-sections of the boundary, average length of each section, the user community using this part of Sanctuary and purpose of their entry. People of surrounding areas come into Sanctuary for defecation, biomass extraction, cremation, and fishing and bring their animals for grazing and water use. Locals from nearby areas of both Delhi and UP states bring their livestock into the Sanctuary for grazing and wallowing. Fuel-wood and fodder grass collection is done by few families of nearby areas.

3.4.1 Water harvesting

A weir was built on river Yamuna at Okhla in the year 1874, to supply water for irrigation through Agra Canal. Due to siltation, a new barrage was built some 3 km downstream of older one. Agra Canal supplies water to the areas of Haryana and Uttar Pradesh. Water is harvested for irrigation and industrial purposes from the reservoir through Agra Canal. The primary role of barrage is to release water into the Agra Canal. The average monthly discharge through Agra Canal for the last 10 years is given in Table 3.2.

3.4.2 Livestock Grazing

Residents of nearby settlements of both Delhi and UP state leave their livestock inside the Sanctuary mainly for grazing and wallowing. On an average, 250 cattle and horses graze inside the Sanctuary everyday during the winter months. This number increases one and half times (380) during summer months because of shortage of water. Grazing inside Sanctuary takes place mainly by animals originating from Jasola gaon, Harolla gaon, Chilla and Nayi basti. Horses come from Nayi Basti. In addition to this, the residents of Nayi Basti leave some 45-50 pigs free inside the Sanctuary throughout the year. Their owners provide these pigs with vegetable and other household wastes. It was observed that at any given day 66% livestock found inside the Sanctuary are cattle, 24% are pigs, and 10% are horses. On top of this, feral cattle and dogs also put additional pressure up on the Sanctuary resources and disturb the habitat.

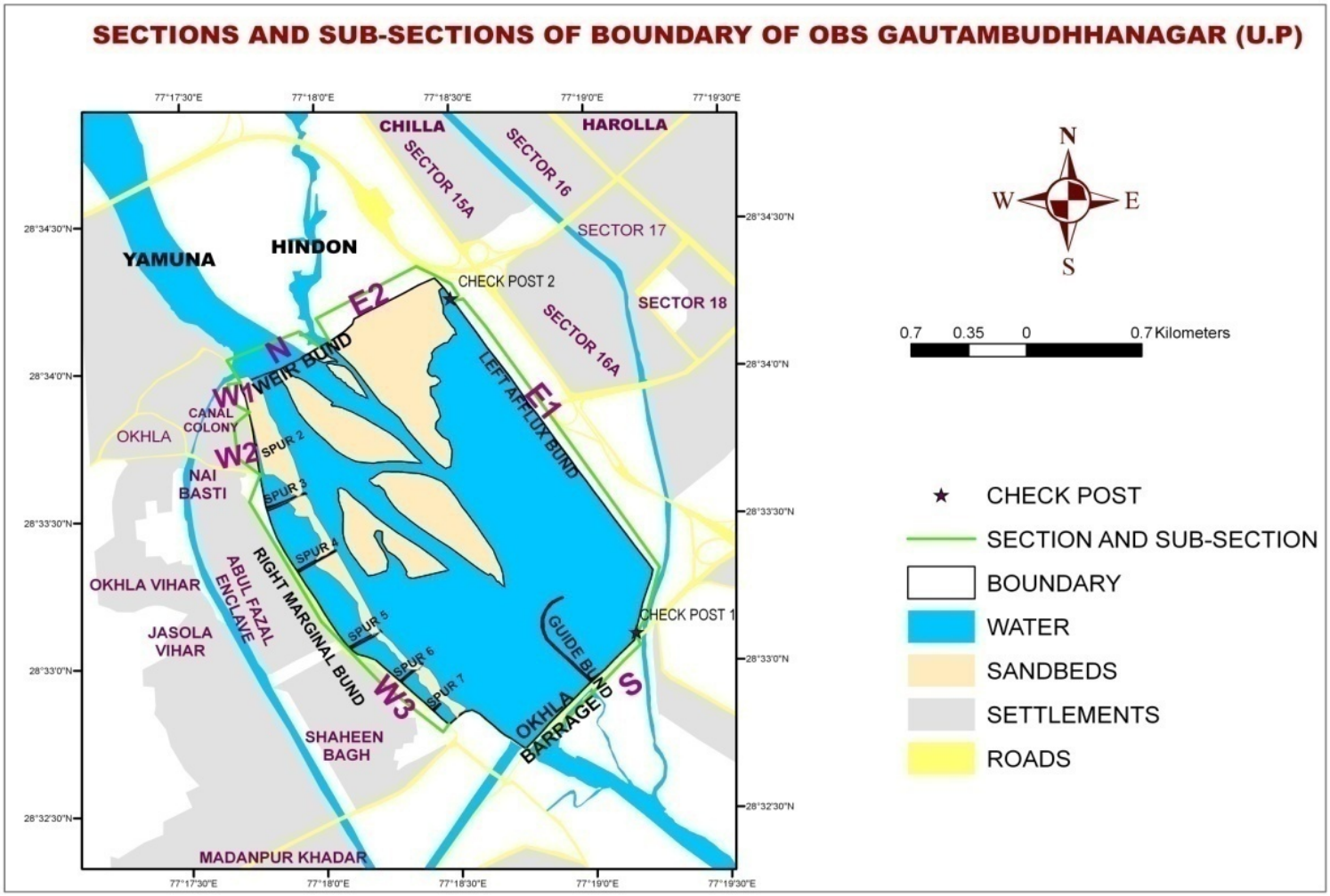


Fig 3.1 Sections and sub-section of Sanctuary boundary based on status of protection

Table 3.1 Biotic pressures upon the Sanctuary

Sections	**Sub-sections description**	**Length in km**	**Protection status**	**No. of entry points**	**Anthropogenic pressures**	**User community**
Western	W-1 (Weir head to Northern point of canal colony wall)	0.21	No wall, No patrolling	Completely open	Waste disposal and defecation	Canal colony and passersby
	W-2 (Canal colony wall)	0.37	A brick wall separating Canal Colony and Sanctuary	1	Temple and attached Crematorium	Canal Colony, Nayi Basti and Okhla
	W-3 (Iron fence, Thoker no.2 to 9)	2	An iron fence, breached at 4 points	4	Defecation, Grazing, Fishing, Pig rearing, Sand collection, Fuel wood collection, Crematorium use	Nayi Basti, Jasola Gaon, Shaheen Bagh
Southern	S (Barrage, guide bund and open road)	0.98	Road after barrage is open, guide bund allows entry into the Sanctuary waters	1	Grass collection, Waste disposal	Chhalera and passerby
Eastern	E-1 (Check post no. 1 to 2)	0.94	Well guarded check posts at both ends	0	Thoroughfare, Morning and evening walk (jogging), Grass and fuel wood collection	Aali Gaon, Chhalera, NOIDA Sec- 15 (A) and 19, Mayur Kunj, and New Ashok Nagar
	E-2 (Check post no. 2 to bank of Hindon cut near banyan tree)	2.47	Weir bund is an open road, Entry near DND flyway	1	Grazing, thoroughfare, Temple inside the Sanctuary, use as a path to reach crematorium	Chilla Gaon, Harolla, Naya Bans, Chhalera, Atta Gaon
Northern	N (River Yamuna and Hindon Cut)	0.5	Yamuna River and Hindon Cut entries	2	Fishing	Fish contractor

Table 3.2 Average monthly discharge of water through Agra Canal for the last 10 years (discharge value is in cusecs)

Month	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jan	1206.45	820.06	861.74	1094.23	810.74	816.84	755.00	1922.00	1860.35	1468.65
Feb	1295.14	1165.71	959.57	1077.36	916.93	913.07	927.64	1951.50	1634.86	3498.79
Mar	828.58	793.65	694.77	670.45	718.32	712.87	652.52	1384.32	1481.06	1661.29
Apr	1106.43	92.07	711.33	785.70	680.53	0	459.73	1391.20	1080.80	642.13
May	1119.71	1147.81	1229.29	1022.61	926.74	953.26	1167.68	1557.74	1199.06	NA
June	1712.87	1287.60	1357.53	1493.93	1248.27	1225.40	1829.87	1187.03	1167.73	NA
July	2205.52	1884.65	1914.26	2213.35	2012.00	1731.32	2164.68	2209.06	1528.26	NA
Aug	2262.26	1958.84	2136.97	2120.39	2133.45	1871.58	2338.42	181.00	1769.32	NA
Sept	1811.23	1676.23	1789.00	1545.40	1388.20	1324.97	1813.40	1640.50	2444.67	NA
Oct	186.84	475.03	696.48	527.42	583.94	79.19	681.87	0	509.29	NA
Nov	1138.30	1006.47	938.97	1071.80	886.03	1302.67	1304.57	1802.80	728.40	NA
Dec	1198.90	1146.71	1208.97	1240.71	1206.77	1318.97	1623.32	1815.58	1583.23	NA
Total	16072.23	13454.83	14498.88	14863.35	13511.92	12250.14	15718.7	17042.73	16987.03	7270.86

The entire Sanctuary area was divided into grids of 50 x 50 m for accessing the spatial distribution of grazing pressure in different areas of the Sanctuary. Number of animals grazing in a particular grid on a particular sampling day and time was recorded for 3 consecutive days in early summer. Sampling time for this purpose was fixed between 8 am to 12 noon. While occurrence of more than 7 animals per grid was given a score of high grazing pressure, 3-7 animals per grid and less than 3 animals per grid was assigned medium and low pressure respectively. Figure 3.3 gives a detail account of the distribution of livestock grazing pressure inside the Sanctuary. Of the total area of 400 hectares, 280 hectares of Sanctuary is water and rest 120 hectare is landmass on which cattle from the surrounding areas graze. Cattle graze mainly on islands covered with *Paspalum distichum* and on the land between two spurs situated in the western section. While roughly 68 ha experiences low grazing pressure, 35 ha and 14 ha are subjected to medium and high grazing pressure respectively. Thus, only 12% of the total area grazed is subjected to high grazing pressure, while 58% and 38% grazed area comes under low and medium pressure respectively.

3.4.3 Extraction of plant products

Some people of Nayi Basti (Delhi) and slum dwellers of NOIDA collect fuel-wood regularly from the Sanctuary. While 4-5 women of Nayi Basti visit the Sanctuary area for collection of 8-10 kg each of *Prosopis juliflora* wood everyday mainly during the winter months, 8-10 women of the slum areas near NOIDA sector-15 collect fallen branches of *Leucenia leucocephala* for use as fuel. Each such head load of fallen branches weighs 15-18 kg. Thus, some 12-15 head loads of fuel wood are removed everyday from Sanctuary area.

Grass collection is not very frequent. Only 8-10 persons from Aali gaon (Delhi) and Chhalera (UP) come occasionally to Sanctuary for grass collection. Each of them collects 20-25 kg of fodder grass.

Some people of Madan Pur Khadar collect Eicchornia during summer months for keeping their vegetables fresh. Rare incidents of lotus root and fruit collection and *Typha* removal were also noticed from Sanctuary.

3.4.4 Fishing

Being a Sanctuary, commercial fishing is prohibited inside the OBS. Fishing is allowed upstream and downstream (sites details are given in section 3.3) outside the Sanctuary; where fish contractors do commercial fishing. However, stray illegal attempts are made to enter into the Sanctuary for fishing late in the evening. Information about illegal fishing is based on informal interviews so quantitative data regarding the same is not available. As per the information provided by U.P. Forest Department, the crimes involving illegal fishing were higher in 2007-08 (8 cases reported) as compared to previous and recent years (Details of the crimes regarding the matter is given in Appendix XV. As western section is not protected properly owing to it lying in the territory of Delhi resulting in difficulties in legal action by UP Forest Department staff, people were seen fishing on western bank and near the guide bund with rod and line during the study period. Eastern section on U.P. side is comparatively better protected due to continuous vigilance of the forest guards from UP forest department.

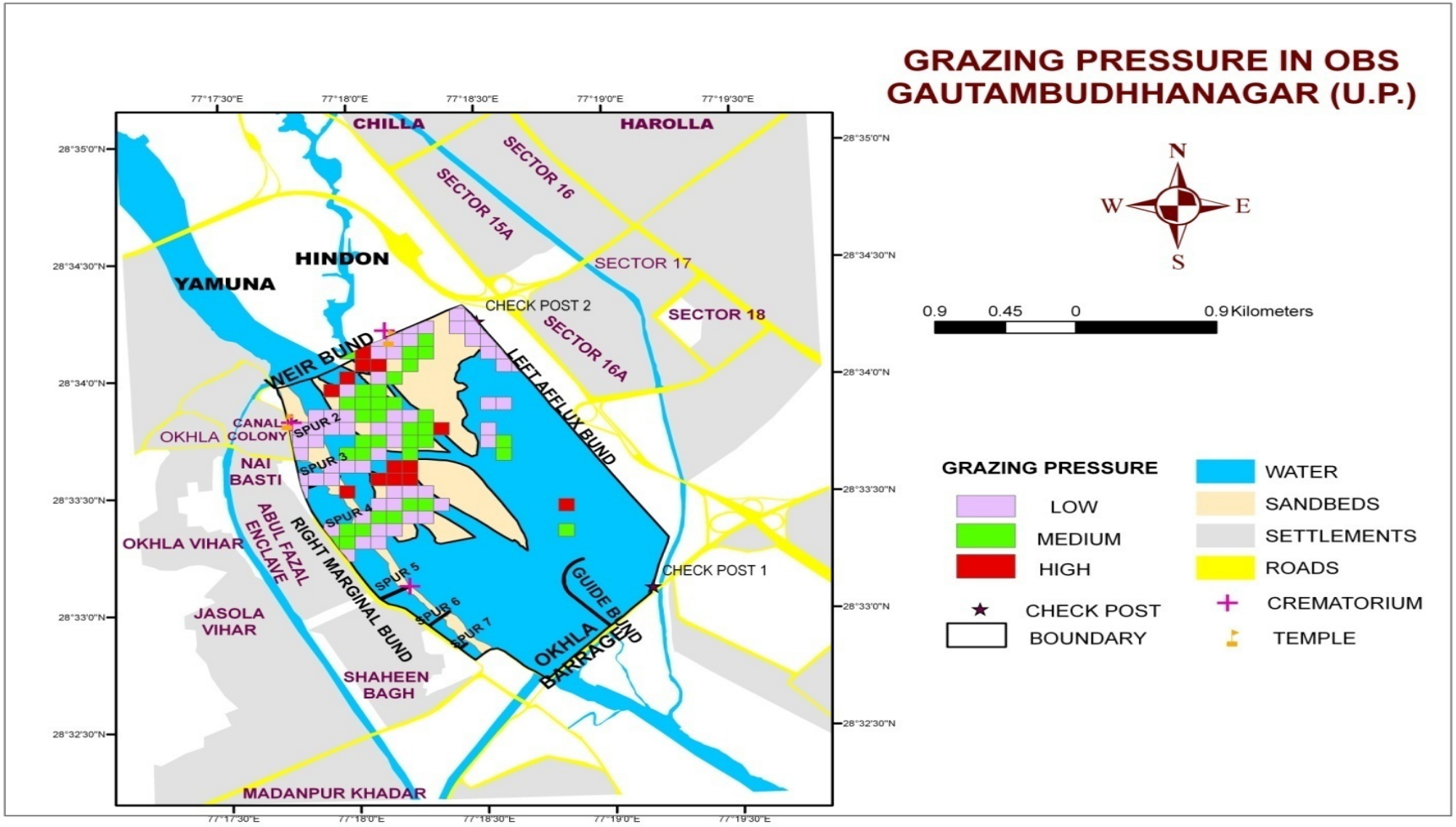


Fig 3.2 Distribution of grazing pressure inside the Sanctuary

3.4.5 Religio-cultural dependence

There are two temples inside the Sanctuary, one in the E-2 sub-section of the boundary and the other in the W-2 sub-section. A priest lives in the temple in W-2 section. The residents of Harolla organize bhandara in the temple situated in the E-2 sub-section, once in a year during June-July. People cook food inside the Sanctuary using LPG and some 250-300 people assembles for bhandara on that day.

Of the three crematoriums, two are inside the Sanctuary boundary and one is just 30 m outside the boundary. Even though the crematorium near E-2 boundary is outside the boundary, residents of Harolla gaon, Naya Bans, Atta gaon and Nithari use the weir bund road to reach to the crematorium spot. In case of crematoriums in W-2 and W-3 sub-sections, residents of Canal Colony and Jasola gaon need to enter inside the boundary. In a year, some 25-30 bodies are cremated in the crematorium situated in W-2 section and the priest living in the nearby temple performs the necessary rituals.

Table 3.3 Location of temples and crematorium

	Location
Crematorium	1. Adjacent to boundary, inside the Sanctuary in the western section
	2. Some 350 m, inside on spur no. 5 in the western section
	3. Some 30 m, outside the Sanctuary in the northeastern section
Temple	1. Adjacent to boundary, inside the Sanctuary in the western section
	2. Some 30 m, inside the Sanctuary in the northeastern section

Every year *kanwadiya* camp is organized just outside the northeastern boundary of the Sanctuary near check post no. 2 in the month of *shrawan* (July- August) for large number of *Shiva* devotees returning from Haridwar with the holy water of river Ganges to their respective villages. When the devotees pass through this area they stop in the camp for a short while and resume their journey using the left afflux bund road of the Sanctuary to avoid heavy traffic on the parallel Dadri road. This camp is organized by volunteers of Harolla gaon and Naya Bans under the supervision of district administration and held for about a week for providing temporary shelter to roughly 35,000-40,000 people. This works out to a crowd of 5,000 – 6,000 *kanwadiya* using the Sanctuary road every day during that time of the year. Loud music played at the campsite creates lots of noise.

Chhat puja is held after Diwali during the month of October- November and large number of devotees use the left afflux bund road for a couple of days to go to the downstream of barrage for offering *pooja*. Large congregation of devotees can also be seen near the weir head in the northwestern side (W-1 sub-section) during this time.

Plate 3.1 A crematorium in W 2 sub-section

Plate 3.2 A temple in E 2 sub-section

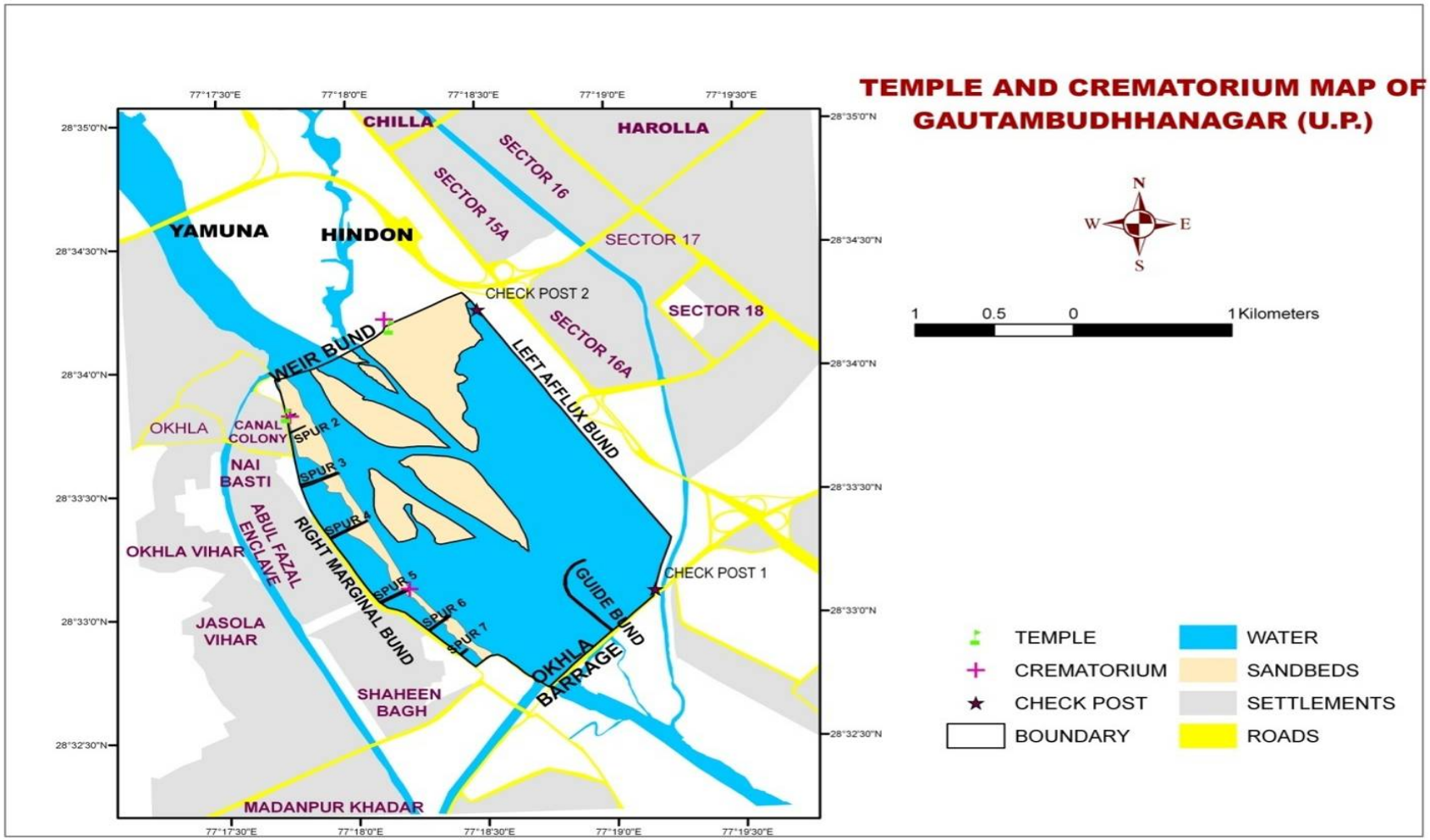


Fig. 3.3 Temple and crematorium inside the Sanctuary

3.5 STATUS OF PROTECTION

3.5.1 Encroachment & other forms of wetland reclamation

The location of the Sanctuary makes it susceptible to conflicting land-uses. As stated in section 3.4.5, there are two crematoriums and two temples inside the Sanctuary. These cause occasional temporary encroachment activity. Every year in the month of July-August (*Sawan)* residents of Harolla and Naya Bans hold a one-week camp outside the Northeastern Boundary of OBS for Shiva devotees coming from Haridwar.

The areas upstream and downstream of the Sanctuary witness few small-scale agricultural activities (growing watermelon and cucumber) and certain temporary settlements were observed.

3.5.2 Poaching of water-birds and other animals

Although there are no official records, there is a constant threat of migratory waterfowl being poached during the winter season particularly on the Right marginal bund of the Sanctuary.

3.5.3 Other activities

Large amount of sand mined in the past from Yamuna River between Spurs 1 and 2 in the north-western section of the Sanctuary on the Delhi side, is now piled along the west bank of Yamuna River in the region between spur 1 and 2 at the north-western part of the Sanctuary. Although commercial mining has been stopped now, but residents from nearby areas take sand from here whenever they need. Local builders also sometimes take sand from the pile.

3.5.4 Defecation

Everyday some 300-325 persons of Nayi Basti and Shaheen Bagh enter into the Sanctuary in the western side for defecation. They enter through five entry points; one in W-1 sub-section and rest 4 in W-3 sub-section of the Sanctuary boundary (Table 3.4). Of the total

people entering for defecation, 72% are male while 16% and 12% are female and children respectively.

Table 3.4 Number of people entering inside the Sanctuary for defecation

Sub-section of boundary	Entry point	Number of people ± SD
W-3 sub-section	Thoker no. 2	176± 47
	Thoker no. 7	68± 16
	Thoker no. 8	58± 3
W-1 sub-section	Open	23± 2

Nayi Basti is a colony with high population density and many houses do not have sufficient toilet facilities. Most of the residents of this area lent few rooms of their house on rent mainly to rickshaw pullers and laborers. It is these people and laborers from nearby construction sites who use the Sanctuary regularly for defecation.

3.5.5 Sewage, effluent and solid waste disposal

The river Yamuna in Delhi is heavily polluted, mainly due to the discharge of several drains, including the large Najafgarh drain. The pollution load at Okhla is the highest along the 1,170 km stretch of the Yamuna through the Indo-Gangetic plains (Gopal and Sah 1993). Hindon cut brings wastewater of NOIDA and Ghaziabad and meets the river Yamuna at the northern boundary of the Sanctuary.

3.5.6 The landscape of OBS

Due to its location in urban setting, OBS is surrounded by various developmental activities. A network of roads that carries heavy traffic surrounds it. Various developmental activities in surroundings of Sanctuary are given in table 3.5.

Table 3.5 Different developmental activities around the Sanctuary

Sl. No.	Project	Agency involved	Programme/activity (broad description)	Status (YTS, O, C)*	Anticipated Impact on Sanctuary
1	Highway and flyovers (DND Flyway)	The NOIDA Toll Bridge Company Ltd	9.2 Km long. Connects NOIDA, and East Delhi to South Delhi. Some 100,000 motorized vehicle use flyway daily	O	Loss of marshy habitat and pond from Sanctuary surroundings. Heavy traffic may cause disturbance in the long run
2	Transmission line (440 KV)	Delhi Transco Ltd.	Electricity transmission line from Dadri station (generated here) to Maharani Bagh substation (distributed from here).	O	Reduced growth of trees falling in affected zone of transmission line Noise caused due to high voltage
3	Ambedkar Park	NOIDA	Hon'ble Supreme court has permitted this activity after halting it for some time with a number of conditions to safeguard the environment the details of which are listed in the judgement.	C	
4	Waste water discharge (Hindon Cut Canal)	Irrigation Department (UP)	Hindon Cut canal brings water from Hindon river and receive untreated waste water from NOIDA and Ghaziabad	O	Hindon cut discharges untreated waste water into the river inside the Sanctuary

***YTS: Yet to start; O: Operational; C: Under construction**

3.6 TOURISM

In recent times, the forest department has started encouraging tourism in the area. Despite its location in NCR, OBS is not very famous amongst tourists. The avian diversity attracts a number of bird watchers. However, number of tourists coming to the area is not very high. The tourist influx is low during summer months. The managing staff of OBS organizes some educational and awareness camps for school students and local people.

3.6.1 Scope

OBS is situated between Delhi and NOIDA. Being situated on the road connecting NOIDA and Delhi (city which daily witnesses a high influx of tourists), the Sanctuary has immense tourism potential. Presently it is famous among birdwatchers. The Sanctuary attracts tourists because of its high bird diversity, which increases during the migratory season. Local NGOs and the Forest department organize educational camps for the school children regularly. Because of its location in the NCT of Delhi, it has high potential of becoming a site for recreation and conservation education.

3.6.2 Visitor statistics

Table 3.6 gives the number of visitors in the financial year 2007-08 and 2008-09. This shows that majority of visitors were Indians with foreigners forming only 6.5% and 4.7% of total visitors.

Table 3.6 Number of visitors in the year 2007-08 and 2008-09

Year	Number of Visitors		
	Indians	Foreigners	Total
2007-08	3002	195	3197
2008-09	5286	260	5546

(Source: UP forest department)

Figure 3.4 shows visitor trends from April 2007 to March 2010. Trends show an increase in visitor flow during winter months; this is the time when winter migratory birds come to the

Sanctuary. This shows that bird watching is primary reason for visiting the Sanctuary, also proven in the results of survey that asks people about primary reason to visit Sanctuary (Table 3.7).

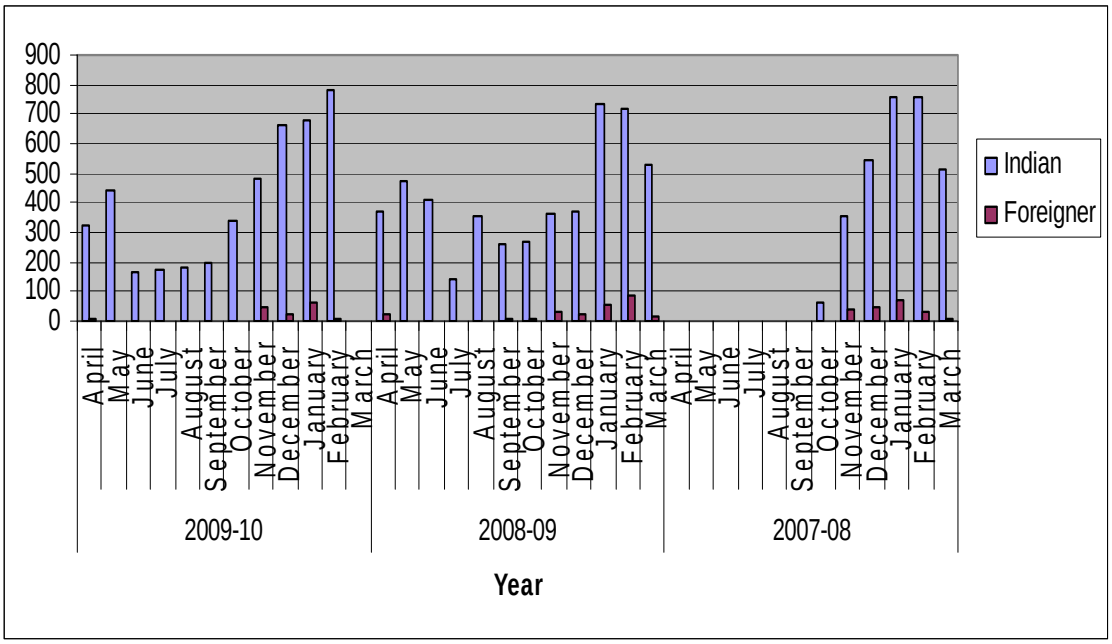


Fig. 3.4 Chart showing tourism trend from year 2007 to 2010 (data from April 07 to September 07 is not available)

3.6.3 Interpretation Programme

The interpretation programme presently involves signage depicting important birds of OBS and some directional signage. The place lacks a proper interpretation centre. Forest guards accompany visitors as guides. Forest department has brochures that give information about the fauna and flora of the Sanctuary to the visitors.

Table 3.7 Visitors statistics showing primary reason for visiting the Sanctuary

Reason of visit	Total	%
Bird watching	49	72.1
Crossing over	3	4.4
Educational Tour	7	10.3
To spend time in natural environment	9	13.2
Photography	6	8. 8

* visitors were asked to choose from a list of options; as many choose more than one option therefore total percentage is more than 100.

3.6.4 Facilities

There are no accommodation and canteen/restaurants facilities available for visitors in or around the Sanctuary provided by forest department.

There are two watchtowers available for the visitors inside the Sanctuary the location of which is shown in Fig.3. 3. There are few benches, signage and publications (a brochure) are available for visitors, but are not enough and need to be improved. Facilities like drinking water/ toilets, guides, interpretation centre and museum need to be introduced in the OBS.

3.7 RESEARCH, MONITORING AND TRAINING

3.7.1 Research and monitoring

The OBS has a good scope for research and monitoring and this is realized by different organizations who have conducted studies on various aspects of the ecosystem. Major-General H. P. W. Hutson recorded the birds of Okhla during the course of his ornithological surveys in the Delhi region during June 1943 to May 1945. Subsequently, Usha Ganguli also recorded the avifauna from this site in her book, *A guide to the birds of the Delhi area* (Ganguli 1975). Urfi has been monitoring the avifauna of this region since 1989 and has published many articles. A number of studies have been conducted on the floodplains of Yamuna in Delhi stretch, which includes the floodplains in the OBS region also. A study on Assessment Of Ecological And Hydrological Functions Of Floodplains Of River Yamuna In Delhi Stretch And Developing Strategies For Integrated River Basin Management was conducted by Wetland International-South Asia in 2006. A study by NEERI was conducted as Hydrodynamic Simulation of River Yamuna for Riverbed Assessment: A Case Study of Delhi Region by Ritesh Vijay & Aabha Sargoankar & Apurba Gupta (2006).

Vegetation in the Delhi stretch of the floodplain of the Yamuna River was examined in relation to hydrological characteristics by Tanveera Tabasum, Pamposh Bhat, Ritesh Kumar, Tasneem Fatma and C. L. Trisal from Wetland international And Department of Biosciences, Jamia Millia Islamia (2009) which included the study of floodplains upstream and downstream of OBS. Besides this, many birdwatchers including the Delhi Bird Group have

been contributing to the knowledge and understanding of the avifauna of the wetland including many rare and interesting bird records. The major study on the economic aspect of the Yamuna floodplains in Delhi region has been dealt by Pushpam Kumar. His work on the Valuation of Ecosystem Functions: A Case Study of Wetland Ecosystem along the Yamuna River Corridors of Delhi Region (2001) is a premier work on the economic estimates of the ecological functions of the Yamuna floodplains in Delhi. The most extensive work in OBS is done by Wildlife Institute of India in collaboration with Uttar Pradesh Forest Department and Tata Energy Research Institute in the year 2001 and 2002. The study was basically on the ecological, social and hydrological factors affecting the management of wetland systems.

OBS has been a site where students from the research, educational and training institutions located in and around Delhi and NOIDA have been pursuing their short-term researches particularly the ones pertaining to their dissertation works. A number of researches are being conducted on various aspects of the wetland every year, which can provide a good study to monitor the temporal change in and around the wetland.

3.8 WILDLIFE CONSERVATION STRATEGIES AND THEIR EVALUATION

Presently the administrative power of OBS lies temporarily with Divisional Forest Officer, Gautam Buddha Nagar (Appendix XIII). The staff of Forest Department for OBS comprises of a Range Officer, a Deputy Ranger, a forester and three forest guards. Presently two protection/fire watchers have been engaged on daily wages basis in the sanctuary.

Chapter 4

The wetland area and the interface landuse situation

4.1 THE EXISTING SITUATION IN THE ZONE OF INFLUENCE (ZI)

The major water source for Okhla Bird Sanctuary (OBS) is the Yamuna River that has a large catchment area of 6,93,000 ha. Its catchment is heterogeneous in landscape and it includes a part of Himalayas. The slope of the catchment is in the north-south direction, which conforms to the general southward drainage of this region. The Yamuna River enters Delhi at village Palla and traverses a total distance of 48 km within the National Capital Territory of Delhi (NCTD). The floodplain along this stretch is encroached by human developments and converted for different purposes.

Apart from Yamuna water, there is an enormous amount of sewage from Delhi urban area released into this system. The 22 km stretch of the river from Wazirabad to Okhla is worst in terms of water quality. There are 19 major drains, which discharge untreated and partially treated waste water/sewage of Delhi and Haryana into this stretch of the river. Another source of water comes from Hindon River of Uttar Pradesh and enters the Sanctuary through Hindon cut at the northern boundary.

The zone of influence around the Sanctuary, except areas north and south of the Sanctuary, is studded with human habitation and developmental activities. The area north of the weir bund (northern boundary of the OBS) up to DND Flyover is a promising site for water birds. This approximately 130 ha area is a part of the remnants Yamuna River floodplain. It has many high ground areas, which are suitable resting and feeding sites for Geese and Waders. The area becomes waterlogged whenever there is any rise of water level in Yamuna and Hindon Rivers. As a result, this shallow waterlogged area becomes a perfect feeding ground for several waterbird species. Although very small, the area has mosaic of habitats like OBS. Part of the area located on the eastern side of the Hindon cut used to be the agricultural

field for wheat cultivation. At present, it is an open ground covered with grasses, like *Cynodon dactylon, Dactyloctenium aegyptium, Paspalum distichum* etc. and small bushes. Birds like Ibises, wagtails, prinias, skylark, pipits, bluethroat, munias, lapwings etc. were seen foraging on this land during the survey. Another part falls between the Hindon cut and Yamuna River. This part is characterized by reed beds and mud flats. Vegetation in this part is mainly composed of tall grasses, like *Sacharum bengalensis, Sacharum spontaneum, Typha sp., Phragmites karka* etc. Bar-headed and Greylag geese and waders, like Common Redshank, Common Greenshank, Common Snipe, Blackwinged stilt, Black-tailed Godwit etc. were found to congregate in this part of the area during the study period.

Area down-stream of the Okhla barrage up to Shahadra drain-Yamuna confluence is unique in its habitat. It is mostly formed of loose sand with less vegetation cover. Patches of long grasses are seen dispersed throughout the area. It has shallow flowing water with sand and mudflats, which are perfect habitats for waders. Such habitat is not present within the Sanctuary. Being situated downstream of the barrage, the area gets inundated whenever the barrage releases good amount of water especially during monsoon. After the water recedes down portion of the area with dry sand becomes wet, thus creating suitable foraging grounds for waders, herons, storks etc.

4.1.1 Human settlement around the wetland

There are about 20 human settlements around the OBS, however not all these are resource users. Few families of nearby areas use the Sanctuary for livestock grazing, fishing and fuel-wood and fodder grass extraction. Few locals also come for jogging. Table 4.1 gives a list of human settlements around the Sanctuary.

Based on extent of dependency on the wetland for different resources four settlements were selected for survey to assess the socio economic status and dependency of the locals. These include Chilla Saronda, Harolla gaon, Jasola gaon, and Nayi Basti. Among these Harolla gaon, Jasola gaon, and Nayi Basti have significant impact on Sanctuary. Role of other areas in resource extraction is negligible. All these areas are urban settlements.

Table 4.1 Human Settlements around OBS

Western Boundary	Okhla Gaon, Canal Colony, Nayi Basti, Shaheen Bagh, Abul Fazal Enclave, Jasola Gaon, Madan Pur Khadar and Aali Gaon
Eastern Boundary	Chhalera, Noida Sector- 19, Atta, Nithari, Noida Sector- 16A, Noida Sector- 15 A, Naya Bans, Harolla Gaon, Noida Sector- 14 A, New Ashok Nagar, Mayur Kunj and Chilla Saronda

4.1.2 Ethnic identities, traditions, customs

The residents of Harolla gaon, Jasola gaon, Chilla Saronda are mostly *chauhan, gujjar, jatav* and a small proportion of *valmiki, nai, and muslims*. Residents of *Nai Basti* are mostly *muslims* (*shia farukhi*). Rests of them are *Hindus. Gujjar* from Harolla gaon and Naya Bans conduct an annual *Bhandara* in the temple in the northeastern section of Sanctuary.

4.1.3 The state of people's economy

Most of the families fall in middle-income group. Providing rooms on rent is one of the main sources of income. Some 5% families are engaged in service sector or running some business, come in upper middle-income groups. Most of the families have access to electronic appliances. Some 15% locals are earning their livelihood by doing labor-based activities and are poor.

4.1.4 Vocations, landuse, use of wetland and wetland products

The main occupation of these areas is business (40%), followed by agriculture and animal husbandry (30%), labor (15%), and service sector (15%). Businesses include running shops, property dealings (real estate), transportations, giving rooms on rent, etc. As these areas are urban settlements, thus very less land is available for agriculture. Few families from Jasola Gaon do cultivation on the land along the old Agra canal and few families from Chilla Saronda do cultivation in the flood plains of River Yamuna, upstream the Sanctuary. No family is dependent on Sanctuary for forest dependent occupation; as OBS Sanctuary is a wetland with some 70% area under water. Rest has mainly reed beds, patches of grass *Paspalum distichum* and tree secies like *Prosopis juliflora, Leucaena leucocephala.* Animal

rearing for various purposes is primary livelihood for many *gujjar* families and *shia farukhi* families.

4.1.5 Wetland management practices and their implications for people

As the direct dependence of the people on the wetland is negligible except for livestock grazing, the direct implication of wetland management on the people is minimal.

4.2 THE DEVELOPMENT PROGRAMMES AND CONSERVATION ISSUES

4.2.1 Delhi Development Authority (DDA) Proposal for development in Zone 'O'

As per Master Plan Development (MPD) - 2021 notified on 7.02.2007, the National Capital Territory of Delhi (NCTD) has been divided into fifteen Zones (Divisions), designated 'A' to 'P' (except Zone 'I'), eight in urban Delhi ('A' to 'H'), six in urban extension and rural areas ('J' to 'N' & 'P') and one for River Yamuna/River front which has been designated as Zone 'O'. The Zone 'O' covers about 9700 ha area from northern to southern boundary of NCT of Delhi. The Zonal (divisional) Plan of the area is prepared under Section-8 and processed under Section -10 and simultaneously the modification of the land uses to be processed under Section 11(A) of the Delhi Development Act, 1957. DDA has delineated Zone 'O' into 8 sub zones based on its magnitude and the nature of the problems which different stretches of river Yamuna are exposed to in its different reaches. The OBS falls in the sub zone No. 7. This sub-zone includes approximately 1300 ha area between NH 24 Bridge and Okhla Barrage.

The Zonal Development Plan of Zone 'O' is conceived to set the strategies for rejuvenation of River Yamuna and eco-friendly development. The riverbed area is encroached for different development activities, which aggravate the condition of the already heavily polluted river Yamuna. Various Proposals and Recommendations have been made for the development of this Zone through different plans at different times. Details are given in the table below.

Planning Proposals by DDA

The DDA assigned a study on "Environment Management Plan for Rejuvenation of River Yamuna" in NCT to the National Environmental Engineering & Research Institute (NEERI). Accordingly, the NEERI has submitted the final study report that gives the study of the existing situation in the flood plains and guidelines for further development. The NEERI has recommended sub-zone wise development proposals, based on which the Zonal Development Plan proposals have been worked out.

(a) Proposed Land Use

Keeping in view the existing development in the various sub zones, their proximity to the transportation network and other essential infrastructure, land availability and suitability and flood zoning etc. the following uses are proposed by DDA in the various sub zones: Residential (62.21 ha), Commercial (39.50 ha), Industrial (34.04 ha), Recreational (2045.00 ha), Transportation (582.93 ha), Utilities (172.66 ha), Government (1.80 ha), Public and Semipublic (181.74 ha) and River and water body (6591.12 ha). No additional areas other than existing have been proposed under Residential, Commercial, Industrial, Government and Public and Semi-Public use zones. Commercial includes existing IT Park (6.0 Ha), Bottling Plant (28.0 Ha), at Madanpur Khadar, Commercial/Hotel (5.5 Ha) Site at CWG Village. Proposed Recreational uses will be considered as Green use zone in which green stretches, Biodiversity Park etc. will be permitted without any permanent construction.

(b) Increased accessibility to the river

Pedestrian promenade (based on *Ghats* concept), construction of special paving, with benches, ornamental street lighting etc. are proposed.

Table 4.2 Developmental plans for Zone 'O' and their probable impacts on OBS

Sl. No.	Plans	Proposals & Recommendations	Probable impact on the OBS
1	MPD - 1962	The entire area north and south of Wazirabad Barrage was recommended. Development of District Parks, Play Grounds and Open Spaces on the western bank of River Yamuna and in the area south of Wazirabad Barrage.	Okhla Bird Sanctuary was notified in year 1990 after creation of lake in 1986.
2	MPD - 2001 Proposals	Yamuna banks were recommended for the development of large recreational areas and integration with other urban developments. It also recommended channelization of river with the following provisions: i) After the result of the model studies for the channelization of the river Yamuna become available, development of river front should be taken up, considering all the ecological and scientific aspects. ii) Strict enforcement of Water Pollution Act is needed to keep the river clean.	Channelization of a water channel results in increased soil erosion along the bank and thus increased danger of their bed being raised by deposit, producing a rise in the flood-level, and necessitating a raising of the embankments if inundations are to be prevented. As there is a barrage at okhla, it might result in more silt deposition and thus change in water regime that will act as a threat to wetland habitat.
3	DUAC- Conceptual Plan-2001	Through proper channelization of Yamuna, a sizeable area can be made available for recreational activities and three-dimensional developments.	(same as above)
4	(NCR) - Regional Plan-2021	The plan has identified river zone as natural conservation zone. The following activities have been recommended in the natural conservation zone: i) Agriculture and horticulture ii) Pisiculture	Any type of agricultural activity in the floodplain will result in the addition of pesticidal runoffs in the Yamuna water that can be lethal to aquatic life. OBS, being situated downstream, will be affected directly.

		iii) Social forestry/ plantation including afforestation iv) Regional recreational activity with no construction exceeding 0.5% of the area with the permission of competent authority	
5	Yamuna Action Plan of Slum Wing, MCD/NCTD	Under this Plan, the following facilities have been developed in this zone: i) Low cost toilets ii) Sewage treatment plants iii) Electric crematoria iv) Bathing *ghats* v) Plantation	Development of low cost toilets will discourage people in defecating on or near riverbanks. More sewage treatment plants will reduce discharge of untreated effluents into the river Yamuna.
6	MPD - 2021	i) Rejuvenation of River Yamuna through a number of measures (Appendix XVI) ii) The natural features such as Forest, Wildlife Sanctuary, River Yamuna and other water bodies should be conserved and kept free from unrestricted and unplanned urban development. iii) Designation and delineation of appropriate land uses and aesthetics of the river front which should be more/ fully integrated with the city and made more accessible-physically, functionally and visually. iv) Water bodies, having a minimum size of surface area of 1 ha shall be preserved by the concerned authorities.	

(c) Transportation

A number of Master Plan roads and Railway lines are passing over the River Yamuna connecting both sides of the city. The Eastern Bank of the sub zones 5, 6 & 7 has been proposed for locating the Recreational facilities. Hence, in addition to the present roads the following connectivity are proposed:

i) Signature Bridge Road connecting NH-2 and Marginal bund Road south of Wazirabad Road; ii) Geeta Colony Bridge Road (30 m R/W) connecting Marginal bund Road and Ring Road; iii) Urban Relief Road from Salimgarh Fort to Yamuna Velodrome behind Samadhi Complex to function as a diversion route for Ring Road; iv) NH-2 bypass (90 m R/W) from Ring Road at DND fly way to UT Border along Agra canal; v) 30 m R/W road from Ring Road along Barapula Nallah to Mayur Vihar; vi) 30 m R/W Road from Ring Road to Marginal Bund Road along north of Railway line. This may increase the traffic noise and air pollution.

(d) Mass Rapid Transit System (MRTS) corridor

Presently the MRTS corridor from Shahadara to Rithala is passing along the ISBT Road. Another Metro corridor from New Ashok Nagar to Barakhamba Road has been proposed to pass along Marginal bund Road connecting the proposed Commonwealth Games Village site to Connaught Place.

(e) Urban design

Broad urban design guidelines have been formulated. Two levels of urban design inputs are envisaged:

i) River Front Development: In order to integrate the river within the larger framework of the city and to bring the river closer to the citizens a) Bathing *Ghats*; b) Pedestrian Boulevards; landscaped venues; d) Sports activities, play fields have been proposed.

ii) Wherever feasible, for short stretches of 2.3 km, light motorways have also been proposed for pleasure drives.

iii) In keeping with the vision of the MPD 2021 and DUAC (Conceptual Plan 2001 and Imagining Delhi) three dimensional developments (restricted) are envisaged in the

central areas which have good locational potential, however, location for these have not been identified yet.

(f) Proposed measures for rejuvenation of Yamuna River

In accordance with the recommendation of the Delhi Master Plan 2021 the total area of 9,700 ha on the banks of the river Yamuna, while it is flowing through the Union Territory of Delhi, i.e. the O-Zone as designated by the MPD, is proposed to be developed as a **'Biodiversity Park'**. There has been an appropriate consideration of the natural potential of the land for developing into a biodiversity zone for conserving the natural heritage of the river basin as well as the local and transient requirements of facilities at the city level, like large level city greens of varying nature along with some recreational facilities.

4.2.2 Development proposal as per the Master plans 2021 and 2031 of the NOIDA

The NOIDA Master Plan - 2021 proposes revision of boundary of some sectors (viz. Sec- 63, 128, 131, 133, 134, etc.), construction of Toll Plaza in Expressway and metro corridor. Plan also involved a railway line in the west along the river Yamuna and re-planning of land for station. Out of 20,216 ha of land in NOIDA, 25% comes in riverfront. No development activities are planned in this zone and are left mainly as green belt.

As per the Master Plan-2031 the area after left afflux bund road of OBS falls in sector 95. This area has been left aside as green belt and recreational area extending up to Sector 38A. Area, after this up to Shahadra drain comes in sectors 16A (institutional and industrial land use), 16B (park and playground, commercial and institutional land use), and 15A (residential land use with medium density below 500 person per ha). Area to the northeast of the Sanctuary up to DND flyway and south of the Sanctuary up to confluence of river Yamuna with Shahadra drain falls in riverfront development zone. Presently agriculture is being done on land available along the riverbanks and in the middle of rivers. No development activities have been planned on this land presently, but planning could be done for riverfront development zone with utility and support facilities after carrying out environmental assessment.

4.2.3 Evaluation of government and non-government agency programmes

Due to its location, a network of roads that carries heavy traffic surrounds Sanctuary. Amrapali Marg forms the southern boundary of Sanctuary, which connects Noida to the South-east Delhi. Recently opened DND flyover and Mahamaya flyover are also located very close to Sanctuary and carry high traffic. DND flyover carries nearly one-lakh motorized vehicles every day. Kalindi kunj road goes along the western boundary of Sanctuary; this also carries huge amount of traffic.

On the eastern side of the Sanctuary just next to the left afflux bund, NOIDA has started construction of a city level park. It runs along the left afflux bund road for a length of nearly 2 km. and width of 250 m. The park covers an area of 33.43 ha. A transmission line of 440 KV constructed by Delhi Transco Ltd. also runs across the Sanctuary along the left afflux bund. Details of development activities in and around the Sanctuary are discussed in section 3.5.5 and table 3.4.

4.2.4 Problems faced by people due to the creation of Sanctuary

The people living in the surrounding area do not face as such many problems from the Sanctuary. However, due to poor water quality of the reservoir in OBS, habitations in the surrounding areas face problems from mosquitoes and disease such as dengue. Foul smell is another problem that can also be included in the list. As discussed before in this chapter, people from some nearby villages make use of the resources of the Sanctuary. The main use includes livestock grazing. Although their dependency on the biological resources of the reserve is low, it does exist. Therefore, it is a challenge for the Sanctuary management to curtail these pressures without antagonizing the local people. However, dependence on biological resources is likely to reduce gradually with increasing urbanization and awareness.

Chapter 5

Vision, objectives and problems

5.1 VISION

The vision for Okhla Bird Sanctuary (OBS) has been the outcome of discussions with different stakeholders and it is given as follows:

To develop OBS as a well managed urban wetland ecosystem which harbours its unique diversity and acts as an important centre for conservation education and ecotourism with the active involvement of local communities and other stakeholders.

5.2 GOAL

The main goal of the management is to secure ecological integrity of OBS and develop it as a centre for conservation education, ecotourism and research.

5.3 OBJECTIVES

The Okhla Barrage was created to extract water of Yamuna River for irrigation and other end-uses in the downstream areas. Over the years, owing to development of a healthy aquatic ecosystem the barrage started attracting wildlife, particularly birds in large numbers adding another important value to the area which was subsequently declared as a Bird Sanctuary. Hence, the primary objective of creating the barrage remains unchanged. The proposed objectives outline below aims to strengthen the overall management regime of the Sanctuary including wildlife values.

1. To strengthen the existing management of OBS for effectively maintaining its ecosystem service values;
2. To reduce impact of urbanization in the zone of influence on OBS for maintaining its integrity;
3. To improve the habitat quality of OBS for wildlife,
4. To mitigate the anthropogenic pressures on OBS; and
5. To promote OBS as a centre for conservation education, research and ecotourism.

The proposed management aims at restoring and conserving the habitats suitable for wetland birds. Being a Bird Sanctuary, increase in both the number and diversity of native and migratory birds can be considered as the best indicator for the fulfillment of this objective. Once this long term objective is fulfilled, the vision to develop OBS as a centre for conservation education and ecotourism can also is achieved. The objectives mentioned above are the pre-requisite of the goal. There are outputs for each objective which should be focused first for achieving these objectives. To fulfill these outputs different activities or management strategies are developed. There are some assumptions for each objective without which the complicacy of achieving the objective increases. The goal of this management i.e. to secure the ecological integrity of the OBS, can only be met if the monitoring of different components of the Sanctuary are done regularly. Continued legal protection and absence of any external threats are also assumed for this objective. The objective i.e. to strengthen the present management system effective is chiefly dependent on the adequate support from the concerned departments, especially Forest Departments (U.P. and Delhi) and U.P. Irrigation Department. To minimize incompatible developments in the Zone of Influence (ZoI), strict enforcement of laws and presence of responsive target groups can be considered as important assumptions. To improve habitat of OBS though considered as an objective, it includes two major outputs viz. improvement in water quality and control of weed proliferation. Availability of adequate treatment facilities, water quality monitoring at regular intervals and adequate budget are important assumptions for this objective. The objectives, output, activities and assumptions are given in a logical framework in Appendix XVII.

5.4 PROBLEMS IN ACHIEVING OBJECTIVES

The OBS is a small, human modified urban wetland situated in a metropolitan area is susceptible to development pressures. Results from several studies showed that the surrounding urban infrastructure creates basic constraints on “best achievable” wetland condition thereby affecting its functional output. Differences in the land-use-diversity relationship among different plant functional groups suggest that adjacent land use affects wetland plant communities in two important ways. First, it alters the abundance and distribution of propagules in adjoining habitats. Second, it alters the number of dispersal

routes. Adjacent land use 250 - 300 m from the wetland affects plant diversity. The increasing infrastructural development in the zone of influence of the OBS, coupled with increased pollutant load in the Yamuna River will have a range of potentially significant impact on this wetland and its species composition.

Infrastructure developments such as, railways, roads, airports, mines, buildings, wind-turbines, power lines and pipe lines are a major source of ecosystem damage and habitat loss, which can have a variety of impacts on waterbirds. Such impacts may also be exacerbated by the tendency for some waterbirds to congregate in large numbers, such as at migration and wintering sites. Furthermore, some migratory species rely on a network of a few specific sites along a flyway over their annual cycle. In view of above discussion this Chapter describes the problems and issues of OBS which may put it in the risk.

5.4.1 Inadequate coordination between inter & intra-state departments

OBS is an inter-state protected area that falls in the states of Delhi and Uttar Pradesh. As a result, different interstate issues, like, inadequate coordination between the interstate departments are there which negatively affect the management of the Sanctuary. In the present scenario, the area declared as Sanctuary is under the control of Forest Department (U.P.). The part of the Sanctuary that falls in the U.P. side is well managed compared to the part in the Delhi side. Consequently, the Delhi part of the Sanctuary faces severe biotic pressures.

The land ownership of the Sanctuary is with the U.P. Irrigation Department. Water level maintenance and construction of any permanent structure within the Sanctuary is under the control of Irrigation Department. The primary aim of the barrage is water storage and abstraction and flood control. Water level in the Barrage is maintained according to the agricultural and other requirements. The ecological aspect of the wetland is being ignored in the process and hence is affecting the flora and fauna of the Sanctuary.

Absence of a unified coordination body, which can bring all the concerned departments on a single platform, is one of the root causes behind such coordination gap. Lack of awareness among stakeholders and policy makers on the biological values of OBS is also a reason,

which hinders communication among them. Thus, roles and responsibilities of the concerned authorities in protecting this unique habitat are still ambiguous.

5.4.2 Land tenure and ownership issues

The construction of Okhla Barrage and resulting lake, inundated lands of some people, who were supposed to be given the compensation, but over the years the ownership and the compensation issues could not be resolved (although the irrigation department claims to have paid compensation, some people dispute it). Subsequently, some conflict over the right on the land inside the Sanctuary persists. The issue strongly came out during the stakeholder meeting as well.

5.4.3 Development activities in the surrounding areas

Due to its location amidst a large metropolitan city, OBS faces various anthropogenic pressures from the surrounding human habitation. As per the Environment (Protection) Act, 1986 Eco-sensitive zones can be declared around wildlife sanctuaries. In case of OBS, surrounding areas, except areas next to the northern and southern boundaries of the Sanctuary, are highly urbanized and development activities are imperative. This sometime leads to conflict of interest and litigation.

5.4.4 Habitat modification and degradation

Like other protected areas OBS is facing serious threats from habitat modification and degradation. In spite of its small area, OBS is known to have mosaic of interesting habitats. Such diverse habitats are one of the main reasons behind the rich avifauna of the Sanctuary. Hence, any change in the habitats directly affects the biodiversity of the Sanctuary. The habitats of OBS have considerably changed due to human activities, pollution and unplanned management practices. Weed infestation, especially aquatic, in the Sanctuary is also very profound, which is nothing but a form of habitat degradation. Similarly, high rate of siltation is creating problem to the Sanctuary by destroying deep-water habitats. Eutrophication, a threat to every wetland and a direct consequence of water pollution and nutrient enrichment is also a type of habitat change, which was observed in parts of the Sanctuary. The small island whose presence was essential for Waders is in dearth in present times because of irregular water level in the sanctuary. The shallow water is required by

dabbling ducks, waders, flamingoes etc. and irregular water level affect their abundance. The fluctuation in water level is changing the floral and faunal composition of the wetland.

5.4.4.1 Water quality degradation

The water quality of OBS is extremely degraded because of the pollution load that enters the Sanctuary through Yamuna River and Hindon Cut. The Sanctuary water has a high level of Biological Oxygen Demand (BOD), up to 30 mg/litre and also presence of high concentration of faecal coliform (a pathogenic microorganism). Dissolved oxygen (DO_2) level considered as one of the limiting factors for wetland ecosystem, is also low (below 1 mg/l at some points). The turbidity is also high which makes the water obscure. Concentrations of heavy metals are also a matter of concern. Levels of As, Pb and Cd were found to be significant according to the WHO guideline value (1998). These metals once enter the food chain get accumulated in the species of different trophic levels which ultimately leads to the biological magnification. Degradation in water quality is directly affecting the biodiversity of the Sanctuary. Species richness for both fauna and flora is showing a decreasing trend.

5.4.4.2 Weed infestation

Weed infestation is one of the major problems that should be given priority in management practices for long term maintenance of Sanctuary. Being a wetland, spreads of aquatic (*Eicchornia*) and amphibious (*Typha* and *Alternantherea*) weeds are prominent in OBS rather than terrestrial species. Nevertheless, eradication of terrestrial weeds (e.g. *Cannabis*, *Lantana* etc.) should also be done periodically to maintain the terrestrial floral diversity and habitat. As discussed in section 2.7.3.3, presently OBS is facing serious threats from the rapid proliferation of *Typha* and *Eicchornia*. The cutting, burning and other management practices are inadequate and hence the spread of *Typha* is increasing. It was observed that 70% of the plots surveyed for vegetation in the islands of OBS contained the two species of *Typha.* Many of these areas were earlier good shallow water areas for dabbling ducks and waders, a habitat which has almost vanished from OBS. There is an urgent need to curtail the extent of *Typha*. Its rapid spread has resulted in retrograding habitat diversity and in turn decreasing species diversity.

Spread of *Eicchornia*, particularly in summer, is another important problem that causes habitat modification. *Eicchornia* spread has resulted in the depletion of open water habitat which is essential for the growth of submerged floral communities. Thus, fauna associated with submerged vegetation also gets affected. Diversity of birds preferring open water for foraging has also declined. Besides, it is believed that high intensity of aquatic weeds may enhance the evapo-transpiration rate which would put more pressure on water level which is already at low.

5.4.4.3 Siltation

Siltation has considerably increased in the period of a decade as is evident from the satellite imageries. Also from the depth data collected during the study, it was observed that the maximum part of the wetland had shallow water whose depth ranged from 1-2 m. This too gives an indication of the fact that the wetland is facing threats from siltation. It has however a negative influence on the storage capacity of the reservoir which in turn influences the power generation to some extent. Siltation is affecting the bird species diversity of the Sanctuary by reducing the deeper water areas that is preferred by diving ducks (tufted duck, common pochard etc.). Also with the change in depth aquatic communities get affected which in turn may affect the dependent fauna as well.

5.4.4.4 Water abstraction, demand and shortage

The Okhla Barrage was constructed for water harvesting. Complete draining of the reservoir happens occasionally, mainly for repairing sluice gates of the Barrage. The satellite imageries (as observed in January 2002 and February 2003) has shown that at times the draining of water has been done in months of January and February which is the peak season of migratory birds. As there are no alternative water bodies for these birds, complete draining of the reservoir is an issue.

The demand of water to be discharged through Agra canal has increased since 2007 (as per data in Table 3.1). To meet this demand high water level is maintained in the reservoir. As the primary aim of the Barrage is to release water through the Agra canal for industrial and agricultural use, in the process the ecological aspect of the wetland is being ignored which is affecting the flora and fauna of the Sanctuary.

5.4.5 Socioeconomic issues

5.4.5.1 Dependency of local communities

As discussed in section 3.4, people from nearby settlements come into the Sanctuary for various undesirable purposes. They bring cattle and horses for grazing, make ingress into the OBS for fishing, use it for defecation and use the Sanctuary premises for cremation and various other purposes leading to increase human pressure (Table 5.1).

Table 5.1 Dependency of local communities on the Sanctuary for various purposes

Purpose	**Human Settlement**
Livestock grazing	Jasola, Harolla, Chilla Saronda, Nayi Basti
Defecation	Nayi Basti, Shaheen Bagh
Fishing	Shaheen Bagh, Contractors from Delhi
Crematorium, Temple	Canal Colony, Nayi Basti, Jasolla, Harolla, NayaBans, Atta, Nithari
Grass and Fuel wood Extraction	Chhalera, Aali Gaon, Nayi Basti, Slums near Sec-15 of Noida
Sand Collection	Nayi Basti, Builders from Delhi
Morning and Evening Walks	Noida Sectors- 15A and19 , Mayur Kunj, New Ashok Nagar

5.4.5.2 Livelihood issues

There are no livelihood issues attached to Sanctuary except for the graziers. There are dairy farms in the Harolla Gaon and Jasola gaon; many families from these areas bring their cattle into Sanctuary. Horses and Ponies owners from Nayi Basti also earn their livelihoods by ferrying goods on these animals. Pig owners who keep pig inside the Sanctuary, sell its meat.

5.4.5.3 Miscellaneous

People come into the Sanctuary for cremation, defecation and jogging. There are temples inside the Sanctuary and a *kanwadiya* camp is held every year near Sanctuary boundary. People have sentimental attachment to crematorium; as they have been coming to this place for many generations. Presence of cremation ground and temple inside the Sanctuary is encroachment. Dumping of waste in and around the Sanctuary results as after effects of *Kanwadiya* camp near the Sanctuary and *Bhandara* in the temple. Defecation inside the Sanctuary by residents of Nayi Basti and Shaheen Bagh makes the western side of the Sanctuary inapproachable for visitors. Loud music played during the *Kanwadiya* camp also disturbs tranquility of Sanctuary environment. Jogging and defecation inside the Sanctuary result as habitual dependency of people.

5.4.6 Any other

5.4.6.1 Lack of adequate staff

OBS has a dearth of staff and facilities. Trained staff who can look into the management of the habitat, provide information to the tourists, and for providing adequate protection to the Sanctuary need to be increased in number.

5.4.6.2 Lack of advertisement

Inadequate signage is present outside and within the Sanctuary. Since the Sanctuary main gate is on a heavy traffic load carrying road, many tourists find it impossible to locate the entrance to the Sanctuary. The proper direction to the location of the Sanctuary is lacking. Same is the lack of information about the direction inside the Sanctuary. The way to watch towers and other areas inside the Sanctuary is lacking resulting in causing problem to the visitors. No basic amenities available (toilets and canteen etc) also cause decline in the tourists influx.

5.4.6.3 Lack of tourism facilities

Tourism, interpretation and environmental education in OBS are in its infancy and not so developed at present. This area gained prominence due to the large flocks of migratory birds arriving in the reserve each year which attracts large number of bird watchers and students alike from surrounding schools and colleges. However, there is lack of interpretation centre, tourism infrastructure and basic amenities and Sanctuary brochure having information on flora and fauna of the Sanctuary.

A key to the success of ecotourism is the formation of strong partnerships so that the multiple goals of conservation and equitable development can be met. Partnership may be difficult because of the number of players involved and their different needs, but forging relationship is essential.

Chapter 6
Management strategies

6.1 MANAGEMENT PHILOSOPHY

At the outset it would be appropriate to discuss the philosophy or the approach towards management of the Okhla Bird Sanctuary (OBS). Some of these ideas are discussed in this section. The management strategy prescribed in this management plan is based on the philosophy outlined in this section.

6.1.1 Degree of intervention

In general, a policy of minimal intervention in natural biological processes has been followed in this management plan considering the fragility of the wetland ecosystems. The floral and faunal assemblage of the wetland has arisen through years of changes and adaptation to a natural set of conditions. All life forms are dependent on each other in a complex web of life. The chain of interdependence is too complex to be understood in totality. Tampering with this natural ecosystem with limited understanding may create a chain of events that we may not understand and can have long-term undesirable effects. Management prescriptions therefore are mostly directed towards reducing human influences that may create undesirable impact on the flora and fauna and making off-site (wetland) efforts to develop the site as a major centre for ecotourism.

At the same time, a totally hands off approach cannot be justified since the reserve's ecosystem is not a fully natural system. It has been created by man for the primary purpose of irrigation. In situations where the cause and effect relationship is well understood it may be justifiable to carry out interventions that help to mitigate an altered natural feature of the ecosystem or for achieving specific management objectives. This implies a good understanding of the ecology of the wetland at the habitat level, species level, hydrology and other disciplines.

Today's protected areas are often like islands in human altered landscape. In the distant past, when the species and ecosystems evolved, the natural checks and balances functioned effectively and the ecosystem was at a stable equilibrium. Today such checks do not exist, forcing us to make necessary interventions to manage the problem that arise in such areas.

6.1.2 Statutes, rules and guidelines followed

The management strategies suggested in this plan follow the extant statutes, rules, directives and guidelines prevalent in the country. The primary one in this regard is the Wildlife (Protection Act), 1972. In addition the provisions of Environment (Protection) Act, 1986, Scheduled Tribes and other Traditional Forest Dwellers (recognition of forest rights) Act, 2006 have been followed in suggesting strategies wherever relevant. The Central Empowered Committee (CEC) constituted by the Hon'ble Supreme Court of India has given very important decisions in March 2006 regarding management of OBS (Appendix XVIII). While most of these decisions have been implemented certain important ones are yet to be completed. Hence these have been reiterated in the proposed strategies. In addition suggestions from persons having wide experienced with the sanctuary have also been considered while framing the strategies for the management of OBS. Most recently the Hon'ble Supreme Court of India pronounced the judgment on IA no 2609-2610 of 2009 in writ petition (civil) No 202 of 1995 regarding construction of park at NOIDA near Okhla Bird Sanctuary dated 3rd Dec 2010 which included directions regarding management of OBS and its surrounds (the relevant portions of the judgment are in Appendix XIX which have also been followed while drawing up the proposed strategies.

6.2 BOUNDARY OF THE SANCTUARY

Boundaries of the OBS are well defined in the notification. However, the inter-state boundary between Delhi and UP in the middle of the Yamuna River which actually bisects OBS in two unequal parts is not clear on the ground. Yamuna and Hindon cut, pass through its northern boundary. There is no proper fencing at many places and the influx of humans and cattle from different boundaries is a management challenge to deal with.

6.2.1 Eastern boundary of OBS

The eastern part of the sanctuary is secure primarily because of left afflux bund and has an adjacent recreational Park of about 2 km length with a high boundary wall. Both the entry gates to OBS are also located on this boundary.

6.2.2 Southern boundary

The southern boundary of the sanctuary is well demarcated by Shahadra drain, the road linking NOIDA with Okhla and the barrage. The Shahadra drain and the barrage afford protection to OBS but the open road going along the boundary for a distance, is where the ingress into the sanctuary can be made and hence needs to be fenced. People also enter into the sanctuary through guide bund located close to the barrage, which needs to be made out of bounds except for the forest and irrigation department staff involved in the management of OBS and the reservoir respectively. The areas requiring fencing are marked on the map (Fig. 6.1). The fencing would cover the boundary from barrage to Gate No. 3 (approx 1 km).

6.2.3 Western boundary

The western boundary is in three stretches. The northern most section is the weir head to Northern point of canal colony wall. This section (0.21 km in length) doesn't have a wall and is poor on patrolling. Consequently it is being used for waste disposal and defecation. A six feet wall is proposed to be built here. The next section is just south of this and has a brick wall separating between Canal Colony and OBS. The last section is the longest one spanning a length of nearly 2 km from spurs popularly called *thokers* no.2 to 9. Presently there is a high wire-mesh fencing put up by the irrigation department. However, the fencing is breached at a few places and cattle and people make regular ingress. The fencing needs to be repaired and strengthened. Kalindi Kunj road along the fence is a source of continuous disturbance and broadening it will have greater impact on the OBS. A six feet live hedge would be grown here along the fencing on the inside. This hedge would reduce the constant disturbance on this part of the sanctuary by the vehicular traffic.

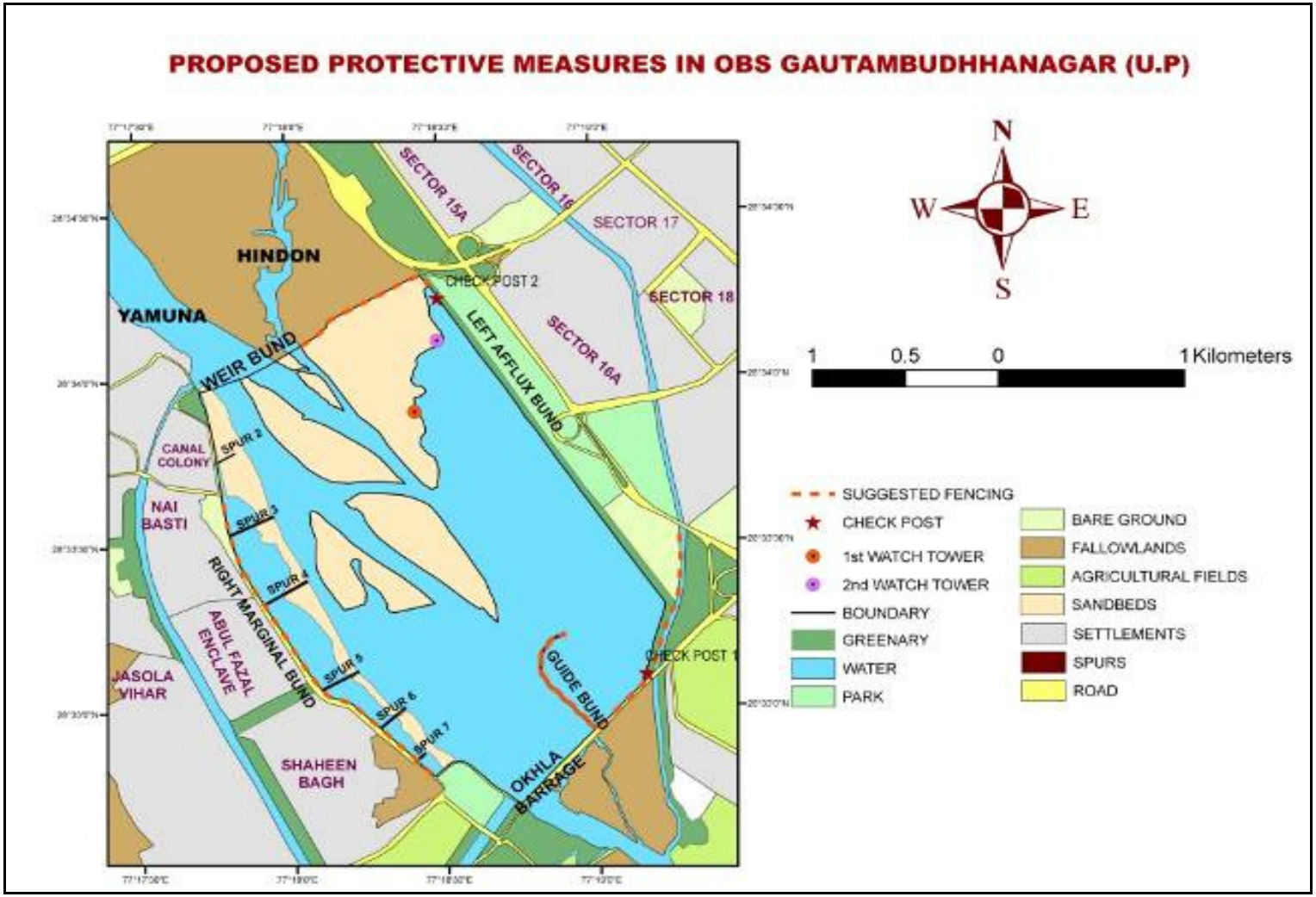


Fig. 6.1 Map showing areas proposed for fencing in OBS

6.2.4 Northern boundary

It is the most vulnerable side since Yamuna and Hindon Cut enter from here. A regular ingress by fishing boats and people has been observed from here. Since the river enters from here a complete permanent barrier is impossible to be constructed to demarcate and protect the boundary. The stretch from Check post no. 2 (northern one) to Banyan tree along the weir bund which is nearly 0.75 km long, also needs to be protected. However owing to ecological continuity with northern areas which are all proposed to be included as buffers of OBS no hard demarcation may be the preferred method. Intensive patrolling would perhaps the best way to safeguard it.

Presently the areas just up-streams of the boundary of the OBS on the Delhi side are leased out for fishing by the Delhi Govt. The fishermen occasionally make ingress in to the Sanctuary area and the UP half of the river which is being proposed as a buffer of the OBS. There should be a complete stoppage on fishing lease by Delhi Govt. up-streams of the Weir bund up to DND Flyover. The Delhi Govt. should be pursued to stop fishing lease on the Delhi side of the river up to the DND flyover since the area is an important buffer of OBS.

6.3 ZONATION

Considering the small extent of the sanctuary (400Ha), the need for a formal zonation is not felt. The areas in the north and south of OBS (as indicated in the Fig. 6.3), when are added as buffer as per the order of the Honorable Supreme Court, will allow some degree of resource use in the form of regulated grazing and/or grass collection by the local people if a genuine dependence is felt. The entire area of the OBS would be kept inviolate except the small tourism zone the extent of which is described in the next section. No human activity will be allowed in this area. The area will be kept disturbance free.

6.3.1 Tourism zone

Even though the need to create zones within OBS is not felt, there is a need to identify a definite zone where tourism may be allowed in the OBS. OBS being a small sanctuary and also keeping in mind, the possible disturbance to the birds by the tourists, the area/paths where they should be allowed, need to be clearly identified. Although the number of visitors

to OBS is not high at present, in future some restriction on number of visitors may also be imposed to contain the possible disturbance to birds. The primary areas/paths in this zone would include the left afflux dam road, the embankment to the Banyan tree on the northern boundary, the footpath leading to the watch-tower and the weir on the northern boundary (Delhi side). In addition a small walking path on the western side just inside the fence may be developed once the live hedge is in place from *thokar* no.2 to *thokar* no.9. Some of these spurs (*thokars*) may also be then opened for use by birdwatchers in future. Map showing points with existing and proposed watch tower in OBS is provided in the chapter on tourism and interpretation.

Tourists would never be taken by boats since the wetland is too small and the birds would get disturbed. Continued disturbance of such kind may force the birds to leave the wetland permanently. The water-body would be completely out of bounds for the tourists. The detailed prescriptions for management of the tourism zone are given in Chapter 8.

6.3.2 Additional areas as buffers

To reduce direct disturbance to the sanctuary and to make it an ecologically more viable unit, following areas may be included into the sanctuary management as buffer with the status of conservation reserve. These may then be placed under the management of the Sanctuary. Hon'ble Supreme Court of India in a recent judgment (dated 3rd Dec 2010) on IA no 2609-2610 of 2009 in writ petition (civil) No 202 of 1995 regarding construction of park at NOIDA near Okhla bird sanctuary in Appendix II(WII) point no 2 has called for creation of such buffers.

6.3.2.1 Northern buffer

The area north of the weir bund (northern boundary of the OBS) up to DND Flyover is a promising site for water birds. It is still a riverine area with many high ground areas traditionally known for attracting Geese and Waders in large numbers. The entire area between the DND flyover and the weir bund on the UP side (left bank) may be included in this conservation reserve. The area should be managed as an area with riverine vegetation, and no attempts should be made to change the character of the vegetation there. However, weeds may be eradicated from the area. This buffer should also include the strip of

woodland to the north of the park being built in NOIDA adjacent to the OBS. The land-use of this strip also needs to be maintained unaltered. The area on the Delhi side may also be accorded better protection and Delhi Govt. may be requested for the same. This would further safeguard the ecological integrity of OBS. A proper survey and demarcation of the buffer may be undertaken before issuing the notification.

6.3.2.2 Southern buffer

Area down-streams the barrage up to Shahadra drain-Yamuna confluence may be added as a conservation reserve. It is grassy area with sand flats- a habitat which is not present in OBS. It also has shallow flowing water. A proper survey and demarcation of the buffer may be undertaken before issuing the notification. The location of both the proposed buffers is given in map (Fig. 6.3). The owners of this land and stakeholders or institutions should be pursued for creating improved conditions for protection of birds and improvement of their habitat while following the procedure for declaration of the area as conservation reserve.

6.3.2.3 Ownership of areas to be added as conservation reserve

Based on the available information, the left bank ownership of the area north of the sanctuary, up to DND flyover is with the UPID and right bank ownership is with the Delhi Government. We are proposing only the UP part of this stretch for Conservation reserve. The Delhi side hardly has any good habitats at present, but increased protection may help it recover. However, certain land-use such as fishing should be stopped immediately as mentioned earlier in the Delhi part as well, by requesting the concerned Govt.

In the South of the sanctuary, downstream up to Shahadra drain-Yamuna confluence, the ownership is primarily with UPID. Based on the surveys by us, it has come to notice that people from Chhalera do cultivation on parts of this land. They grow seasonal vegetables and fruits. The legality of these activities need to be ascertained before going ahead with the declaration of these lands as conservation reserves.

Plate 6.1 Habitat feature of the proposed southern buffer

Plate 6.2 Vegetable cultivation in the area proposed as southern buffer

6.4 ADMINISTRATIVE ISSUES

6.4.1 Constitution of advisory committee for OBS

As per the provisions under section 33B(1) of Wildlife (Protection) Act, 1972 “the State Government shall constitute an Advisory Committee consisting of the Chief Wild Life Warden or his nominee not below the rank of Conservator of Forests as its head and shall include a member of the State Legislature within whose constituency the sanctuary is situated, three representatives of Panchayati Raj Institutions, two representatives of non-governmental organizations and three individuals active in the field of wild life conservation, one representative each from departments dealing with Home and Veterinary matters. Honorary Wild Life Warden, if any, and the officer-in-charge of the sanctuary as Member-Secretary”. The advisory committee for OBS needs to be constituted immediately.

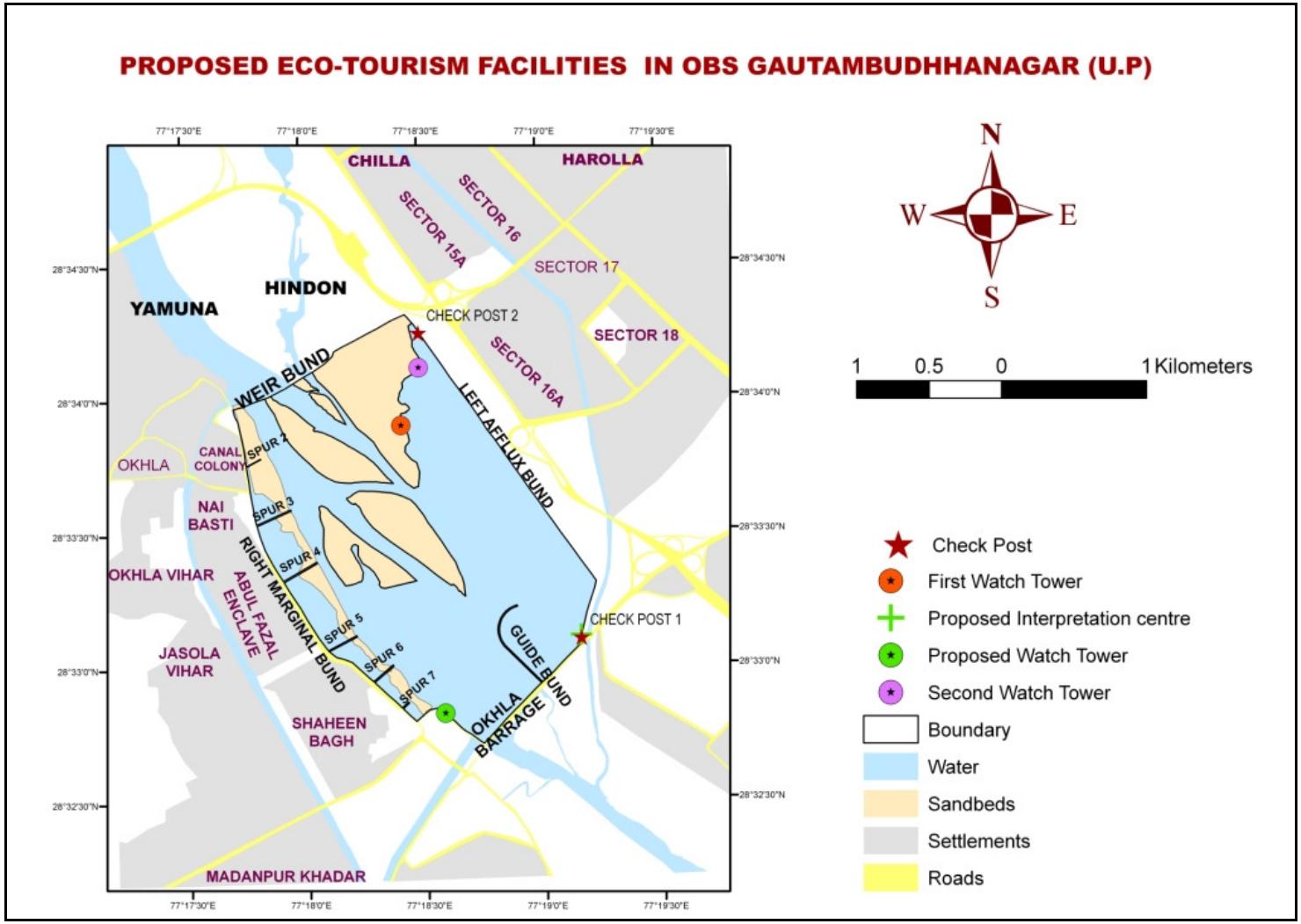


Fig. 6.2 Map showing points with existing and proposed watch towers in OBS

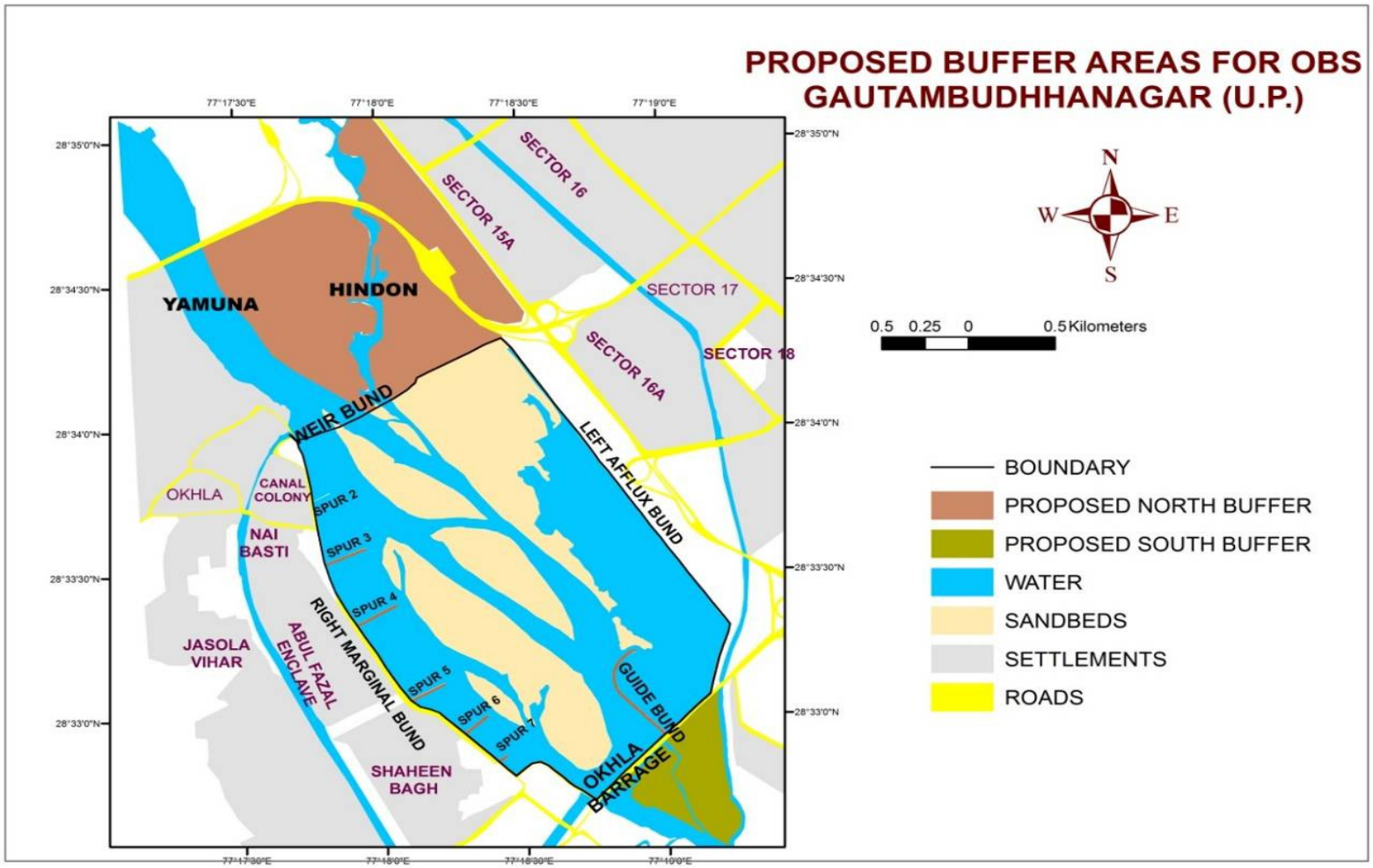


Fig. 6.3 Map showing areas proposed for buffer in OBS

6.4.2 Settlement under WPA 1972

As per the provisions of Wildlife (Protection) Act, 1972 the settlement of rights (proceeding under section 19 to 25, both inclusive) has to be completed by the collector in as far as possible a duration of two years from the declaration of the sanctuary under section 18. The sanctuary was declared in the year 1990 and hence the settlement process is long since overdue**. CEC of Hon'ble Supreme court had also given a decision in March 2006 to complete the settlement process and given the responsibility to pursue the matter to CWLW Uttar Pradesh and Forest Department of Delhi for the UP and Delhi parts of the sanctuary respectively.** As per the information provided by the DCF National Chambal Sanctuary Project, U.P., Agra who was the manager of OBS in the recent past, the proceedings are still under consideration of the Collector, Gautam Buddha Nagar (Appendix XX). Settlement of rights is an extremely important step in the constitution of a sanctuary since it is the single legal opportunity to settle all the rights in a sanctuary after evaluating their genuineness. Hence the entire proceedings of settlement have to be completed expeditiously. The concerned authorities may write letter to Collector Gautam Buddha Nagar for taking up this important job at top priority. The following points may be brought to the light of the collector by the forest manager of the area so that they may be addressed during the settlement process, besides the rights admitted by the local people.

a) **Crematorium**: Presently there are two crematoriums inside the sanctuary in the western section and one just outside the northern boundary. Crematoriums present inside the sanctuary need to be shifted outside the sanctuary and if northern area is declared as a conservation reserve, the one present at northern boundary will need to be shifted (possibly close to the DND flyover or just beyond it). Being a sensitive issue, proper consultation with the affected people needs to be done to look for alternative sites outside OBS. This issue should be taken up as a part of the settlement process of OBS. As per the suggestion received during stakeholders' consultations, an electric crematorium in sector 94 can substitute the existing crematoriums.

b) **Chatth puja**: Presently people use left afflux bund to go downstream of barrage from Noida and weir head within OBS. Steps for diversion of the pressure outside the OBS should be taken.

c) **Kanwariyas**: They have already been pushed outside the OBS but are still very close to the boundary near exit gate. They use left afflux bund road to avoid traffic and sanctuary is closed for visitors during this period. Permission for the camp is given by district admin; a temporary police post is made available here and NOIDA provides water tankers for camp. The Kanwariyas are known to use the OBS areas for defecation.

d) **Temples:** There are two temples inside the sanctuary, one in the western section another in the northeastern. The collector may deal with the issue during the process of settlement.

Above issues must be taken up in settlement process. Further details have been provided in Chapters 3 and 4 which may be looked into.

6.4.3 Declaration of eco-sensitive zone

As per the Environment (Protection) Act, 1986 Eco-fragile zones can be declared around wildlife sanctuaries. During the XXI meeting of the Indian Board for Wildlife held on 21st January 2002, a 'Wildlife Conservation Strategy-2002' was adopted wherein point no.9 envisaged that " lands falling within 10 Kms of the boundaries of National Parks and Sanctuaries should be notified as eco-fragile zones under section 3 (v) of the Environment (Protection) Act and Rule 5 Sub rule 5 (viii) & (x) of the Environment (Protection) Rules."This limit of 10 km was later amended and delineation of eco-sensitive zones was to be site specific and relate to regulation, rather than prohibition, of specific activities. This was later communicated to states by MoEF on 27.05.2005. Hon'ble Supreme Court, vide their order dated 4th December 2006, had directed the Ministry of Environment & Forests to give a final opportunity to all States/Union territories to respond to the letter dated 27.5.2005 and that the State Governments send their proposals within four weeks, to the Ministry in the writ petition No. 460/2004.

Recently guidelines for declaration of Eco-sensitive zone have been issues by MoEF and proposal for declaration of such a zone should be developed by the state Govt. based on these guidelines and submitted to Govt. of India which can then follow the procedure for declaration of the same as an eco-sensitive zone.

6.4.4 Declaration of OBS as a Ramsar Site

OBS is not a Ramsar Site at present. However, it fulfills following five out of eight criteria for being a Ramsar site:

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

It is a unique representative of Indo-Gangetic flood plain eco-system of which there are very few areas under protection as this ecosystem has almost completely converted into land-uses favouring humans.

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

15 species of birds found in OBS are globally threatened and 8 near threatened (see listing in section 2.7.2) because of which OBS deserves to be a Ramsar site.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

OBS provides a refuge to a large number of migratory water birds in winters.

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more water birds.

Based on the counts done in recent years by Forest Department, the number of water birds has exceeded 20,000 in certain years.

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

OBS has unique assemblage of biodiversity of Gangetic system in the bio-geographic zone 7A.

6.4.5 Resolving inter-state issues

One of the primary issues in the effective management of the sanctuary is a lack of co-ordination between various departments from two adjoining states working in close vicinity of the sanctuary and who are directly or indirectly affecting the management of OBS. There is a need to establish a unified coordinated body which would bring all the concerned departments (e.g. forest department, irrigation department, municipal development department, development authorities) on a single platform. Joint meetings conducted by this unified body can bring forth the various management issues and dialogues can be conducted to solve them.

The river Yamuna in the reaches of OBS forms the inter-state border between Uttar Pradesh and Delhi. The Delhi part of the OBS has been under the control of UP irrigation department. The irrigation department claims to have ownership on the area and have provided with land records favoring their claim (Appendix XIV). In fact the entire area in the western side of the sanctuary (west of the mid-stream of Yamuna) which approximately makes one third of the OBS is being managed by UPID. An extensive colony of UPID also exists in Delhi adjoining this part of OBS. However, during the stakeholders' meeting held on 11th November 2010 (Appendix XXI), the Deputy Conservator of Forests (South) Delhi Govt. clearly mentioned that the territorial control over this part of the OBS (west of the mid-stream of Yamuna) rests with Delhi Govt. and it is the prerogative of the Delhi Govt. to manage and administer this area. He went on to say that the Delhi Govt. is committed to the conservation of this part of the OBS and may if the need be issue a separate notification to declare it as a protected area. Clearly the ownership and management of the Delhi part needs to be streamlined. Even though Delhi Govt. may have the claim on the area, they definitely do not have the necessary infrastructure to manage or protect it right now. Instead, UPFD has the presence in the area and their staff lives in the Kalindi colony of UPID on the Delhi side. The issue needs to be resolved at the earliest and MoEF may help in resolving this inter-state issue. Till such settlement UPFD may be allowed to continue with the management of this part since they have the necessary infrastructure and have had a

long experience of managing the same and Delhi Govt. should support them in the general interest of OBS.

6.4.5.1 Coordination committee for the addressing of inter-state issues

Since the inter-state issues discussed above are of serious nature which may take time to get resolved an inter-state coordination committee is proposed to be constituted for resolving the matters. Hon'ble Supreme Court of India in a recent judgment (dated 3rd Dec 2010) on IA no 2609-2610 of 2009 in writ petition (civil) No 202 of 1995 regarding construction of park at NOIDA near Okhla bird sanctuary in Appendix II(WII) point no 3 has called for eliciting support from Delhi Govt. for conservation of OBS. Consequently the proposed committee must be well represented by Govt. of India, Govt. of Uttar Pradesh and Govt. of Delhi. The wings/departments of these Governments which should be represented in this coordination committee should include *inter alia* Ministry of Environment and Forests, Govt. of India, Forest and Irrigation departments of the two state Governments, development authorities from both the sides and other associated bodies like DND flyover management.

The committee shall meet at least once in a year and shall regulate its own procedure including quorum.

6.5 HABITAT MANAGEMENT

OBS has an interesting mosaic of habitats in a small area. Steps should be taken to ensure that this habitat diversity is maintained so that the sanctuary continues to support the high biodiversity it has. Proper study and mapping of habitat has been done as a part of management planning exercise and a detailed map illustrating the mosaic of habitats is given as figure 6.6.

The list of works done during the past five years in OBS are given in Appendix XXII. Looking at this list one can make out that sizeable share of the budget has been spent on habitat improvement. Most of it has been spent on weed eradication and based on interaction with

field staff it is concluded that much of it has been spent on removal of water Hyacinth which is definitely a major management issue at OBS.

6.5.1 Major issues in habitat management

6.5.1.1 Management of Typha

Typha is found to cover extensive area on the northeastern part of OBS. As per the vegetation survey as many as 70% sample plots in the terrestrial part of OBS contained the two species of *Typha* (Table 2.4). *Typha* dominated vegetation covers 65.88 ha. of the OBS. Many of these areas were earlier good shallow water habitats for dabbling ducks and waders, a habitat which has almost vanished from OBS. *Typha* has also spread in the islands and other parts of sanctuary. In fact *Typha* has been following the siltation in OBS and encroaching into new high ground created on account of it (Fig 6.8). There is an urgent need to curtail the extent of *Typha*. Steps need to be taken to completely stop its ingress into the area which are still free from it. Certain areas from where Typha has to be removed on priority have been identified. These include areas where *Typha* has encroached into in recent times and areas which were known for shallow-water birds in the past. These are delineated on map (Fig. 6.7). The strategy of removing *Typha* from these areas would be to cut it below the water level, which would lead to dying (rotting) of its root stock. The work would be labour intensive and should ideally be done in the small time window of post monsoon, well before the arrival of the winter migratory birds. The operation may require repeated cutting back (usually three times in one year) to ensure that the shoots do not emerge. The procedure may be repeated over three consecutive years to completely get rid of *Typha* from these areas. Adaptive management should be resorted to i.e. experimenting and learning from experience from past years since tested ready methods are not in vogue. Every year 20 ha of area would be taken up for *Typha* fresh removal distributing it equally in the two identified priority zones of *Typha* removal. The removal should be done in a checker-board pattern and not in single blocks.

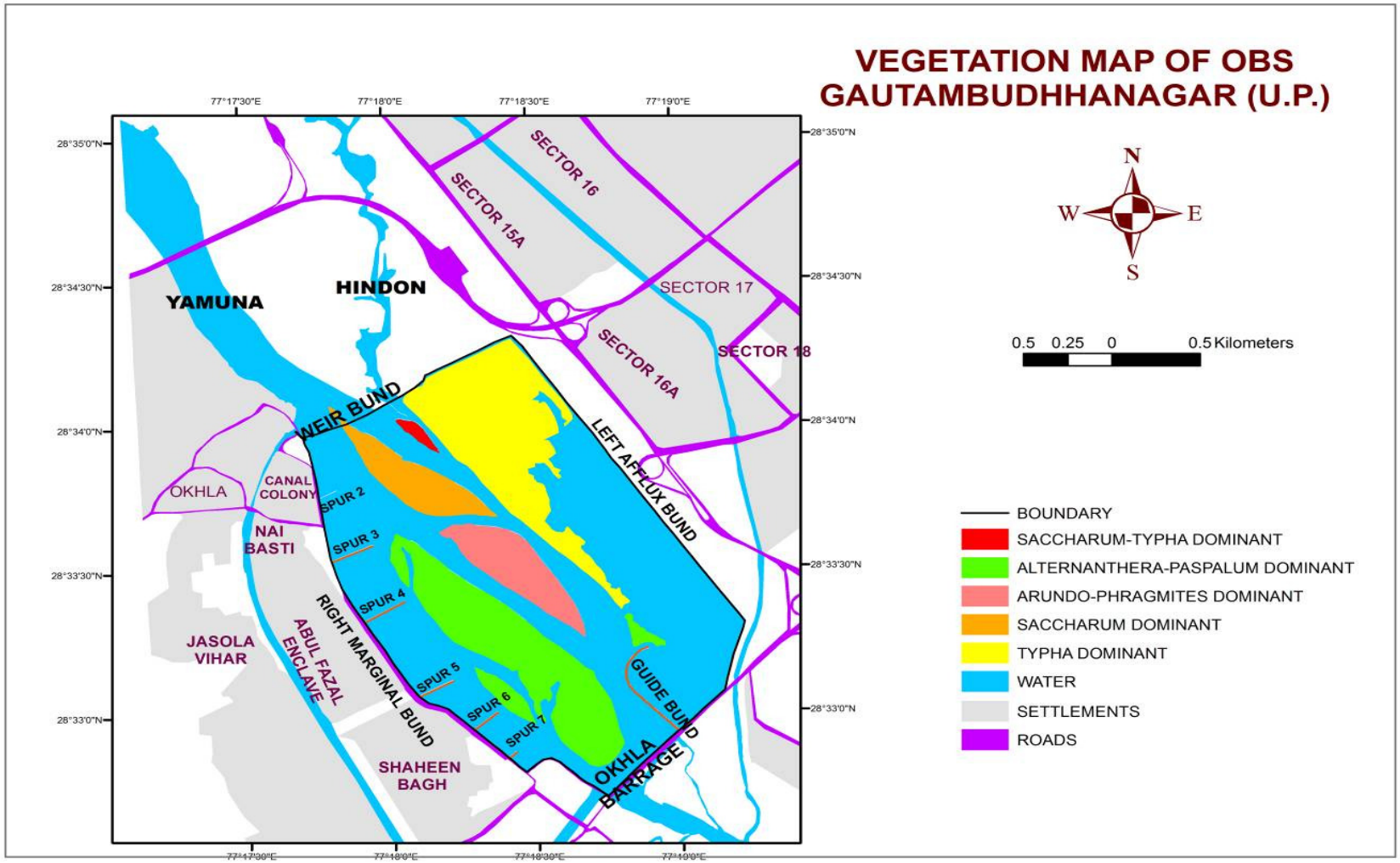


Fig. 6.4 Vegetation map of Okhla bird sanctuary

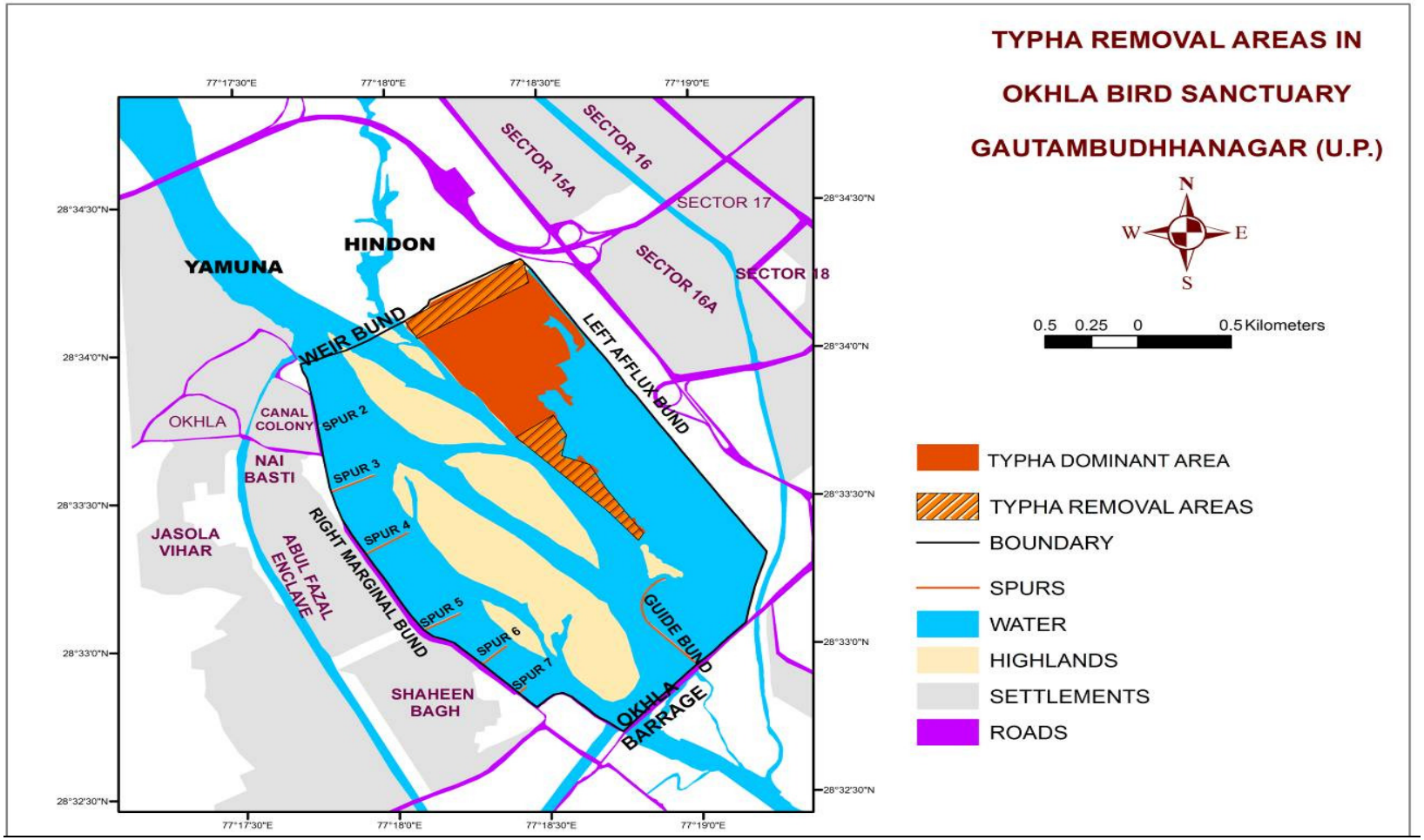


Fig. 6.5 Map showing areas from where Typha has to be removed on priority

6.5.1.2 Management of Luceanea and Prosopis

Luceanea lucocephela an exotic to India, has covered many parts of high ground (mainly embankments such as afflux bund and guide bund). There are many large trees of *Luceanea* and thick natural regeneration of *Luceanea* is seen under and near them often making impenetrable tangles. This regeneration needs to be cut back/uprooted from most terrestrial area to eliminate it gradually from OBS. There should be planting of native species viz. *Acacia, Dalbergia, Zizyphus* and *Ficus* species. Removal of *Luceanea* trees should be done at a later stage once native trees are properly established.

Prosopis grows in some of the high areas on the boundary of the OBS. It is not regenerating on its own and does not pose much problem as of now. However, once more native tree species grow up as indicated in the above paragraph, the *Prosopis* species may also be gradually removed.

6.5.1.3 Management of Eichhornia

Presently the water hyacinth is being manually removed. With the help of boats, water hyacinth is piled up at high ground and set on fire once it dries up. Poles with wire mesh are also erected to keep parts of the lake clear of water hyacinth. Wind controls movement of water hyacinth. Semi-permanent series of poles (treated wooden) connected by rope mesh should be placed as a barrier at select location to contain Hyacinth movement. Similar structure need to be tried at the entry of the river and/or DND flyover. The biological control of water hyacinth can be tried as well. As per the assessment approximately 150 ha of area would be covered for water hyacinth removal every year at the prescribed rate of Rs. 17,000/- per hectare. Approximately 2 km of temporary barrier would be erected to contain the movement of Hyacinth on both sides from weir bund to channel bund.

The use of a dredging machine like Truxor could be useful to clean OBS from weeds and siltation. The experiment with the lake is found successful for Dal lake(Kashmir) in July 2010 and now it has been improvised for Hussain Sagar lake(Hyderabad). Hyderabad lake management has imported the amphibious Aquarius Truxor from Switzerland at an approximate cost of Rs 1.30 crore. The machine is helping to clear Dal lake of weed, muck, pollutant and silt.

6.5.1.4 Siltation

Both Yamuna river and the Hindon Cut carry heavy silt load because of high pollution thus water in 70% of the grids has the depth less than 2 m (Fig. 6.8). This gives an indication of the fact that the wetland is facing threats from siltation. Bathymetry exercise has been completed during the present exercise which would provide a bench mark for future comparisons, and if siltation is noticed steps may be taken to deal with it ensuring minimum disturbance to the habitat. The details of bathymetric monitoring is in chapter 9.

6.5.1.5 Maintenance of water level

The barrage is under the control of Uttar Pradesh Irrigation Department. Water discharge from barrage varies from 101 cusecs (during dry period) to 110000 cusecs (during peak monsoons) per day. The reservoir usually is maintained at a near constant water level. As per the information given in section 2.6.4, the water level is usually maintained at about 0.65m (2 feet) lower in non-monsoon period. This would be helpful for birds since it would throw-up many mudflats out of water which would provide resting habitats for waterfowl and habitat for waders. This however is not being adhered to properly as was the case in August 2010. Major problems in maintaining the water level arrive at the time of draining of the lake as was the case in August 2010 and impounding more water in the reservoir to meet the high demand during summer, as was the case this winter. The reason for draining include maintain the water level a little lower to maintain a cushion for sudden inflow of floodwaters during monsoon. Even through the priority of the water management may be for irrigation purposes, certain interventions can help the birds as well. Maintenance of a water level a feet lower from November to March every year will throw mudflats open on all the edges of the terrestrial habitats and since this is not the growing season for the natural grasses of the area, they would not encroach onto these flats. This would provide ideal habitat for waders which are no longer seen in OBS the way they were seen in the past before the colonization of mudflats and other shallow water areas by *Typha* and other grasses. The mudflats would also provide resting areas for many species of waterfowl. A dialogue with the irrigation department may be initiated by the OBS management to look at the feasibility of the above suggestion.

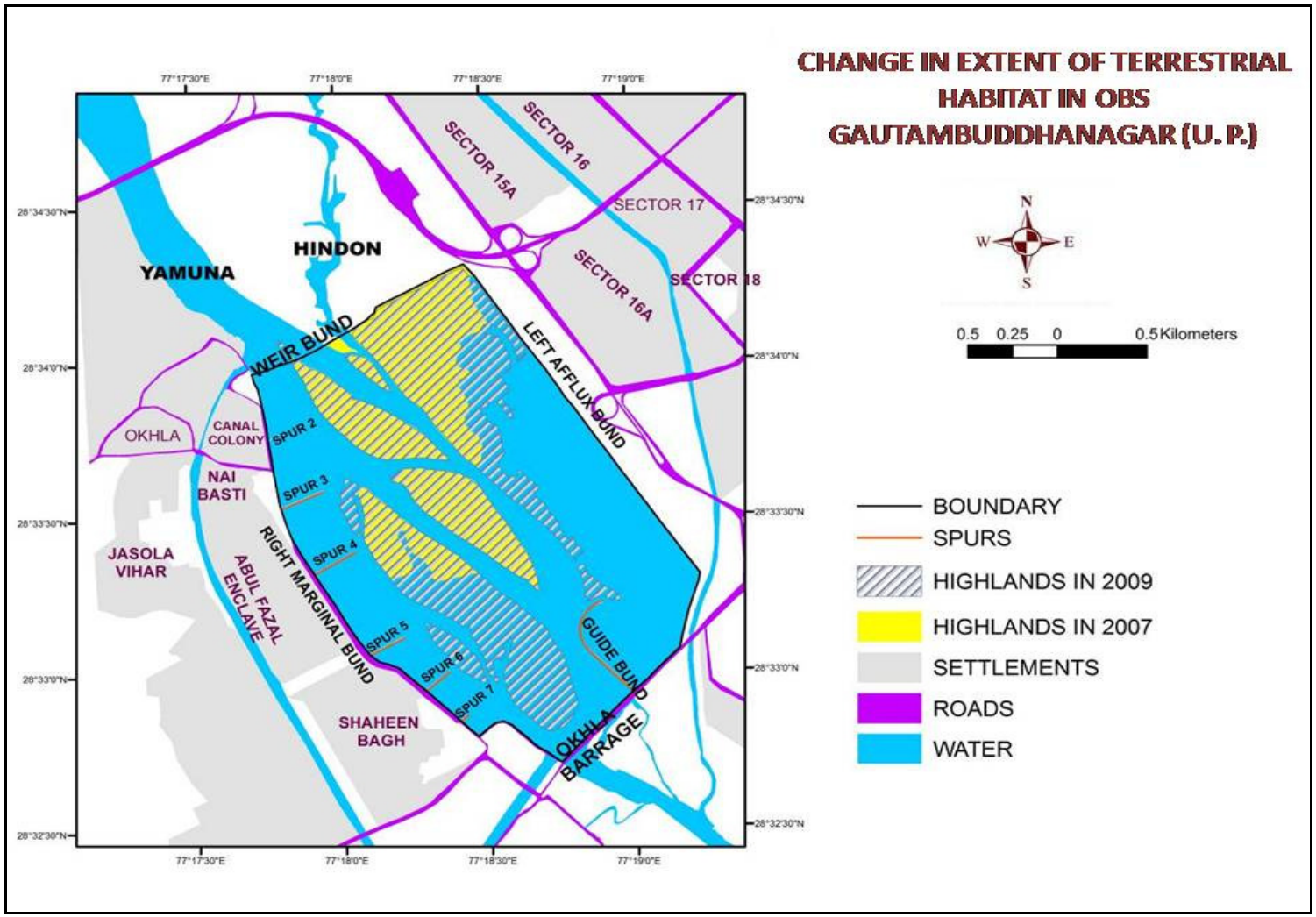


Fig. 6.6 Change in extent of terrestrial habitat in OBS (2007-2009)

6.5.2 Miscellaneous habitat management

6.5.2.1 Sprinkling of wheat in Oct/Nov in moist high ground areas to attract geese

The areas immediately to the north of the weir dam have short grass and have been known to be favourite sites for wintering Geese species. These areas are to be maintained as moist grasslands and to facilitate feeding by the Geese, could be sprinkled with wheat in November. Similar practices in Pong dam sanctuary in Himachal Pradesh help in attracting Bar-headed Geese in very large numbers (ca. 30,000). In OBS such intervention is necessitated owing to a completely urban surrounding where the Geese cannot find any food for themselves. The areas for wheat sprinkling are indicated in Fig 6.8.

6.5.2.2 Poles/snags at appropriate positions as perches for raptors/other birds

The water spread in OBS particularly the areas next to afflux dam which are very important for birds and bird watching do not have any perch for birds of prey such as Osprey and other water birds such as Cormorants which like to occasionally perch on dry perches clear of the water. It is proposed that a series of artificial perches using wooden poles or tree trunks be erected in the wetland some 50 m away from the afflux bund with the inter-perch distance of approx. 200m.

6.5.2.3 Artificial nest boxes on the trees for terrestrial birds

Despite having a very limited habitat in OBS, the terrestrial birds contribute to over half of species diversity of birds. To sustain the population of these birds in OBS particularly that of cavity nesting birds, nest boxes would be put up on trees on the left afflux bund to facilitate their breeding. Nest boxes with different dimension need to be put up to facilitate the use by different species. They need to be monitored continuously for their success.

6.6 PROTECTION

The main protection issue about OBS relates to regular ingress by people for biomass based resources present in the sanctuary. The details about these dependencies are given in chapter 3. The list of offences in the past five year is given in Appendix XV. As can be seen from this list, majority of the ingress has been for fishing and since the area just up streams of OBS has fishing lease from Delhi Govt. it is difficult to check.

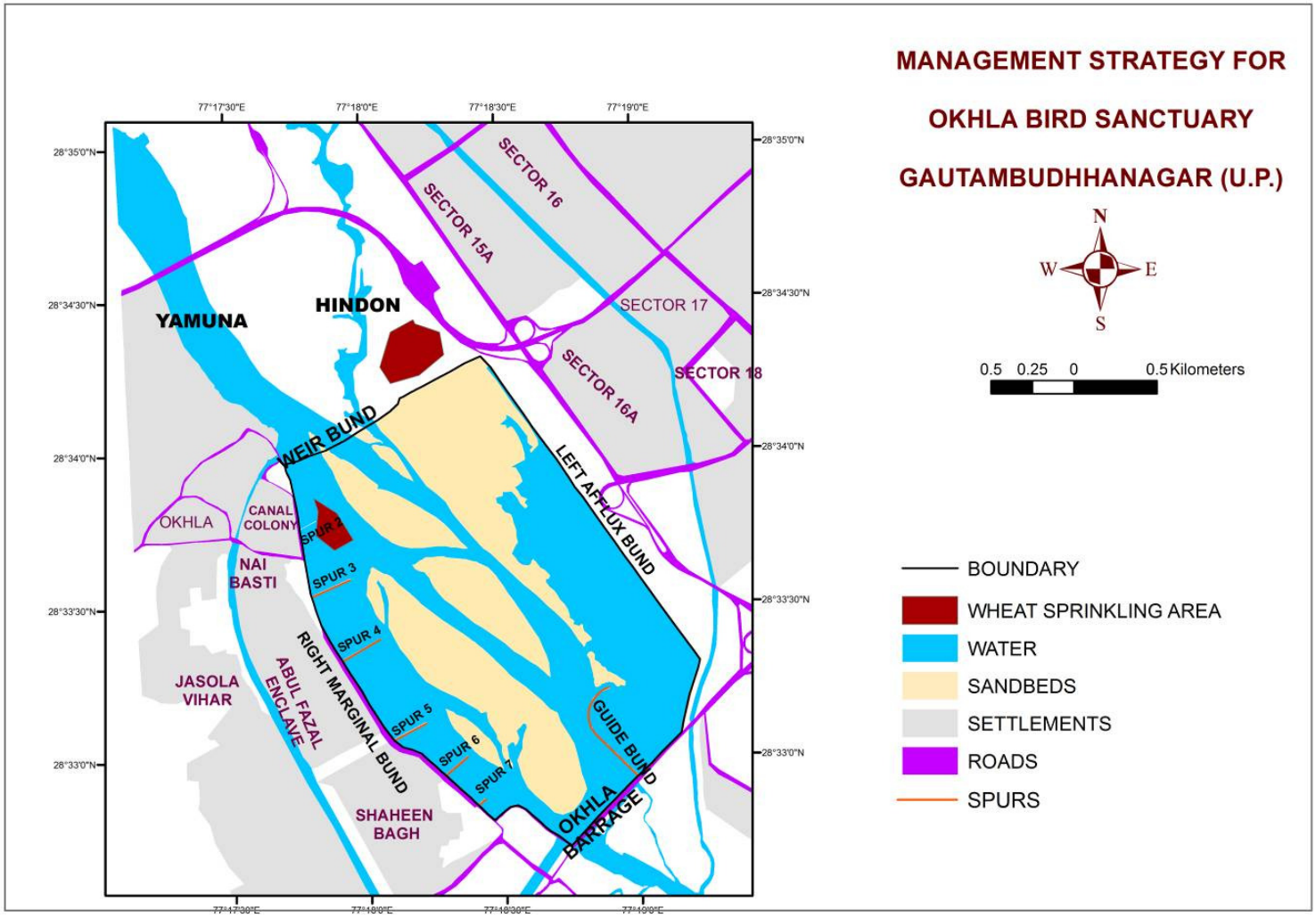


Fig 6.7 Areas identified for wheat sprinkling in winters (shown by arrows)

6.6.1 Dealing with cattle

To deal with the cattle and to prevent them from entering the sanctuary enforcement of proper protection need to be done. At present very few protection staff are there in OBS (Appendix XXIII). More helpers/watchers need to be engaged for the same in appropriate seasons. Eco-development initiatives should also go hand in hand. Village protection committee must be promoted or must be initiated. Fencing may be erected where-ever other measures fail. A special vigil at the northern and western boundaries is required. Details of peoples' involvement have been discussed in Chapter 7.

As per section 33A of Wildlife (Protection) Act, 1972, Chief Wildlife Warden shall take measures for immunisation of livestock kept in or within five kilometers from the boundary of a sanctuary. Consequently cattle immunisation camps are being proposed at regular intervals in which help from veterinary department of UP and Delhi may be taken by the OBS management.

6.6.2 Ingress by people

People around the sanctuary make illegal ingress in to the area for a variety of reasons ranging from grazing to fishing. Sometimes the local people put fire on dry *Typha* reeds. Mobile patrols on land and water need to be established. Two four-wheel vehicles are a must for the protection of the sanctuary, one for the DCF and other for the Range Officer. Four motor-cycles for the rest of the staff are also required for better and efficient protection. In addition two rowing boat are required to check the ingress of fishermen and others in to the wetland. There would be a requirement of boat men for these boats as well, who can be engaged on a daily wages basis. OBS has an old motorboat at present which may need replacement in a few years. This is also proposed in the plan. Even though suggestions for additional staff have been given in Chapter 10, hiring temporary staff during the sensitive periods of the year till new staff is recruited would strengthen the hands of the scanty staff of the sanctuary. A small patrolling hut near the Banyan tree to check ingress of people in the night for fishing etc. should be set up for the staff to act as a base since this part of the OBS is the farthest from their quarters but very sensitive.

A new entry gate at the weir head (Delhi side) may be created so that there is a constant staff presence in this part of the OBS and people from Delhi side have a more convenient entry to the sanctuary. A gate check post will also be established here. Wall/fencing will be extended to the weir bund (Delhi side) from the canal colony (ca. 200m) to secure the sanctuary from this side.

Private security for the four gates of the sanctuary at approximately four corners of the sanctuary, would be engaged with two guards at each gate at a given time during the day hours in two shifts (16 guards in all). For the night when the gates would be locked a *chowkidar* each would be stationed at these gates.

6.7 WATER POLLUTION

Results of water quality testing (section 2.6.5) indicate heavy pollutants entering the OBS from Hindon cut and Yamuna river. In fact just by looking at the water of Yamuna at the OBS, one can make out that it is one of the most polluted rivers of India. Ambitious Yamuna action plans being implemented for last many years do not seem to have visibly influenced the water quality. Stopping the polluting effluents from nearly two dozen major drains of Delhi and the Hindon cut from UP is beyond the scope of this plan. Regular water quality monitoring has been suggested in chapter 9.

6.8 MISCELLANEOUS REGULATIONS

6.8.1 Lopping of trees under high tension line

There is high tension power line which passes along the afflux bund. The trees growing under it are to be lopped periodically (immediately after monsoon) to prevent the risk of accidental discharge which may risk lives of tourists/staff of the sanctuary. The norms set by the power grid corporation according to the voltage of the high tension line may be followed. As suggested earlier the fast growing *Leuceanea* be uprooted and replaced by native short trees like *Zizyphus* species.

6.8.2 Fire protection

Sometime graziers put reed beds on fire intentionally as cattle graze on young shoot of *Typha.* Besides patrolling, preventive measures should be taken to cut temporary fire lines at appropriate locations as and when required. Vegetation on both sides of the road on the left afflux bund up to two meters would be cleared to increase visibility and reduce fire hazards.

6.8.3 Plantation of trees

A large number of trees have been planted particularly on the eastern side of the road running on the left afflux dam on the eastern boundary of the OBS by the NOIDA. The trees include both indigenous and exotics and have been planted in very close spacing. It is suggested that thinning of the same may be done at appropriate time and the exotics may be thinned out preferentially. A list of trees planted is given in Appendix (XXIV). In addition at appropriate locations on the afflux dam and weir dam additional native trees would be planted. No plantations would however be raised on the riverine stretches of the sanctuary.

Chapter 7

Stakeholder participation and ecodevelopment

7.1 RATIONALE OF ECODEVELOPMENT

The concept of ecodevelopment has emerged in India as a means for overcoming the unsustainable resource use practices of the local communities living in and around PAs. However, examples from the field have not indicated very bright results from the beneficiary oriented-approach to participation under Ecodevelopment schemes. There is growing realization that unless the local communities are given definite roles, responsibilities and benefits from PAs, merely providing limited economic benefits to the local communities will not ensure the long-term sustainability of such programs. Another lesson that has emerged from implementation of such projects is that while addressing the issues of local livelihoods and development, there is a need to develop linkages with other stakeholders and to set up mechanisms to institutionalize these linkages. However, the inputs and activities undertaken should be site specific and unique to the situation.

Unlike the problems of interface conflict around a typical national park or Sanctuary of the country, the case of Okhla Bird Sanctuary is different. An analysis of interface situation around this Sanctuary clearly indicates that the biotic pressures upon the PA is mainly because of inadequate protection and monitoring, and to a very less extent due to non-settlement of grazing rights of residents of Harola. Thus, the various forms of ecodevelopment inputs that can be envisaged here are:

- To develop local support for Sanctuary protection by ensuring that local people receive economic benefits from conservation of the PAs.
- To provide support for alternate livelihood opportunities for families solely dependent on cattle grazing inside Sanctuary.

Thus, ecodevelopment in Okhla Bird Sanctuary includes a unique agenda of building partnership with local people for Sanctuary protection and conservation awareness.

7.2 OBJECTIVES

Main objectives of ecodevelopment in Okhla Bird Sanctuary will be:

1. To empower the surrounding communities and other stakeholders for protection and scientific management of this unique ecosystem so as to generate their long term stake in PA conservation, and
2. To strengthen the livelihood opportunities of selected families of the surrounding area through a mix of innovative alternatives

7.3 BROAD STRATEGIES

In order to capture the main issues and concerns of the various stakeholders and to arrive at consensus, a one-day consultative workshop was organized in New Delhi on 11th November, 2010 and the report of this workshop is appended as Annexure 1. The outcome of this workshop with respect to handling interface conflict indicates that the main challenge for the management of this Sanctuary is ensuring protection, strengthening the livelihoods opportunities of local people and linking the benefits of PA conservation to the local people. Simultaneously the other issue will be to initiate the programme of ecotourism in Okhla Bird Sanctuary to provide a good visitor experience and create additional livelihood opportunities for the local people. To develop and nurture such an arrangement, the process of ecodevelopment needs to spread over a reasonable period in which various concurrent actions may be initiated. Some of the proposed initiatives are described below.

7.3.1 Awareness, extension and empowerment

Until and unless the local community participate in PA conservation, any effort put in by the Sanctuary management will be a one sided affair. Therefore, community awareness about importance of this unique ecosystem has to be the foundation of any ecodevelopment programme here and community empowerment will be very crucial for this purpose. The PA management should initiate a system of conservation awareness programmes for different target groups. The prominent stakeholders, which need to be covered, will be the local communities, schoolchildren, college students, line agencies, forest department staff as well

as policy makers. Eventually, the Okhla Bird Sanctuary should strive to become a prominent centre of nature education not only for the local stakeholders but also for the educational institutions of Delhi, NOIDA and other nearby cities and towns.

7.3.2 Spearhead teams

The Sanctuary management will have to facilitate the task of empowerment of stakeholders. Currently, the staff strength of the Sanctuary and their management capacities are very low. Moreover, for ecodevelopment programme the involvement of the local communities should start right from the stage of planning. Therefore, it is proposed to constitute a spearhead team consisting of few forest staff (3-4 members) and the representatives of surrounding communities (3-4 members) under the leadership of local range officer. The responsibility of the spearhead team will be institution building and facilitating the micro-planning process.

7.3.3 Capacity building

The process of capacity building has to begin with the training of spearhead team members for the skills and attitudes required for awareness generation and planning. Capacity building programme will have to be decentralized so that the spearhead team could further take up the work of trainings of the village community and other stakeholders directly or in association with other specialists. While some of the training programme could lead to better conservation awareness and empowerment of the communities, others will have to be designed to provide skills related to livelihoods.

7.3.4 Policy and administrative frame work

Management of the Okhla Bird Sanctuary will require lot of decentralization and flexibility of decisions. Therefore, appropriate administrative framework and necessary orders of the government/ forest department will be required to operationalize the functioning of this decentralized mechanism. This will include the roles and responsibilities of the departmental officers, delegation of powers, roles and responsibilities of village ecodevelopment committees (EDCs), etc.

7.3.5 Institution building process

Participatory planning, awareness and capacity building programmes will have to be steered at the Sanctuary level as well as at the level of EDCs in such a way that this facilitates institution building process. Participation of local communities and conflict resolution will be an ongoing process of institution building programme. The communities as well as the forest staff will have to be exposed to good practices of conservation and development work elsewhere in the country so that these lessons can be internalized in the ecodevelopment programme of the reserve. Exposure visits may be planned accordingly.

7.3.6 Micro-planning and local livelihoods

The process of micro planning has to focus particularly on initiating alternative livelihood options compatible with the conservation initiative of this area. The micro-plans for Nayi Basti, Jasola gaon, Harolla gaon and Chilla Saronda will have to be prepared by the spearhead team. Micro-planning process should provide flexibility and space to the dynamic needs and issues of the area. Therefore, it is suggested that the micro-plans should be revisited periodically, in a participatory manner, so as to modify the existing activities or incorporate the designed ones, keeping in mind dual benefit of the community and protection of the Sanctuary. This exercise of re-looking the micro-plans may have to be done at an interval of every two years. Sustainability of the livelihoods will have to be addressed by not only providing benefits of income but also strengthening institutions (EDCs, SHGs, Nature Clubs, etc.), building some physical assets as well as generation of social capital. Management of community development fund for EDCs will be an important aspect of the programme.

7.3.7 Establishment of Okhla Bird Sanctuary Trust (OBST)

Long-term sustainability of the programme will require new institutional arrangements. Therefore, it is proposed that a Sanctuary level trust named Okhla Bird Sanctuary Trust (OBST) may be constituted as a part of institution building process. The trust should have representation of the Sanctuary management, local communities (EDCs), Delhi and UP Forest Department officials, district development authorities of both the state, and other stakeholders at the level of Governing Body and Executive Committee. At Governing Body

level District Collector of Gautam Buddha Nagar could be the chairperson and Sanctuary warden could be the member secretary. Range Officer will be the permanent member in this body. The objective of this trust will be two-fold. Firstly, it will support and facilitate conservation related activities of the Sanctuary and secondly, it will support the programmes of EDCs. In addition to this, the trust will also be responsible for research and monitoring, trainings and conservation awareness programme of the areas. The OBST should have its own financial resources for its functioning. There could be different sources of income for this trust. There could be the funding support from government, incomes from revenue generated from ecotourism, donations from different sources (national and international). The necessary government orders for establishment of such a trust will have to be pursued by the UP Forest Department. Necessary rules for the functioning of the trust as well as the management of finances will have to be framed by the department.

7.4 VILLAGE LEVEL STRATEGIES

The ecodevelopment programme at the village level will have to be steered through EDCs and micro-plans. As the instrument of the micro-plan is very dynamic and flexible it is suggested that revisiting of micro-plans should be carried out at every two years interval to incorporate changes if any in the activities. This process will have to be carried out in a participatory and transparent manner so, as to generate ownership of the communities in the micro-plans and the conservation of Sanctuary. This task will have to be steered by the spearhead team. In the beginning, few trust building activities will have to be undertaken as a part of micro-planning process itself. One of the important areas of trust building will be a system of regular dialogue with the communities and their meaningful engagement in protection and ecotourism related work. Identification and training of few local youth from four EDCs (Nayi Basti, Jasola gaon, Harolla gaon and Chilla Saronda) as tourist guide and their engagement in proposed ecotourism, monitoring and protection programme could be a starting activity. The livelihood component of the micro-plans will have to be prepared in consultation with the selected families solely dependent on the Sanctuary for cattle grazing with very clear agreements regarding mutual roles and responsibilities of forests departments and the beneficiaries. Linking of the community benefits to the

protection/management of the Okhla Bird Sanctuary should be the fundamental principle of any livelihood option provided in the micro-plan. Even though the details of livelihoods options will have to be decided at the time of micro-planning, some of the broad areas of such indicative livelihood and community welfare activities could be protection of Sanctuary and the resident and migratory birds, ecotourism/nature guides and other activities related to tourism management in the Sanctuary, monitoring and research in the PA, etc.

NREGA scheme being implemented by district agencies and Panchayats should be efficiently used for EDCs. This can really make a difference to provide employment to the needy local communities.

7.5 SETTLEMENT OF RIGHTS

As stated earlier, payment of compensation and settlement of rights of local people especially those of Harolla has not yet been completed. This needs to be taken up immediately. Unless these rights are settled, involvement of local people in Sanctuary protection and other programmes will be a futile exercise! Hence, the entire proceedings of settlement have to be completed expeditiously .

7.6 ACCESS TO CREMETORIUM AND TEMPLE

At present, there are two crematoriums inside the Sanctuary in the western section and one just outside the northern boundary. Crematoriums situated inside the Sanctuary need to be shifted outside the Sanctuary. Being a very sensitive issue, proper consultation with the affected people needs to be done to look for alternative sites outside the Okhla Bird Sanctuary. The residents of Harolla gaon, Naya Bans, Atta gaon and Nithari use the crematorium near E-2 section of northern boundary. They use the weir bund road (northern boundary) to reach to the crematorium spot. As an immediate step, an alternate path just outside the boundary may be provided for these people to reach to the crematorium. Eventually, this crematorium also has to be shifted possibly close to the DND flyover or just beyond it in consultation with the affected community. This issue should be taken up as a

part of the overall settlement process. Likewise, the regular visitors to the two temples situated inside the Sanctuary should be persuaded and shifted outside the Sanctuary after proper consultations with them.

7.7 KANWADIYA CAMP, CHHAT DEVOTEES AND JOGGERS

As stated earlier, *Kanwadiya* camp is organized every year just outside the northeastern boundary of the Sanctuary in the month of *shrawan* (July- August). This camp is organized by volunteers of Harolla gaon and Naya Bans under the supervision of district administration and held for about a week for providing temporary shelter to roughly 35,000-40,000 people. The *Kanwandiyas* use left afflux bund road to avoid traffic and Sanctuary is closed for visitors during this period. Loud music played at the campsite creates noise. In consultations with the local *Kanwardiya* committee, appropriate steps should be taken for diversion of the pressure to outside the Sanctuary. Like wise, the pressure of large number of *Chhat pooja* devotees on the left afflux bund road should be diverted after persuasions and proper consultations. The regular visitors to Sanctuary using the left afflux bund road for morning and evening walks should be persuaded for a monthly pass on payment of the entry fee.

7.8 PROTECTION

There is no short cut to strict vigilance and protection for the Sanctuary management, which is dealt separately in chapter 6. However, the ecodevelopment programme in Okhla Bird Sanctuary will always keep in focus involvement of local people in the protection work. In fact, the EDC members should ultimately, become the main string of protection for the Sanctuary in association with forest staff. The ecotourism guides and other user groups will have to play a very important role in protection, even when there are no tourists. Such arrangements will have to be worked out by the Sanctuary management. In this monitoring involvement of other stakeholders will be necessary so, as to make the process transparent.

Chapter 8
Tourism and Interpretation

8.1 GENERAL

Relations among conservationists, communities and tourism practitioners have not always been smooth and collaborative. For years, protected areas were managed through minimal collaboration with the people living in or near these areas. However, the concept and practice of ecotourism brings these different actors together. Ecotourism has emerged as a platform to establish partnerships and to jointly guide the path of tourists seeking to experience and learn about natural areas.

8.2 OBJECTIVES

The main objective of ecotourism in OBS is to ensure ecologically responsible tourism, which is responsive. The objectives can be listed as follows:

1. To promote conservation awareness amongst the visitors through conservation education and interpretation.
2. To find harmonious relationship between the place, the visitor and the host community.

8.3 STRATEGIES

Zoning is the principal method used to deploy visitors, and hence it is critical in achieving the appropriate combination of concentration and dispersal. For tourism, zoning involves decisions about what type of recreational opportunity will be provided and where. Zoning can also be temporal, that is an area set aside for different uses at different times seasonally.

In OBS two sub-zones have been identified for tourism within the main management zone. They are

(i) Nature Watch Sub-Zone

(ii) Conservation education Sub-Zone

8.3.1 Nature Watch Sub-Zone

General Objective: Protect the natural environment and offer recreational opportunities characterized by a minimum of environmental impact and very few group encounters.

Description: The zone will allow movement of visitors interested in observing nature particularly bird watching. This zone would be restricted to the paths all around the wetland.

Short hedges (approximately 2.5 feet high) will be planted along the nature watch zone so that the birds would get less disturbed by the tourists walking on these trails. These would also deter tourists from leaving the designated paths. Preferred species for the hedge would be *Putranjiva roxburghii*. Other substitutes may be *Duranta sp*. and *Dodonea viscosa*.

Rules and regulations:

1. Public use is limited to special groups accompanied by guides.
2. Visitor groups are limited to a maximum of ten people
3. Plastic free zone

8.3.2 Conservation Education Sub-Zone

General objective: Offer educational and recreational opportunities within a relatively natural environment, with medium concentration of visitors.

Description: Consists of Interpretation centre at gate 1 and Visitor centre on the DND flyover entrance. This zone will serve as a transitional zone between the high densities of visitors and those zones with a minimum of public use. Since the visitors will be captive within the complex, therefore the zone will require less attention on the part of park personnel.

Rules and regulations:

1. Site with all basic amenities like toilet and drinking water.
2. Picnicking by visitors not allowed
3. Entry to the complex on payment of cover charge.

8.3.3 Education and Interpretation

Once people get to the reserve, they will want to know about the resources and facilities available, what activities are permitted or forbidden and about safety and security. As their understanding of the area grows, visitors show more curiosity about its natural environment. This is the demand to which interpretation has to respond. The result of well-planned interpretation should be a more fulfilling visitor experience for thousands of people.

Interpretation and education go beyond simply informing, towards developing an understanding and appreciation. There are three fundamental objectives of interpretation – to promote management goals, to promote understanding of the department and to improve understanding of the protected area. To be used as a visitor management tool, interpretation has to affect visitor's behavior and in order to do this, motivate through an appeal to human needs and emotions.

8.3.3.1 Entry gates

OBS has at present two entry gates on the UP side shown as Check post 1 and 2 in the map. It is proposed to make the entry gate more appealing by erecting thematic entry gates to the OBS. The entry gate would include mural of the bird sanctuary, a signage on do’s and don’ts and a signage on timings for visitor entry.

INTERPRETIVE MATRIX DEFINED

THEMES Stories are at the heart of human interaction, and at the heart of interpretation. The largest, most overarching stories of a place are the base of primary interpretive themes. As the structure for interpretation, five categories linked by education facilitate a connection between the interests of the visitor, the priorities of the Management Plan, and the meaning of the wetland.		ADULT	SCHOOL GROUPS	FAMILY	SELF-GUIDED	GUIDED TOURS	SIGNAGE	INTERPRETATION CENTRE	PROGRAMS	PUBLICATIONS	VISITOR CENTRE
STATEMENTS OF SIGNIFICANCE	**SUB THEMES**	**AUDIENCE**				**SERVICES AND MEDIA**					
Statements of Significance embody the power of the place through a factual representation of what makes a place special. They are the elements that are so attractive, interesting, and engaging that people choose to experience them time and time again. They describe the distinctiveness of the wetland, natural, scientific, recreational and inspirational resources. Significances may evolve over time as a result of discoveries or other updates to knowledge about the place.	**Subthemes** are the smaller, more specific stories that nest within primary interpretive themes. They offer opportunities for deeper, more focused explorations of the meanings of the place.	**Audiences** include many existing and potential groups and subgroups. For use in this Matrix, groups have been simplified into the following: Adult, School Groups, Youth and Family, and Self-Guided Learners.				It is possible that almost all Statements of Significance, themes, and subthemes, could be interpreted using all of the interpretive services and media listed and reach all audiences. This Matrix, however, suggests the best intersection of these categories.					

ECOLOGY

Displaying a broad array of wetland plants, OBS is a unique place for comparing and contrasting plants found in wetlands.		ADULT	SCHOOL GROUPS	FAMILY	SELF-GUIDED	GUIDED TOURS	SIGNAGE	INTERPRETATION CENTRE	PROGRAMS	PUBLICATIONS	VISITOR CENTRE
STATEMENTS OF SIGNIFICANCE	**SUB THEMES**	**AUDIENCE**				**SERVICES AND MEDIA**					
OBS is an outdoor plant classroom focused on plant science, ethnobotany and wetlands ecology. As human pressures affect the ecological health of the Earth, living museums such as OBS, have a duty to educate people about the values of plants, of their natural environments, and of their importance in urban landscapes. The climate, topography and exposure of OBS provide uniquely diverse growing conditions that allow for a wider variety of plants to grow there.	The study of plants and their ecological role is a foundation for understanding related systems	•	•	•		X			X		
	Plants and plant communities growing in wetland areas around the country share many common traits and have evolved to survive in similar, yet distinct, ecosystems.	•	•	•	•	X			X	X	
	Plants must be grown and managed under the proper soil, water and light conditions; casually referred to as “right plant, right place.”	•	•	•	•	X	X		X	X	X
	The movement and passage of time through geological, hydrological, biophysical, biological and cultural cycles is demonstrated in OBS.	•	•	•	•	X	X	X	X		X

CONSERVATION

OBS is a unique living museum that displays and interprets the biodiversity of the wetland to educate visitors about the need to conserve wetland biodiversity.		ADULT	SCHOOL GROUPS	FAMILY	SELF-GUIDED	GUIDED TOURS	SIGNAGE	INTERPRETATION CENTRE	PROGRAMS	PUBLICATIONS	VISITOR CENTRE
STATEMENTS OF SIGNIFICANCE	**SUB THEMES**	**AUDIENCE**				**SERVICES AND MEDIA**					
OBS has 188 plant species belonging to 55 families. Of these are trees (32), shrubs (10), herbs (107), grasses (16), sedges (14) and climber (9). 302 species of birds have been recorded in OBS, aquatic (124) and terrestrial (178). OBS is unique among as an urban green spaces: it embodies the ecological values of any well-forested urban park – such as habitat for wildlife, absorption of pollutants and moderation of urban heat island effects – while most effectively displaying the beauty, diversity, and landscape utility of the wetland flora and fauna	Biodiversity, the variety of life on Earth, provides sustenance for human survival.	•	•	•	•	X			X		
	OBS contributes to the conservation of avifauna	•	•	•	•	X			X	X	
	Continued management of invasive species is critical.	•	•	•	•	X	X		X	X	X
	OBS protects and manages extensive urban wildlife habitat, a diminishing resource in metropolitan areas.	•	•	•	•						
	Human impacts made on natural systems can be mitigated by instilling values of stewardship in visitors.	•	•	•	•						

COMMUNITY AND RECREATION

OBS is an oasis providing a retreat from the pressures of modern urban life and an opportunity for urban dwellers to connect with the natural world.		ADULT	SCHOOL GROUPS	FAMILY	SELF-GUIDED	GUIDED TOURS	SIGNAGE	INTERPRETATION CENTRE	PROGRAMS	PUBLICATIONS	VISITOR CENTRE
STATEMENTS OF SIGNIFICANCE	**SUB THEMES**	**AUDIENCE**				**SERVICES AND MEDIA**					
OBS performs important functions of a wetland amidst metropolitan cities with presence of 13 globally threatened bird species. A significant number of visitors to OBS utilize the area for personal reflective or recreational purposes unrelated to any formal educational aspects of the wetland.	With its size and diverse landscapes, OBS provides a unique and enduring sense of place for visitors experiencing the natural world through many informal and personal ways.	•	•	•	•	X			X		
	Wetlands such as OBS, provide important experiences and places for visitors.	•	•	•	•	X			X	X	
	Visitors to the OBS come from local, regional, state and international locations.	•	•	•	•	X	X		X	X	X
	OBS visitors can be a partner in management of the park by following standard park etiquette, volunteering for bird counts and/or attending programs or special events.	•	•	•	•	X		X	X		X

HISTORICAL

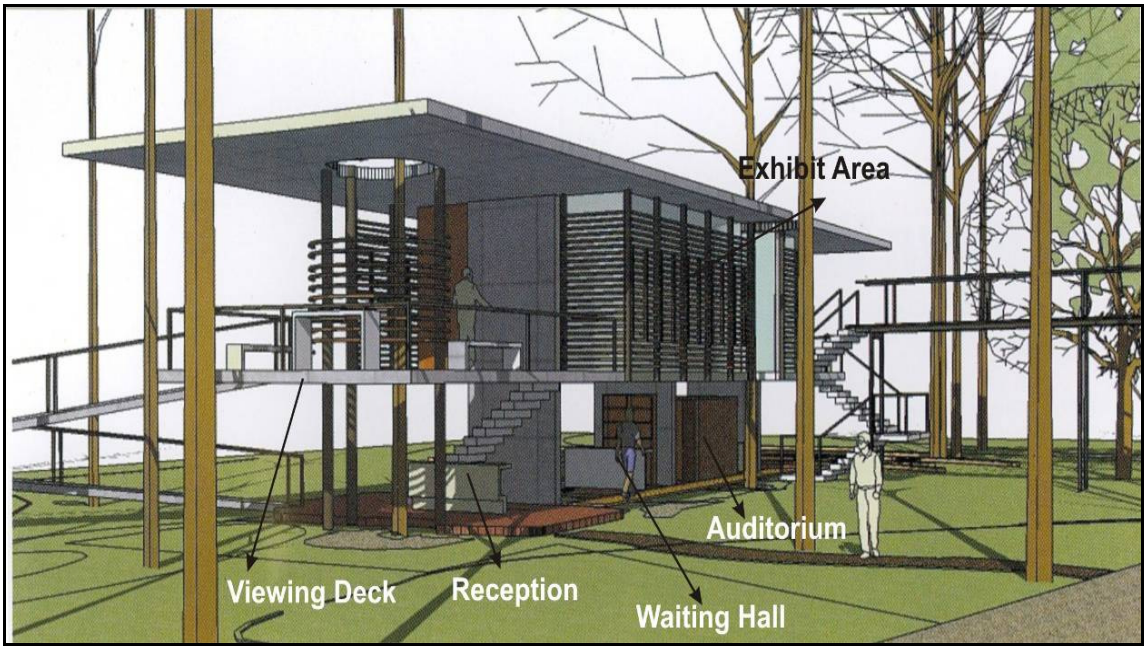
With elements dating back over 60 years, OBS is an ornithologically significant site.		ADULT	SCHOOL GROUPS	FAMILY	SELF-GUIDED	GUIDED TOURS	SIGNAGE	INTERPRETATION CENTRE	PROGRAMS	PUBLICATIONS	VISITOR CENTRE
STATEMENTS OF SIGNIFICANCE	**SUB THEMES**	**AUDIENCE**				**SERVICES AND MEDIA**					
Major General H.P.W. Hutson recorded the birds of OBS during the course of his ornithological surveys in the Delhi region in 1945.	Construction of the OKhla barrage across the river Yamuna has resulted in a small portion of river to become a static water system and has been declared as a bird Sanctuary.	•	•	•	•	X			X		
The Agra canal originates from OBS barrage and was opened in 1874 for navigation.	People from surrounding areas are dependent on the Sanctuary for biomass extraction and grazing.	•	•	•	•	X			X	X	

8.3.3.2 Interpretation and visitor centre

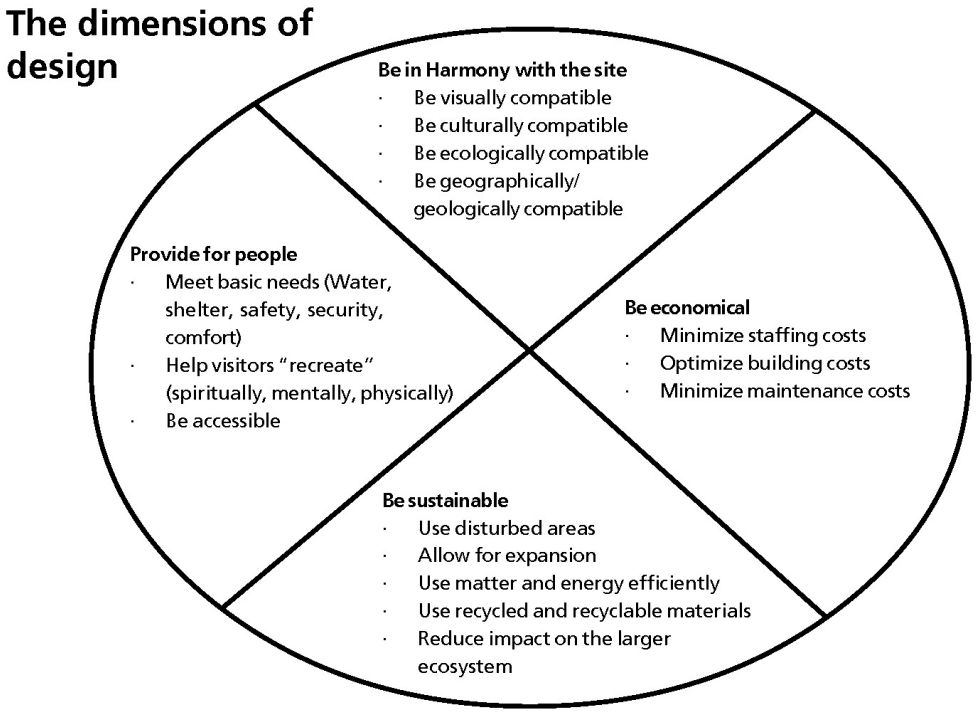
This Concept Plan below deals with nature interpretation and Conservation Education for the visitors and public use of the OBS wetland. The goal is a safe, visually coherent, appropriately sequenced and enjoyable experience with a focus on Conservation education centre, exhibits and self-guided activities. Signs and exhibits, when designed, fabricated and installed will welcome, orient and educate visitors to the facilities and the resources of the wetland. Through the signs, exhibits and brochures, visitors would be better informed about how to enjoy their visit and how to manage their activities to avoid affecting the area. Most visitor questions will be anticipated and answered by the exhibits, so personal contact with the Forest Department staff will not be necessary to understand the purpose and objective of the protected area.

Though this plan means to simplify and organize elegantly, it also suggests methods to reach different people of varied backgrounds, from all parts of the city and of all ages.

8.3.3.2.1 The building



The design of the building is based on Green technology. The building design is such that it has ample natural light and aeration. The diagram below provides the dimensions of the designs:



Panel 1: Map of the OBS

The panel would depict the map of the reserve and indicate the tourism zones, which the visitors can use. This would be in Ceramic and would be vandal proof.

Panel 2: Walk in diorama of the OBS

The exhibit would depict the life in the wetland with life size models of important birds found in the reserve. The diorama would also have calls of important birds, which the visitors can click and listen to.

Panel 3: Avifauna of OBS

132 migratory and resident birds have been recorded in this area. The panel would depict pictorially the migrant and resident birds and their behavior. Calls of birds would also be

included in the panel to make it interactive for visitors and the children coming to the nature interpretation centre.

Panel 4: Flora and Vegetation

The panel would depict both the wetland as well as the island vegetation. Importance of different species for the fauna and avifauna would be emphasized. Along with pictorial depiction, herbarium too would be displayed. Vegetation would be classified into natural vegetation and those that occur due to biotic and abiotic disturbance. This would help visitors understand what is good for the wetland system and what should not happen.

Panel 5: Management

The panel would describe the management issues and also describe the initiatives taken by the Forest Department.

8.3.3.2.2 Film Show Hall

The Interpretation Centre will have a hall with a seating capacity of 20-30 visitors at a time. The hall would require a screen, computer and a LCD projector of atleast 4500 lumens.

8.3.3.2.3 Souvenir Kiosk

The Interpretation Centre building would host a souvenir kiosk which would cater refreshment as well souvenir for the visitors.

8.3.3.2.4 Amenities

The Interpretation centre area would have a toilet and drinking water facility.

8.3.3.3 Entrance/Orientation Kiosk

The entrance kiosk located at the entrance of the DND flyover side will house a detailed map of the wetland, showing boundaries, indicating “you are here” and pointing out major points of interest. The kiosk will also list the rules to be followed while on the visit to the wetland.

The kiosk is so placed that it is visible to the visitors.

Thus the kiosk will also be the site for entry permit, hiring of guides for nature watch zone and trails, sale of souvenirs and holding area for the visitors.

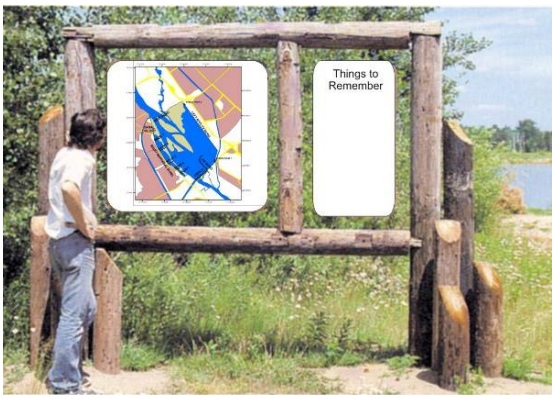
8.3.3.4 Signs and Visitor Circulation

A minimum number of signs are needed to welcome, direct or control visitors at OBS. These signs are described below:

8.3.3.4.1 Pathway Directional Signs

In order to regulate the flow of visitor's pathway directional signs should be placed at regular intervals so that the visitors are aware which way to go. The signs should lead them to all the major facilities that are available for the visitors such as toilets, drinking water and conservation education centre.

Since the area is open for visitors and minimum park management personnel is visualized in this complex therefore steel reinforced concrete footing with granite sign panel is recommended.

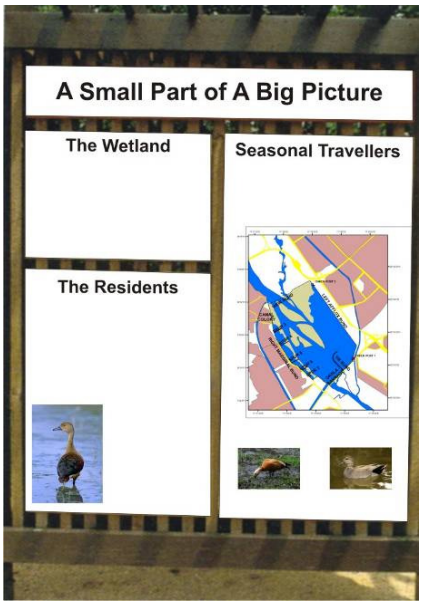


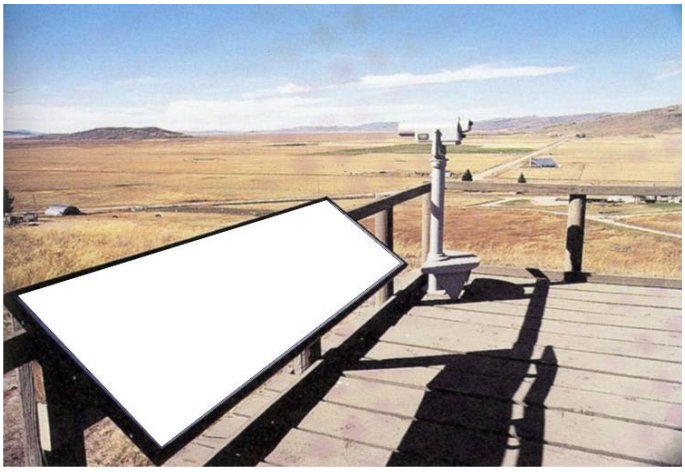
This should also include the "Things to remember" signage near the entry kiosk and in the Conservation education Zone.

Signage declaring the presence of the Conservation Reserve should be placed on the NOIDA Expressway so that travelers are aware of the presence of a natural heritage site next door.

8.3.3.4.2 Interpretive Signages

Interpretive signage about the importance of wetland, geophysical setting of OBS and about birds can be placed around the wetland and on the viewing platform. These signage should be low lying and non-obtrusive. The signage can either be made on steel panels or in ceramic, both of which are vandal proof and are outdoor material.





8.3.3.4.3 Temporary Signs

Since the area receives migratory birds for a limited period, therefore some signs can be made temporary which can be removed. These signs can be placed for interpreting seasonal or temporary things like migratory birds, which arrive in the area during a particular period. The signs are to be placed all around the wetland.

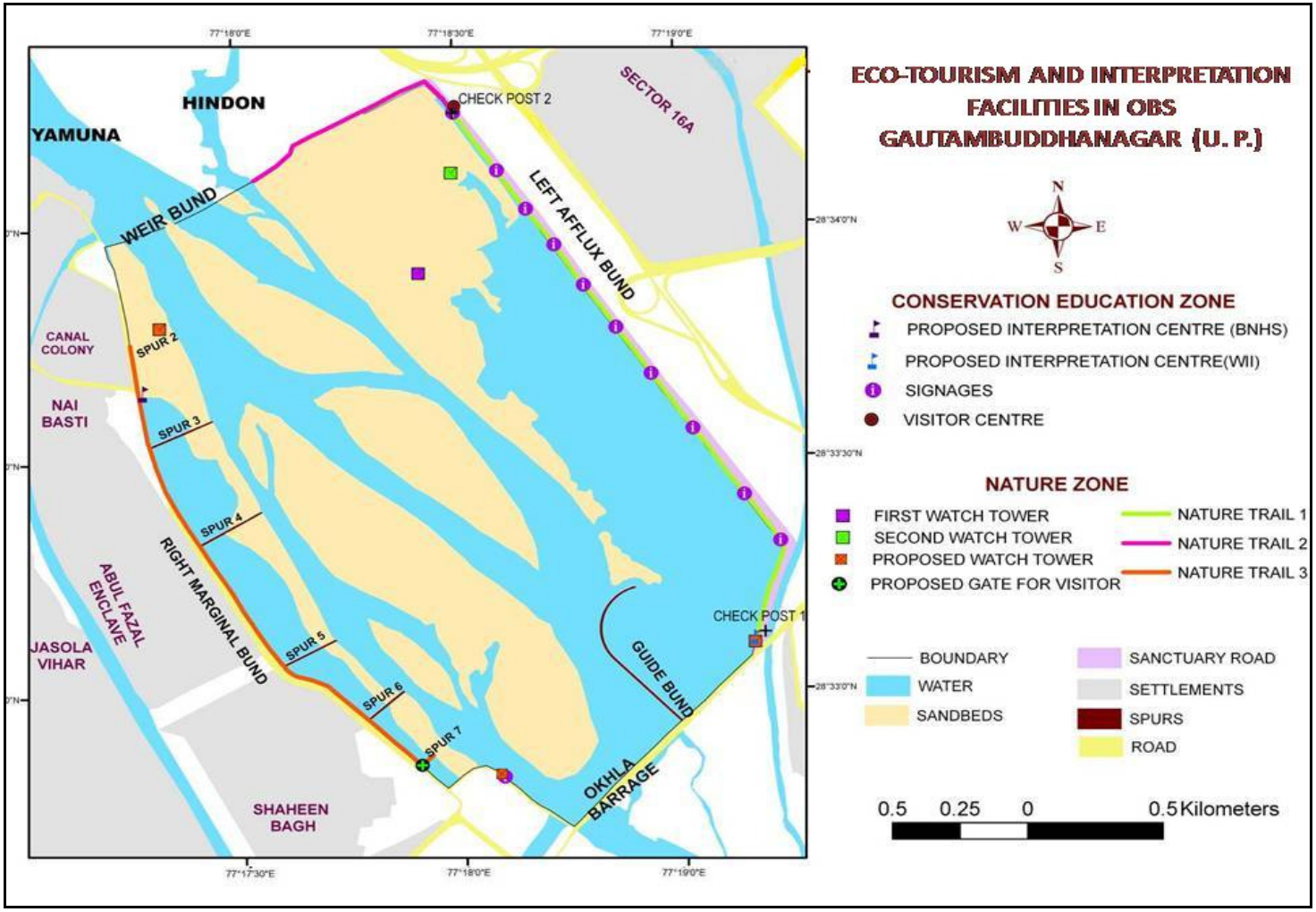


Fig. 8.1 Map showing current and proposed eco-tourism and interpretation facilities in OBS

8.3.3.5 Publications

All publications should have a masthead so that the viewer can know which department has produced it. This would also act as a means of publicity for the area and the department. Following publications for the area are proposed:

* Park Brochure
* Checklist of Birds
* Plant identification guide
* Poster
* Outreach Material

Publications can be priced and the money generated can be ploughed back through village eco-development committee. The revenue can be used for replenishing the stock of publications and maintaining the conservation education centre.

8.3.3.5.1 Park Brochure

The brochure would consist of all the information that would be required by a visitor for planning the visit and what one can expect to see in the area. The brochure would also have the Things to remember i.e. what one is allowed to do on the trip within the wetland and what is prohibited. It would also give information on the timings and the period when the wetland would be open for visitation.

8.3.3.5.2 Checklist of Birds

OBS has large number of resident and migratory birds which have been recorded. The area is already popular as birding site for bird lovers and students. In order to assist the students a checklist of birds needs to be prepared. This checklist can be regularly updated with the help of Birdwatchers and new records mentioned. The checklist can be produced both in Hindi and English so that the students from the neighboring schools and colleges can also be benefited.

8.3.3.5.3 Plant Identification Guide

Since most of the facilities in OBS would be self guided therefore it is important that the visitors have some aid to assist them in knowing about the wetland. The plant identification guide would be a source of information for wetland flora. Visitors can use the guide to know about the plants in the wetland and on the islands.

The guide would be pictorial with line drawing depiction of the plant. It will have the Botanical name, common name, flowering and fruiting period, importance to the habitat and to the fauna.

8.3.3.5.4 Posters

A series of pictorial posters is recommended namely:

* Fishes
* Avifauna
* Importance of a Wetland

These posters can be sold as souvenirs for the visitors and can also be used as out reach material for the local villagers and school children. The posters can be produced in two languages i.e. Hindi and English.

8.3.3.5.5 Outreach Material

Since students, local villagers and children are also potential visitors to the area, therefore it is important to reach out to them through publications and other means.

These materials can be used during special event days such as World Environment Day 5th June, Wildlife Week 2nd-8th October and Wetland Day 2nd February. Special events increase public awareness of an environmental issue and motivate people to participate by focusing their attention on a particular issue.

The materials can be activity booklets like draw and color, sheets or cards. The material produced has to be in Hindi and in easy to understand language. The activity booklets can be used by schoolchildren and on successful completion of the activity; they can be given a Certificate, which would motivate the children to learn more about their surrounds.

Environment clubs too can be formed in schools and colleges located around the wetland and activities can be undertaken in the clubs.

Souvenirs such as caps postcards posters, diaries, calendars and CDs of local flora and fauna may be developed to be sold through the outlets in OBS interpretation and visitor centre.

A **website** may be developed to promote visitation and awareness about OBS amongst the masses.

8.3.3.6 Nature camps

Nature camps for school children should be regularly organized at OBS. Considering that most of the schools located in Delhi would be the priority target group, the camps could be daylong and there is no need to have over night camps. The OBS management should reach out to the schools by inviting them to the wetland giving details of the facilities, which they can offer. Formal letter should be written by the DFO to the schools to this effect. On special events like the World Wetland Day or World Biodiversity Day special events may be organized with the involvement of school kids.

There is a need to procure some equipment for the above activities involving school students as well as visiting tourists. It is proposed that few binoculars and two high-power tripod mounted spotting scopes be procured for the reserve. The binoculars could be loaned out to the nature guides accompanying the tourists so that the equipment is safe and can be used by the tourist for enhancing their observation and there by their satisfaction levels.

8.3.3.7 Nature Trails

Three trails have been identified in the OBS. Trail 1 goes parallel to the left afflux bund. Trail 2 is on the weir bund and goes up to the check post and trail 3 is all along the right marginal bund starting from the gate proposed to be opened. The trails will have signages on regular intervals telling the visitors about the birdlife. The starting point will have a map depicting the trail and also the Do's and the don'ts. These trails will be exclusively for the bird watchers.

Suitable dustbins would be placed at appropriate locations along the trails identified for the visitors. The design of the dustbin may be aesthetically and visually appealing with respect to the environs. Periodical clearance of these would be ensured through a contractual arrangement.

At present only one wooden watch tower exists in OBS. This needs to be replaced with a proper iron watch-tower and two additional ones need to be erected. The location of one of these is given in the map at the end of this chapter and another one is proposed at the end of the guide bund.

Battery operated vehicles (golf carts) would be used for movement of visitors between gate 1 and gate 2. It would also be used for taking special need visitors around OBS.

8.3.3.8 Nature Guides

Local educated youths from the adjoining area should be trained as nature guides. At present, there are not much visitors and therefore the youths see no advantage of pursuing their career as nature guides. Once the facilities are developed and visitors start flowing then there would be an opportunity for the youths. These youths can take groups of students/ visitors on the journey around the wetland. They can also be deployed to take care of the entry kiosk and the Conservation education zone.

Training of guides should be a routine process. During non-visitation period, the guides can undergo refresher course training. This would update their knowledge and sharpen their skills required for guiding visitors. During the refresher course, the performance of the guides also needs to be evaluated. The recognized nature guides who meet the criteria of knowledge and conduct would be issued identity cards from the OBS management.

The guides can charge a fee of Rs 100/ per trip (upto 2 hrs) from the visitors. The group size should not be more than 10 persons. Later, on evaluation, the management can decide to enhance the guide fee and categorize them as per knowledge and skills i.e. Grade 'A' guides would be the one who have good knowledge about the birds and is good at communication in both English and Hindi. His/her fee would be on the higher side as he/she would cater to

groups in the nature watch zone. The recognized nature guides may be provided with half jackets of olive colour with OBS logo.

Once tourism picks up then the guides will have to contribute a small amount of the fee to the staff welfare fund. The other portion would be contributed by the department either from the proceeds of the sale of publications or souvenirs or else from some other funding source like donations etc. This fund would provide financial support in times of need to the guides and would provide for uniform and books for the guides.

8.3.3.9 Audio Visual

Films are an important media of mass communication and it works well in rural settings. Series of 20 minutes film on the wetland, its importance, threats and its mitigation can be prepared with strong visual content. The commentary can be in Hindi for use in the villages but English commentary can be superscripted for use in the Conservation Education Centre. The film should be professionally done on DG Beta Pro Formats and sound recorded on DAT (Digital Audio Tape). The DVD is easy to handle and maintain. Not only this, now in most of the rural areas one can find DVD players through which the films can be shown on television screen for small audience and through LCD projector for large audience.

8.3.3.10 Website

Web surfing today is a common source of information for the visitors. It is, therefore, recommended that a website for the Okhla Bird Sanctuary should be hosted so that the visitors can get relevant information. The website should include the arrival and departure of migratory birds and also special events that would be organized in the Sanctuary.

Chapter 9

Research and Monitoring

In order to improve the status of the wetland a good scientific research and monitoring needs to be put in place in the wetland. The research and monitoring activity should look into the various aspects of reliable baseline data collection, water quality, biodiversity values, and siltation and its impact, abundance of various species, ecosystem response monitoring and evaluation, consistent documentation, archiving and referral system and interaction with national and international forums for collaboration of technology transfer.

9.1 POTENTIAL AREAS FOR RESEARCH

The OBS has a good scope for research and monitoring and this is realized by different organisations who have conducted studies on various aspects of the ecosystem. Major-General H. P. W. Hutson recorded the birds of Okhla during the course of his ornithological surveys in the Delhi region during June 1943 to May 1945. Subsequently, Mrs. Usha Ganguli also recorded the avifauna from this site in her book, *A guide to the birds of the Delhi area* (Ganguli 1975). Dr. A.J.Urfi has been monitoring the avi-fauna of this region since 1989 and has published many articles. A number of studies have been conducted on the floodplains of Yamuna in Delhi stretch which includes the floodplains in the OBS region also. A study on Assessment Of Ecological And Hydrological Functions Of Floodplains Of River Yamuna In Delhi Stretch And Developing Strategies For Integrated River Basin Management was conducted by Wetland International-South Asia in 2006. A study by NEERI was conducted as Hydrodynamic Simulation of River Yamuna for Riverbed Assessment: A Case Study of Delhi Region by Ritesh Vijay & Aabha Sargoankar & Apurba Gupta (2007).

Vegetation in the Delhi stretch of the floodplain of the Yamuna River was examined in relation to hydrological characteristics by Tanveera Tabasum, Pamposh Bhat, Ritesh Kumar, Tasneem Fatma and C. L. Trisal from Wetland international And Department of Biosciences, Jamia Millia Islamia (2009) which included the study of floodplains upstream and

downstream of OBS. Besides this, many birdwatchers including the Delhi Bird Group have been contributing to the knowledge and understanding of the avifauna of the wetland including many rare and interesting bird records. The major study on the economic aspect of the Yamuna floodplains in Delhi region has been dealt by Pushpam Kumar. His work on the Valuation of Ecosystem Functions: A Case Study of Wetlands Ecosystem Along the Yamuna River Corridors of Delhi Region (2001) is a premier work on the economic estimates of the ecological functions of the Yamuna floodplains in Delhi. The most extensive work in OBS is done by Wildlife Institute of India in collaboration with Uttar Pradesh Forest Department and Tata Energy Research Institute in the year 2001 and 2002. The study was basically on the ecological, social and hydrological factors affecting the management of wetland systems.

OBS has been a site where students from the research, educational and training institutions located in and around Delhi and NOIDA have been pursuing their short term researches particularly the ones pertaining to their dissertation works. A number of researches are being conducted on various aspects of the wetland every year which can provide a good study to monitor the temporal change in and around the wetland.

NCR has a large number of renowned research institutions, which may be requested to conduct research and help forest department in the management of Sanctuary in a more scientific manner. Some of the research areas, which are more relevant to this wetland and could help in generating baseline data, which can be well utilized, are as follows:

1. Study to generate the baseline data on impact of wetland degradation on migratory and resident bird species found in the OBS.
2. Study, which can generate data on the carrying capacity of tourists inside OBS.
3. Ecological separation amongst wintering waterfowl species in OBS. The topic would dwell into the co-existence of many species of waterfowl at OBS.
4. Preparation of an annotated checklist of Lepidoptera (Butterflies and moths) at OBS.
5. OBS is located in an urban landscape and many development activities in the surroundings result in the changes in the area that need to be studied. A study of

impact of such activities on the environment and various floral and faunal groups in the sanctuary should be undertaken.

6. The sanctuary provides a good opportunity to study the constraints in maintaining a protected area in a dynamic political and socio-economic development environ and research regarding the study of people perspective in such a case can be carried out.

9.2 MONITORING

It is proposed that the department should regularly monitor the water and the soil quality, the status of aquatic vegetation and water-bird diversity. Forest department conducts water-bird count every year in the winters when migration is at its peak. Wetland International and BNHS also organize Asian Waterfowl Count every year.

Habitat monitoring, which includes study of faunal diversity, need to be undertaken regularly. It is proposed to have permanent protocols for the monitoring of the habitat and key faunal elements. Where ever possible and needed help and support of NCR based institutions and organizations would be requested to carry out these programs.

9.2.1 Biodiversity Monitoring

Forest department and few organizations working in the area conducts water bird count every year in the month of January. An informal bird count is also conducted by Delhi Bird Club, in the month of February to prepare a checklist of birds at that time of year. There is a need to bring all these at a common platform to give more clear and significant picture of the avian diversity in the area. Being a Bird Sanctuary, migratory water birds should be monitored every year to understand the population trend of migratory water birds. As all this is done during the winter season, as a result summer and monsoon seasons are generally neglected. There is need to monitor bird population in these seasons also to give a year-round checklist of birds. Monitoring of breeding of different resident species, impact of wetland degradation on bird species is also needed to be done.

Area supports a small population of Blue bull and other vertebrate groups which need to be monitored.

Sanctuary is facing a change in vegetation community due to weed invasion and spread of species like *Typha.* Regular monitoring of vegetation change, invasive species extension and its effect on native species should also be done.

Effect of pollution on animals can be monitored by analyzing levels of pollution toxicity in different organs and body parts of birds (e.g. feathers) and fishes.

9.2.2 Habitat Monitoring

OBS has a mosaic of habitats that is responsible for a rich avifauna. There is a need to monitor these habitats for long-term protection and conservation of various groups of flora and fauna in the Sanctuary.

Permanent plots may be laid out in the bund areas and islands, which form the terrestrial habitat in the Sanctuary. These may then be monitored regularly for vegetation, which would help in detecting change and so help in studying succession.

Monitoring of wetland habitat may also be carried out through interpretation of satellite imageries. The spatial study has helped us to present the status of the Sanctuary and its surrounding landscape for the present year. Regular study of the satellite imageries will provide useful information regarding the dynamic changes in the river course, siltation, change in habitat and the surrounding landscape.

9.2.3 Environmental Monitoring

9.2.3.1 Water and Soil Quality

CPCB and DPCC conduct water quality monitoring every month at different points throughout the stretch of river Yamuna in Delhi. An intensive monitoring of water quality in the Sanctuary should be carried out on a regular basis. During the preparation of the present plan, a water quality monitoring exercise was done in the OBS. The results have been given in chapter 2 in section 2.7.5. The same locations and parameters can be used for

future monitoring also. The samples may be analyzed at a standard water quality testing lab for the following parameters: Temperature, Conductivity, Ph, DO, Salinity, Turbidity and Ammonia, and Phosphorous.

9.2.3.2 Bathymetry

The bathymetry exercise was conducted as a part of preparation of this plan. A bathymetric profile of the reservoir is given in Fig. 2.9. The bathymetric map prepared during this exercise needs to be updated and a digital model of the reservoir needs to be prepared to detect the heavily silted area that needs corrective measures. It is recommended that a similar bathymetric exercise may be carried out every two years to know about the siltation profile of the reservoir in future. The department may consider procuring an electronic echo-sounder for regular and easy bathymetry of the reservoir.

9.2.3.3 Monitoring Yamuna and Hindon Catchment

Yamuna and Hindon Cut water is heavily polluted and being a main water source for OBS, pollution level of water and sediments should be monitored regularly.

9.2.4 Social Monitoring

Socio-economic conditions and dependency of local people on the Sanctuary and the quantity of biomass extracted needs to be monitored periodically to know the extent of biomass including fish biomass extracted. This would also help in assessing the impact of the reserve on local people. Regular monitoring of people participation and community involvement in protecting an urban green space should be done.

Tourism monitoring should become a regular feature of the monitoring programmes. Tourist feedback surveys also need to be taken periodically to know about visitor satisfaction levels and also to seek suggestions from them. Presently, forest department take feedback from tourist which needs to be made intense.

Being situated amidst of metropolitan city, land use dynamics of the surrounding area can be monitored regularly to make comments on any development activity. In decision making for various policies regarding the Sanctuary in urban landscape, spatial pattern of the space needs to be planned properly.

9.2.5 Wildlife Health Monitoring

There is a need to regularly monitor the health of the resident fauna including the migratory birds visiting the sanctuary. The blood samples of the migratory birds should be checked regularly for any kind of disease threat especially bird-flu.

Chapter 10
The Budget

10.1 THE PLAN BUDGET

Formulation of budget proposal has been done on the basis of the proposed work as suggested in chapters 6 to chapters 9. These figures with physical and financial forecast have been incorporated together in this chapter.

As per the Appendix II Section 5 (4) of the judgment of Hon'ble Supreme court of India dated 03.12.2010, on Construction of a park at NOIDA near Okhla Bird Sanctuary (IA No 2609-2610 of 2009 in writ petition no. 202 of 1995) '5% of the total cost of the project (construction of park) be deposited to Forest Department of UP to improve the ecosystem structure and functions, water-bird habitat, public amenities and interpretation centre and improved management of the OBS'. This money should be used for implementation of this management plan of OBS which includes all the above purposes mentioned in the judgment above. Remaining money, if any, may be maintained as a corpus for future use in the management of OBS.

The budget for the Okhla Bird Sanctuary for the plan period of (From 2011-2012 to 2020-2021) will be as follows:

Table 10.1 Summary of budget requirement (in lakh rupees)

Activity	Chapter	Year I	Year II	Year III	Year IV	Year V	Year VI	Year VII	Year VIII	Year IX	Year X	Total
Accomplishing management strategies	6	285.5	81.3	84.35	89.15	96.95	100.3	105.6	108.2	114.5	121.3	1187.2
Eco-development and participatory management	7	29	27	24	24	23.5	15.5	15.5	13.5	13.5	13.5	198
Interpretation facilities and conservation education	8	299.5	27.5	34	30.75	37.8	50.05	47.35	36.45	47.45	42.2	653.05
Research and monitoring	9	9.4	8.4	9.4	8.4	9.4	8.4	9.4	8.4	9.4	8.4	106.8
Total		623.4	144.2	151.75	152.3	167.65	174.25	177.85	166.55	184.85	185.4	2145.05

Table 10.2 Budget proposed for accomplishing management strategies (in lakh rupees)

Sl No.	Activity	Chapter/ Section	Quantity	Year I	Year II	Year III	Year IV	Year V	Year VI	Year VII	Year VIII	Year IX	Year X	Total
I	**Boundaries**	6.2												
	Southern Boundary fencing and maintenance	6.2.2	0.5 km	50	5	5	5	6	6	6	7	7	7	**104**
	Western Boundary wall and Maintenance	6.2.3	0.21 km	5		0.5		0.5		0.5		0.5		**7**
	Western Boundary fencing and live hedge and Maintenance	6.2.3	2 km	4	4	0.5	0.5	0.5	1	1	1	1.5	1.5	**15.5**
II	**Buffer areas**	6.3.2												
	Northern buffer: Survey and demarcation	6.3.2.1	LS	2	2									**4**
	Soutthern buffer: Survey and demarcation	6.3.2.2	LS	1.5	1.5									**3**
III	**Habitat management**	6.5												
	Typha management 1st yr cycle	6.5.1.1	20 ha	4	4	4.5	4.5	5	5					**27**
	Typha management 2nd yr cycle	6.5.1.1	20 ha		2	2	2.5	2.5	3	3				**15**
	Typha management 3nd yr cycle	6.5.1.1	20 ha			2	2.5	2.5	3	3	3.5			**16.5**
	Management of *Luceanea*	6.5.1.2	LS	2.5	3	3	3	3	2	2	2	1	1	**22.5**
	Water Hyacinth manual removal	6.5.1.3	150 ha	25	27	30	33	36	40	44	49	54	60	**398**
	Barrier of poles to check Hyacinth movement	6.5.1.3	2 km	5	5	6	6	7	7	8	8	9	9	**70**
	Water Hyacinth removal using Truxor dredger	6.5.1.3	LS	150										**150**
	Truxor dredger maintenance and running cost	6.5.1.3	LS		15	15	16.5	16.5	18	18	20	20	22	**161**
	Poles/snags as perches for birds	6.5.2.2	LS	0.5		0.5		0.5		0.5		0.5		**2.5**
	Artificial nest boxes	6.5.2.3	50	0.5	0.5		0.5			0.5			0.5	**2.5**

IV	**Protection**	6.6												
	Engagement of patrolling watchers	6.6.1 & 6.6.2	6	3	3	3.5	3.5	4	4	4.5	4.5	5	5	**40**
	Livestock immunisation camps	6.6.1	2	1	1	1	1	1						**5**
	Patrolling hut with water and electricity	6.6.2	1	3		0.5		0.5		0.5		0.5		**5**
	Four wheel vehicles for DCF and RO with POL and maintenance	6.6.2	2	12	2	2	2.5	2.5	3	3	4	4	4	**39**
	Motor-cycles for staff with POL and maintenance	6.6.2	4	2.5	0.5	0.5	0.5	0.5	0.7	0.7	1	1	1	**8.9**
	Rowing boat and maintenance	6.6.2	2	2		0.5		0.5		0.5		0.5		**4**
	Boat-men for rowing boat	6.6.2	2	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	**14.5**
	New Entry gate, Delhi side	6.6.2	1	3		0.5		0.5		0.5		0.5		**5**
	Gate check post at new gate	6.6.2	1	2.5		0.5		0.5		0.5		0.5		**4.5**
V	**Miscellaneous regulations**	6.8												
	Lopping of trees under high tension line	6.8.1	LS	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	**5.5**
	Cutting and maintenance of fire lines	6.8.2	LS	2	2.2	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8	**29**
	Engagement of fire watchers	6.8.2	4	1	1	1.25	1.25	1.25	1.5	1.5	1.5	2	2	**14.25**
	Procurement of fire fighting equipments	6.8.2	LS	1			1			1			1	**4**
	Plantation of native trees	6.8.3	200 @ 500/-	1	1	1	1	1	1	1	1	1	1	**10**
TOTAL				285.5	81.3	84.35	89.15	96.95	100.3	105.6	108.2	114.5	121.3	**1187.2**

Table 10.3 Budget provisions for ecodevelopment and participatory management (in lakh rupees)

Sl No.	Item of work	Unit cost	Year I	Year II	Year III	Year IV	Year V	Year VI	Year VII	Year VIII	Year IX	Year X	Total
1.	Awareness programme	LS	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	10.00
2.	Training of Spear Head Team (Five)	LS	2.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	8.00
3.	Micro-planning (Four)/revisit	LS	3.00	3.00	-	-	-	2.00	2.00	-	-	-	10.00
4.	Capacity Building of EDC Members	LS	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	20.00
5.	Livelihood support in Micro-plans	LS	20.00	20.00	20.00	20.00	20.00	10.00	10.00	10.00	10.00	10.00	150.00
TOTAL			**29.00**	**27.00**	**24.00**	**24.00**	**23.50**	**15.50**	**15.50**	**13.50**	**13.50**	**13.50**	**198.00**

Table 10.4 Budget provision for interpretation facilities and conservation education (in lakh rupees)

Sl No.	Activity	Chapter/ Section	Quantity	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Total
1	Interpretation and visitor centres	8.3.3.2 and 8.3.3.3	2											
	a. Construction			60.00										60.00
	b. Exhibits			50.00										50.00
	c. Toilets and drinking water			4.00										4.00
	c. Miscellaneous			5.00										5.00
	d. Light and sound system			5.00										5.00
	e. Maintenance				5.00	5.00	6.00	6.00	6.00	7.00	7.00	7.00	8.00	57.00
2	Thematic Entry Gate with bird models signages + maintenance	8.3.3.1	1	7.50		0.50		0.50		0.50		0.50		9.50
3	Highway Signages 6' x 4'	8.3.3.4	5	8.00	2.00	0.50	0.50	0.75	0.75	0.75	1.00	1.00	1.00	16.25
4	Nature Camps	8.3.3.6	20/yr	5.00	5.00	5.50	5.50	6.00	6.00	7.00	7.00	8.00	8.00	63.00
5	Construction of sign at place nature trail (4 Trails.) with maintenance	8.3.3.7	3	50.00	5.00	5.00	5.00	6.00	6.00	6.00	7.00	7.00	7.00	104.00
	Dustbins with maintenance and mechanism for waste removal	8.3.3.7	20	1.00	0.50	0.50	0.50	0.60	0.60	0.60	0.70	0.70	0.70	6.40
	Watch-tower with maintenance	8.3.3.7	3	30.00		5.00		5.00		6.00		6.00		52.00
6	Battery operated vehicles (golf cart) with maintenance	8.3.3.7	3	15.00	2.00	2.00	2.25	2.25	2.50	2.50	2.75	2.75	3.00	37.00
7	Publications a.Park Brochure b.Checklist of Birds c. Plant Identification Guide d.Poster e. Outreach material	8.3.3.5	LS	20.00	5.00	5.00	5.00	5.00	7.00	7.00	7.00	7.00	7.00	75.00

8	Website creation, web hosting and upgradation	8.3.3.10	LS	2.00	1.00	1.00	1.00	1.20	1.20	1.50	1.50	2.00	2.00	14.40
9	Audio-Visual aids and film production	8.3.3.9		30.00	2.00	2.00	2.00	2.50	20.00	2.50	2.50	2.50	2.50	68.50
10	Nature guides training	8.3.3.8	LS	2.00		2.00		2.00		3.00		3.00		12.00
11	Equipment for nature observation													-
	a. Binoculars with periodic replacement		15	3.00			2.00			2.00			2.00	9.00
	b. Spotting-scopes with tripods with periodic replacement		2	2.00			1.00			1.00			1.00	5.00
	GRAND TOTAL			299.50	27.50	34.00	30.75	37.80	50.05	47.35	36.45	47.45	42.20	**653.05**

Table 10.5 Budget provisions for research and monitoring (in lakh rupees)

Sl No.	Item of work	Unit cost	Year I	Year II	Year III	Year IV	Year V	Year VI	Year VII	Year VIII	Year IX	Year X	Total
1.	Water and soil quality monitoring	LS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.0
2.	Habitat monitoring	LS	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
3.	Avi fauna and other wildlife monitoring	LS	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.00
4.	Assorted research	LS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	24.0
5.	Research equipment	LS	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0	6.0
6.	Research technician/Biologist	LS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	28.8
TOTAL		**LS**	9.4	8.4	9.4	8.4	9.4	8.4	9.4	8.4	9.4	8.4	106.8

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Appendix I: Government of Uttar Pradesh, Gazette notification No. 577/14-4-82/89

परिशिष्ट–1

ओखला पक्षी विहार की उद्घोषणा का शासनादेश

उत्तर प्रदेश सरकार

वन अनुभाग–4

संख्या–577/14–3–82/89, लखनऊ दिनांक : 8.5.1990

अधिसूचना

चूंकि राज्य सरकार की राय है कि वह क्षेत्र जिसका सविस्तार विवरण नीचे दी गई अनुसूची में दिया गया है, वन्य जीवों और उनके पर्यावरण के संरक्षण, सम्बर्द्धन और विकास के प्रयोजन के लिये पर्याप्त पारिस्थितिक, वनस्पतीय प्राकृतिक और प्राणि तत्वीय महत्व का है,

अतएव, अब वन्य जीव (संरक्षण) अधिनियम, 1972 अधिनियम संख्या 53 सन् 1972 की धारा 18 की उपधारा (2) के अधीन शक्ति का प्रयोग करके, राज्यपाल उक्त क्षेत्र को पक्षी विहार के रूप में विकसित करते हैं, जिसका नाम "ओखला पक्षी विहार" होगा।

अनुसूची

जिला गाजियाबाद में प्रस्तावित "ओखला पक्षी विहार" की सीमा का विवरण :–

उत्तर	–	ओखला, वियर तथा वियर बंद।
पूर्व	–	बायाँ एफ्लक्स बंद।
दक्षिण	–	टाई बंद, न्यू ओखला बैराज, ओरलिंक चैनल।
पश्चिम	–	दायाँ मार्जिनल बंद।

आज्ञा से,

(जी0 गणेश)
सचिव।

संख्या– 577(11)/14–3–82/89 दिनांकित।

प्रतिलिपि अधिसूचना के अंग्रेजी अनुबन्द की प्रतिलिपि सहित अधीक्षक, मुद्रण एवं लेखन सामग्री, ऐशबाग, लखनऊ को इस आशय से प्रेषित कि वे कृपया अधिसूचना को विधायी परिशिष्ट भाग–4 खण्ड–"ख" में असाधारण गजट के दिनांक 11.5.1990 को अंक में प्रकाशित कर दें तथा उसकी 40 प्रतियाँ इस अनुभाग को भेजने का कष्ट करें।

आज्ञा से –

(गोपी मोहन श्रीवास्तव)
संयुक्त सचिव

संख्या– 577(11)/14–3–82/89 दिनांकित।

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित :

1. प्रमुख वन सरंक्षक एवं समस्त मुख्य वन सरंक्षक, उ0प्र0।
2. मुख्य वन्य जीव प्रतिपालक, उ0प्र0।
3. आयुक्त, मेरठ मण्डल, मेरठ।
4. जिलाधिकारी, गाजियाबाद।
5. विधायी अनुभाग–1

आज्ञा से –

(गोपी मोहन श्रीवास्तव)
संयुक्त सचिव

Appendix II: Threatened Bird List of Okhla Bird Sanctuary according to IUCN and BirdLife International 2010.

Sl. No.	Bird Species	Scientific Name	Status
1	White-rumped Vulture	*Gyps bengalensis*	CR
2	Indian Vulture	*Gyps indicus*	CR
3	Sociable Lapwing	*Vanellus gregarious*	CR
4	Baer's Pochard	*Aythya baeri*	EN
5	Egyptian Vulture*	*Neophron percnopterus*	EN
6	Greater Adjutant	*Leptoptilos dubius*	EN
7	Baikal Teal	*Anas formosa*	VU
8	Sarus Crane	*Grus antigone*	VU
9	Indian Skimmer	*Rynchops albicollis*	VU
10	Pallas's Fish Eagle	*Haliaeetus leucoryphus*	VU
11	Greater Spotted Eagle	*Aquila clanga*	VU
12	Lesser Adjutant	*Leptoptilos javanicus*	VU
13	Bristled Grassbird	*Chaetornis striata*	VU
14	Finn's Weaver	*Ploceus megarhynchus*	VU
15	Dalmatian Pelican	*Pelecanus crispus*	VU
16	Ferruginous Pochard*	*Aythya nyroca*	NT
17	Black-bellied Tern*	*Sterna acuticauda*	NT
18	Grey-headed Fish Eagle	*Ichthyophaga ichthyaetus*	NT
19	Darter*	*Anhinga melanogaster*	NT
20	Black-headed Ibis*	*Threskiornis melanocephalus*	NT
21	Painted Stork*	*Mycteria leucocephala*	NT
22	Blacknecked Stork	*Ephippiorhynchus asiaticus*	NT
23	Black-tailed Godwit*	*Limosa limosa*	NT

CR- Critically Endangered, VU- Vulnerable, NT- Near Threatened, * - Birds observed during the present study

Appendix III: Monthly average of rainfall and other important meteorological factors

Month	Max temp (^{0}C)	Min temp (^{0}C)	Humidity (%)	Rain (mm)	Wind speed	Potential evaporation (mm)
Jan	21.10	7.30	77.00	20.30	8.30	14.00
Feb	24.20	10.10	68.00	15.00	10.10	26.00
Mar	30.00	15.40	56.00	15.80	10.70	83.00
Apr	36.20	21.50	39.00	6.70	11.20	161.00
May	39.60	25.90	37.00	17.50	12.80	204.00
Jun	39.30	28.30	52.00	54.90	13.70	209.00
Jul	35.10	26.80	75.00	231.50	9.90	196.00
Aug	33.30	25.90	80.00	258.70	8.30	176.00
Sep	33.90	24.40	72.00	127.80	8.90	158.00
Oct	32.90	19.50	62.00	36.30	6.10	112.00
Nov	28.30	12.80	61.00	5.00	6.10	43.00
Dec	23.00	8.20	73.00	7.80	7.40	21.00

Appendix IV: Checklist of vegetation identified in 2010

Sl. No.	Scientific Name	Habit	Family	Habitat		
1	*Abutilon indicum*	S	Malvaceae	Terrestrial		
2	*Acacia nilotica*	T	Mimosaceae	Terrestrial		
3	*Acalypha indica*	H	Euphorbiaceae	Terrestrial		
4	*Achyranthes aspera*	H	Amaranthaceae	Terrestrial		
5	*Ageratum conyzoides*	H	Asteraceae	Terrestrial		
6	*Ailanthus excelsa*	T	Simroubaceae	Terrestrial		Planted
7	*Albizia procera*	T	Mimosaceae	Terrestrial		
8	*Alhagi pseudalhagi*	H	Fabaceae	Terrestrial		
9	*Alstonia scholaris*	T	Apocynaceae	Terrestrial		Planted
10	*Alternanthera pungens*	H	Amaranthaceae	Terrestrial		
11	*Alternantherea philoxeroides*	H	Amaranthaceae	Terrestrial	aquatic	
12	*Alternantherea sessilis*	H	Amaranthaceae	Terrestrial	semi-aquatic	
13	*Alysicarpus vaginalis*	H	Fabaceae	Terrestrial		
14	*Amaranthes tricolor*	H	Amaranthaceae	Terrestrial		
15	*Amaranthes viridis*	H	Amaranthaceae	Terrestrial		
16	*Amaranthus paronychioides*	H	Amaranthaceae	Terrestrial		
17	*Anagalis arvensis*	H	Primulaceae	Terrestrial		
18	*Argemone mexicana*	H	Papaveraceae	Terrestrial		
19	*Argemone ochroleuca*	H	Papaveraceae	Terrestrial		
20	*Arundo donax*	G	Poaceae	Terrestrial	semi-aquatic	
21	*Avena sterilis*	G	Poaceae	Terrestrial		
22	*Azadirachta indica*	T	Meliaceae	Terrestrial		Planted
23	*Azolla pinnata*	Fern	Azollaceae		Aquatic	
24	*Basella rubra*	H C	Basellaceae	Terrestrial		
25	*Bauhinia purpurea*	T	Caesalpiniaceae	Terrestrial		
26	*Blepharis maderaspatensis*	H	Acanthaceae	Terrestrial		
27	*Boerhavia difusa*	H	Nyctaginaceae	Terrestrial		
28	*Bombax ceiba*	T	Bombacaceae	Terrestrial		
29	*Brachiaria distachya*	G	Poaceae	Terrestrial		
30	*Brachiaria ramosa*	G	Poaceae	Terrestrial	semi-aquatic	
31	*Calotropis gigantea*	H	Asclepiadaceae	Terrestrial		
32	*Cannabis sativa*	H	Cannabinaceae	Terrestrial		
33	*Carex alopecuroides*	H	Cyperaceae		semi-aquatic	
34	*Cassia occidentalis*	H	Caesalpiniaceae	Terrestrial		
35	*Cassia tora*	H	Caesalpiniaceae	Terrestrial		
36	*Cenchrus ciliaris*	G	Poaceae	Terrestrial		
37	*Centella asiatica*	H	Apiaceae	Terrestrial	semi-aquatic	
38	*Chenopodium album*	H	Chenopodiaceae	Terrestrial		
39	*Chenopodium ambrosioides*	H	Chenopodiaceae	Terrestrial		
40	*Chenopodium murale*	H	Chenopodiaceae	Terrestrial		
41	*Circium arvensis*	H	Asteraceae	Terrestrial		
42	*Cleome viscosa*	H	Cleomaceae	Terrestrial		
43	*Commelina benghalensis*	H	Commelinaceae	Terrestrial	aquatic	
44	*Commelina forskalii*	H	Commelinaceae	Terrestrial		
45	*Commelina kurzii*	H	Commelinaceae	Terrestrial	semi-aquatic	

46	*Cordia dichotoma*	T	Boraginaceae	Terrestrial		
47	*Coronopus didymus*	H	Brassicaceae	Terrestrial		
48	*Cotula hemispaerica*	H	Asteraceae	Terrestrial		
49	*Croton bonplandianum*	H	Euphorbiaceae	Terrestrial		
50	*Cuscuta reflexa*	H	Cuscutaceae	Parasite		
51	*Cynodon dactylon*	H	Poaceae	Terrestrial		
52	*Cyperus bulbosus*	H	Cyperaceae	Terrestrial	semi-aquatic	
53	*Cyperus compressus*	H	Cyperaceae	Terrestrial		
54	*Cyperus iria*	H	Cyperaceae	Terrestrial	semi-aquatic	
55	*Cyperus kyllingia*	H	Cyperaceae	Terrestrial		
56	*Cyperus nutans*	H	Cyperaceae	Terrestrial		
57	*Cyperus triceps*	H	Cyperaceae	Terrestrial		
58	*Dactyloctenium aegyptium*	G	Poaceae	Terrestrial		
59	*Dalbergia sissoo*	T	Fabaceae	Terrestrial		
60	*Datura metel*	H	Solanaceae	Terrestrial		
61	*Delonix regia*	T	Caesalpiniaceae	Terrestrial		Planted
62	*Desmodium triflorum*	H	Fabaceae	Terrestrial		
63	*Dichanthium annulatum*	G	Poaceae	Terrestrial		
64	*Dregia volubilis*	H C	Asclepiadaceae	Terrestrial		
65	*Eclipta alba*	H	Asteraceae	Terrestrial	semi-aquatic	
66	*Ehretia laevis*	T	Ehretiaceae	Terrestrial		
67	*Eichornia crassipes*	H	Pontederiaceae		Aquatic	
68	*Elaeocharis palustris*	H	Cyperaceae		semi-aquatic	
69	*Enterolobium repens*	T	Mimosaceae	Terrestrial		Planted
70	*Enydra fluctuans*	H	Asteraceae		Aquatic/ semi-aquatic	
71	*Eragrostis pilosa*	G	Poaceae	Terrestrial		
72	*Eregeron canadensis*	H	Asteraceae	Terrestrial		
73	*Erythrina*	T	Fabaceae	Terrestrial		Planted
74	*Euphobia heterophylla*	H	Euphorbiaceae	Terrestrial		
75	*Euphorbia granulata*	H	Euphorbiaceae	Terrestrial		
76	*Euphorbia hirta*	H	Euphorbiaceae	Terrestrial		
77	*Ficus bengalensis*	T	Moraceae	Terrestrial		
78	*Ficus bengjamina*	T	Moraceae	Terrestrial		Planted
79	*Ficus palmata*	S	Moraceae	Terrestrial		
80	*Ficus religiosa*	T	Moraceae	Terrestrial		
81	*Ficus sp*	T	Moraceae	Terrestrial		Planted
82	*Fimbristylis dichotoma*	H	Cyperaceae	Terrestrial	semi-aquatic	
83	*Fimbristylis ferruginea*	H	Cyperaceae	Terrestrial	semi-aquatic	
84	*Fimbristylis quinquangularis*	H	Cyperaceae	Terrestrial		
85	*Fimbristylis spathacea*	H	Cyperaceae	Terrestrial		
86	*Gnaphalium purpureum*	H	Asteraceae	Terrestrial		
87	*Gomphrena celosioides*	H	Amaranthaceae	Terrestrial		
88	*Grevillea robusta*	T	Proteaceae	Terrestrial		Planted
89	*Hibiscus micranthus*	H	Malvaceae	Terrestrial		
90	*Holoptelea integrifolia*	T	Ulmaceae	Terrestrial		
91	*Hydrocotyle sybthorpioides*	H	Apiaceae		semi-aquatic	
92	*Imperata cylindrica*	G	Poaceae	Terrestrial		
93	*Indigofera hochstetteri*	H	Fabaceae	Terrestrial		
94	*Indigofera linnaei*	H	Fabaceae	Terrestrial		
95	*Ipomoea aquatica*	H	Convolvulaceae		aquatic	

96	*Ipomoea arachnosperma*	H C	Convolvulaceae	Terrestrial		
97	*Ipomoea fistulosa*	S	Convolvulaceae	Terrestrial	semi-aquatic	
98	*Ipomoea pentaphylla*	H	Convolvulaceae	Terrestrial		
99	*Ipomoea sindica*	H	Convolvulaceae	Terrestrial	aquatic	
100	*Ischaemum indicum*	G	Poaceae	Terrestrial		
101	*Kickxia ramosissima*	H	Scrophulariaceae	Terrestrial		
102	*Kigelia pinnata*	T	Bignoniaceae	Terrestrial		Planted
103	*Kirganelia reticulata*	S	Euphorbiaceae	Terrestrial		
104	*Laggera aurita*	H	Asteraceae	Terrestrial		
105	*Lantana camara*	S	Verbenaceae	Terrestrial		
106	*Launea nudicaulis*	H	Asteraceae	Terrestrial		
107	*Lemna perpusilla*	H	Lemnaceae		Aquatic	
108	*Malva parviflora*	H	Malvaceae	Terrestrial		
109	*Malvastrum corromandelianum*	H	Malvaceae	Terrestrial		
110	*Mazus pumilus*	H	Scrophulariaceae	Terrestrial		
111	*Melia azedarach*	T	Meliaceae	Terrestrial		
112	*Melilotus alba*	H	Fabaceae	Terrestrial		
113	*Melilotus indica*	H	Fabaceae	Terrestrial		
114	*Melothria madespatana*	H C	Cucurbitaceae	Terrestrial		
115	*Morus alba*	T	Moraceae	Terrestrial		
116	*Mukia maderaspatana*	H	Cucurbitaceae			
117	*Nelumbo nucifera*	H	Nelombonaceae		Aquatic	
118	*Nicotiana plumbaginifolia*	H	Solanaceae	Terrestrial		
119	*Oenanthe javanica*	H	Apiaceae	Terrestrial	semi-aquatic	
120	*Oldenlandia corymbosa*	H	Rubiaceae	Terrestrial		
121	*Oplismenus burmanii*	G	Poaceae	Terrestrial		
122	*Oxalis corniculata*	H	Oxalidaceae	Terrestrial		
123	*Oxystelma secamone*	H C	Asclepiadaceae	Terrestrial		
124	*Parkinsonia aculeata*	T	Fabaceae	Terrestrial		Planted
125	*Parthenium hysterophorus*	H	Asteraceae	Terrestrial		
126	*Paspalum distichum*	G	Poaceae	Terrestrial	semi-aquatic	
127	*Pergularia daemia*	H C	Asclepiadaceae	Terrestrial		
128	*Peristrophe bicalyculata*	H	Acanthaceae	Terrestrial		
129	*Phenix sylvestris*	T	Arecaceae	Terrestrial		
130	*Phragmites karka*	G	Poaceae	Terrestrial	semi-aquatic	
131	*Phyla nodiflora*	H	Verbenaceae	Terrestrial	semi-aquatic	
132	*Pithecellobium dulce*	T	Mimosaceae	Terrestrial		
133	*Polygonum barbatum*	H	Polygonaceae	Terrestrial	semi-aquatic	
134	*Polygonum glabrum*	H	Polygonaceae	Terrestrial	semi-aquatic	
135	*Polygonum hydropiper*	H	Polygonaceae	Terrestrial	semi-aquatic	
136	*Polygonum lapathifolium*	H	Polygonaceae		Aquatic/ semi-aquatic	
137	*Polygonum plebejum*	H	Polygonaceae	Terrestrial		
138	*Polypogon fugax*	G	Poaceae	Terrestrial		
139	*Pongamia glabra*	T	Fabaceae	Terrestrial		
140	*Portulaca oleracea*	H	Portulacaceae	Terrestrial		
141	*Prosopis cineraria*	T	Mimosaceae	Terrestrial		
142	*Prosopis juliflora*	T	Mimosaceae	Terrestrial		
143	*Pulicaria crispa*	H	Asteraceae	Terrestrial		
144	*Pupalia lappacea*	H	Amaranthaceae	Terrestrial		
145	*Ranunculus sceleratus*	H	Ranunculaceae	Terrestrial	semi-aquatic	

146	*Rhynchosia minima*	H C	Fabaceae	Terrestrial		
147	*Ricinus communis*	H	Euphorbiaceae	Terrestrial		
148	*Rorippa nasturtium-aquaticum*	H	Brassicaceae		Aquatic/ semi-aquatic	
149	*Rumex dentatus*	H	Polygonaceae	Terrestrial		
150	*Rungia pectinata*	H	Acanthaceae	Terrestrial		
151	*Sacharum bengalensis*	H	Poaceae	Terrestrial		
152	*Sacharum spontaneum*	H	Poaceae	Terrestrial		
153	*Salvadora oleoides*	S	Salvadoraceae	Terrestrial		
154	*Salvinia auriculata*	H	Salviniaceae		Aquatic	Weed
155	*Scirpus litoralios*	H	Cyperaceae		Aquatic	
156	*Scirpus roylei*	H	Cyperaceae		Aquatic/ semi-aquatic	
157	*Setaria glauca*	G	Poaceae	Terrestrial		
158	*Sida acuta*	H	Malvaceae	Terrestrial		
159	*Sida cordifolia*	H	Malvaceae	Terrestrial		
160	*Sida rhomboidea*	H	Malvaceae	Terrestrial		
161	*Sizigium cumini*	T	Myrtaceae	Terrestrial		
162	*Solanum nigrum*	H	Solanaceae	Terrestrial		
163	*Solanum surrattense*	H	Solanaceae	Terrestrial		
164	*Soliva anthemifolia*	H	Asteraceae	Terrestrial		
165	*Sonchus arvensis*	H	Asteraceae	Terrestrial		
166	*Spirodela polyrhiza*	H	Lemnaceae		Aquatic	
167	*Suaeda maritima*	H	Chenopodiaceae	Terrestrial		
168	*Tabernaemontana divaricata*	S	Apocynaceae	Terrestrial		
169	*Tamarindus indica*	T	Caesalpiniaceae	Terrestrial		Planted
170	*Tamarix dioica*	S	Tamaricaceae	Terrestrial		
171	*Tecomella undulata*	S	Bignoniaceae	Terrestrial		
172	*Tephrosia pumila*	H	Fabaceae	Terrestrial		
173	*Tephrosia purpurea*	H	Fabaceae	Terrestrial		
174	*Tephrosia villosa*	H	Fabaceae	Terrestrial		
175	*Thevetia peruviana*	T	Apocynaceae	Terrestrial		Planted
176	*Tinospora sinensis*	H C	Menispermaceae	Terrestrial		
177	*Trichosanthes cucumerina*	H C	Cucurbitaceae	Terrestrial		
178	*Tridax procumbens*	H	Asteraceae	Terrestrial		
179	*Typha angustifolia*	H	Typhaceae	Terrestrial	semi-aquatic	
180	*Typha elephantina*	H	Typhaceae	Terrestrial	semi-aquatic	
181	*Urena lobata*	H	Malvaceae	Terrestrial		
182	*Vernonia cineria*	H	Asteraceae	Terrestrial		
183	*Vetiveria zizanioides*	G	Poaceae	Terrestrial		
184	*Withania somnifera*	H	Solanaceae	Terrestrial		
185	*Xanthium strumarium*	H	Asteraceae	Terrestrial		
186	*Youngia japonica*	H	Asteraceae	Terrestrial		
187	*Zizyphus mauritiana*	T	Rhamnaceae	Terrestrial		
188	*Zizyphus nummularia*	S	Rhamnaceae	Terrestrial		

H - Herb; H C- Herbaceous climber; S- Shrub; T - Tree; G- Grass

Appendix V: Species of birds reported from records resulting from fieldwork since 1989 (Urfi, 2003)

Sl. No.	Birds	Scientific Name	Status
1	BLACK FRANCOLIN	*Francolinus francolinus*	
2	GREY FRANCOLIN	*Francolinus pondicerianus*	R, C
3	RAIN QUAIL	*Coturnix coromandelica*	R, O
4	INDIAN PEAFOWL	*Pavo cristatus*	R, UC
5	LESSER WHISTLING-DUCK	*Dendrocygna javanica*	R, UC
6	GREATER WHITE-FRONTED	*Anser albifrons*	V
7	GREYLAG GOOSE	*Anser anser*	W, O
8	BAR-HEADED GOOSE	*Anser indicus*	W, UC
9	RUDDY SHELDUCK	*Tadorna ferruginea*	W, C
10	COMMON SHELDUCK	*Tadorna tadorna*	W, O
11	COMB DUCK	*Sarkidiornis melanotos*	?, UC
12	COTTON PYGMY-GOOSE	*Nettapus coromandelianus*	?, UC
13	GADWAL	*Anas strepera*	W, UC
14	FALCATED DUCK	*Anas falcata*	V
15	EURASIAN WIGEON	*Anas penelope*	W, UC
16	MALLARD	*Anas platyrhynchos*	W, UC
17	SPOT-BILLED DUCK	*Anas poecilorhyncha*	R,C
18	NORTHERN SHOVELER	*Anas clypeata*	W, C
19	NORTHERN PINTAIL	*Anas acuta*	W, C
20	GARGANEY	*Anas querquedula*	PM, C
21	BAIKAL TEAL	*Anas formosa*	V
22	COMMON TEAL	*Anas crecca*	W, C
23	RED-CRESTED POCHARD	*Rhodonessa rufina*	W, UC
24	COMMON POCHARD	*Aythya ferina*	W, C
25	FERRUGINOUS POCHARD	*Aythya nyroca*	W, UC
26	BAER'S POCHARD	*Aythya baeri*	V
27	TUFTED DUCK	*Aythya fuligula*	W, C
28	GREATER SCAUP	*Aythya marila*	V
29	COMMON GOLDENEYE	*Bucephala albellus*	V
30	SMEW	*Mergellus clangula*	V
31	YELLOW-LEGGED BUTTONQUAIL	*Turnix tanki*	?, O
32	BARRED BUTTONQUAIL	*Turnix suscitator*	R, O
33	EURASIAN WRYNECK	*Jynx torquilla*	W, O
34	YELLOW-CROWNED WOODPECKER	*Dendrocopos mahrattensis*	R, UC
35	BLACK-RUMPED FLAMEBACK	*Dinopium benghalense*	R, UC
36	BROWN-HEADED BARBET	*Megalaima zeylanica*	R, C
37	COPPERSMITH BARBET	*Megalaima haemacephala*	R, C
38	INDIAN GREY HORNBILL	*Ocyceros birostris*	R, C
39	COMMON HOOPOE	*Upupa epops*	R, C
40	EUROPEAN ROLLER	*Coracias garrulus*	PM
41	INDIAN ROLLER	*Coracias benghalensis*	?, C
42	COMMON KINGFISHER	*Alcedo atthis*	R, UC
43	WHITE-THROATED KINGFISHER	*Halcyon smyrnensis*	R, C
44	PIED KINGFISHER	*Ceryle rudis*	?, UC
45	GREEN BEE-EATER	*Merops orientalis*	R, C
46	BLUE-CHEEKED BEE-EATER	*Merops persicus*	M, UC
47	BLUE-TAILED BEE-EATER	*Merops philippinus*	M, UC
48	PIED CUCKOO	*Clamator jacobinus*	M, UC
49	LARGE HAWK CUCKOO	*Hierococcyx sparverioides*	PM
50	COMMON HAWK CUCKOO	*Hierococcyx varius*	?, UC

51	ASIAN KOEL	*Eudynamys scolopacea*	R, C
52	GREATER COUCAL	*Centropus sinensis*	R, UC
53	ALEXANDRINE PARAKEET	*Psittacula eupatria*	R, UC
54	ROSE-RINGED PARAKEET	*Psittacula krameri*	R, C
55	PLUM-HEADED PARAKEET	*Psittacula cyanocephala*	R, UC
56	ASIAN PALM SWIFT	*Cypsiurus balasiensis*	V
57	HOUSE SWIFT	*Apus affinis*	R, C
58	EURASIAN EAGLE OWL	*Bubo bubo*	R(?), O
59	BROWN FISH OWL	*Ketupa zeylonensis*	R(?), O
60	SPOTTED OWLET	*Athene brama*	R, C
61	SHORT-EARED OWL	*Asio flammeus*	PM, O
62	INDIAN NIGHTJAR	*Caprimulgus asiaticus*	?, O
63	SAVANNA NIGHTJAR	*Caprimulgus affinis*	?, O
64	ROCK PIGEON	*Columba livia*	R, C
65	LAUGHING DOVE	*Streptopelia senegalensis*	R, C
66	SPOTTED DOVE	*Streptopelia chinensis*	?, O
67	RED COLLARED DOVE	*Streptopelia tranquebarica*	?, UC
68	EURASIAN COLLARED DOVE	*Streptopelia decaocto*	R, C
69	YELLOW-FOOTED GREEN PIGEON	*Treron phoenicoptera*	R, UC
70	SARUS CRANE	*Grus antigone*	LM, O
71	DEMOISELLE CRANE	*Grus virgo*	W, O
72	COMMON CRANE	*Grus grus*	W, O
73	BROWN CRAKE	*Amaurornis akool*	R, O
74	WHITE-BREASTED WATERHEN	*Amaurornis phoenicurus*	R,C
75	BAILLON'S CRAKE	*Porzana pusilla*	PM?, O
76	RUDDY-BREASTED CRAKE	*Porzana fusca*	R, S
77	WATERCOCK	*Gallicrex cinerea*	R, UC
78	PURPLE SWAMPHEN	*Porphyrio porphyrio*	R, C
79	COMMON MOORHEN	*Gallinula chloropus*	R, C
80	COMMON COOT	*Fulica atra*	W, C
81	BLACK-BELLIED SANDGROUSE	*Pterocles orientalis*	W, O
82	PINTAILSNIPE	*Gallinago stenura*	W, O
83	COMMON SNIPE	*Gallinago gallinago*	W, UC
84	BLACK-TAILED GODWIT	*Limosa limosa*	W, UC
85	EURASIAN CURLEW	*Numenius arquata*	W, UC
86	SPOTTED REDSHANK	*Tringa erythropus*	W(?), O
87	COMMON REDSHANK	*Tringa totanus*	W, PM, C
88	MARSH SANDPIPER	*Tringa stagnatilis*	W, PM, O
89	COMMON GREENSHANK	*Tringa nebularia*	W, UC
90	GREEN SANDPIPER	*Tringa ochropus*	W, UC/O
91	WOOD SANDPIPER	*Tringa glareola*	W, UC
92	TEREK SANDPIPER	*Xenus cinereus*	V
93	COMMON SANDPIPER	*Actitis hypoleucos*	W, C
94	LITTLE STINT	*Calidris minuta*	W, PM, C
95	TEMMINCK'S STINT	*Calidris temminckii*	W, C
96	DUNLIN	*Calidris alpina*	W, UC
97	CURLEW SANDPIPER	*Calidris ferruginea*	PM, O
98	RUFF	*Philomachus pugnax*	W, C
99	GREATER PAINTED-SNIPE	*Rostratula benghalensis*	R, UC
100	PHEASANT-TAILED JACANA	*Hydrophasianus chirurgus*	R, UC
101	BRONZE-WINGED JACANA	*Metopidius indicus*	R, UC
102	EURASIAN THICK-KNEE	*Burhinus oedicnemus*	R, UC
103	GREAT THICK-KNEE	*Esacus recurvirostris*	R(?), O
104	BLACK-WINGED STILT	*Himantopus himantopus*	LM, C

105	PIED AVOCET	*Recurvirostra avosetta*	R, UC
106	COMMON RINGED PLOVER	*Charadrius hiaticula*	V
107	LITTLE RINGED PLOVER	*Charadrius dubius*	W, R, UC
108	KENTISH PLOVER	*Charadrius alexandrinus*	W, PM,UC
109	NORTHERN LAPWING	*Vanellus vanellus*	W, UC
110	YELLOW-WATTLED LAPWING	*Vanellus malarbaricus*	R, O
111	RIVER LAPWING	*Vanellus duvaucelii*	R, UC
112	RED-WATTLED LAPWING	*Vanellus indicus*	R, C
113	SOCIABLE LAPWING	*Vanellus gregarius*	?, O
114	WHITE-TAILED LAPWING	*Vanellus leucurus*	W, UC
115	ORIENTAL PRATINCOLE	*Glareola maldivarum*	LM, O
116	SMALL PRATINCOLE	*Glareola lactea*	LM, O
117	INDIAN SKIMMER	*Rynchops albicollis*	O
118	MEW GULL	*Larus canus*	V
119	YELLOW-LEGGED GULL	*Larus cachinnans*	W, O
120	PALLAS'S GULL	*Larus ichthyaetus*	W, O
121	BROWN-HEADED GULL	*Larus brunnicephalus*	W, UC
122	BLACK-HEADED GULL	*Larus ridibundus*	W, UC
123	SLENDER-BILLED GULL	*Larus genei*	V
124	LITTLE GULL	*Larus minutus*	V
125	GULL-BILLED TERN	*Gelochelidon nilotica*	W, ?
126	CASPIAN TERN	*Sterna caspia*	V
127	RIVER TERN	*Sterna aurantia*	LM, R,
128	COMMON TERN	*Sterna hirundo*	PM (?),
129	LITTLE TERN	*Sterna albifrons*	?, O
130	BLACK-BELLIED TERN	*Sterna acuticauda*	R(?), UC
131	WHISKERED TERN	*Chlidonias hybridus*	R, C
132	WHITE-WINGED TERN	*Chlidonias leucopterus*	PM, V
133	BLACK TERN	*Chlidonias niger*	R, PM
134	OSPREY	*Pandion haliaetus*	W, O
135	ORIENTAL HONEY-BUZZARD	*Pernis ptilorhyncus*	R(?), O
136	BLACK-SHOULDERED KITE	*Elanus caeruleus*	R, O
137	BLACK KITE	*Milvus migrans*	R, C
138	BRAHMINY KITE	*Haliastur indus*	V
139	PALLAS'S FISH EAGLE	*Haliaeetus leucoryphus*	W, R, V
140	GREY-HEADED FISH EAGLE	*Ichthyophaga ichthyaetus*	V
141	EGYPTIAN VULTURE	*Neophron percnopterus*	R, C
142	WHITE-RUMPED VULTURE	*Gyps bengalensis*	R, C
143	INDIAN VULTURE	*Gyps indicus*	R, UC
144	CINEREOUS VULTURE	*Aegypius monachus*	V
145	CRESTED SERPENT EAGLE	*Spilornis cheela*	V
146	EURASIAN MARSH HARRIER	*Circus aeruginosus*	W, C
147	SHIKRA	*Accipiter badius*	R, UC
148	WHITE-EYED BUZZARD	*Butastur teesa*	?, O
149	LONG-LEGGED BUZZARD	*Buteo rufinus*	W, O
150	COMMON BUZZARD	*Buteo buteo*	V
151	UPLAND BUZZARD	*Buteo hemilasius*	V
152	GREATER SPOTTED EAGLE	*Aquila clanga*	W, O
153	TAWNY EAGLE	*Aquila rapax*	?, O
154	STEPPE EAGLE	*Aquila nipalensis*	W, O
155	BONELLI'S EAGLE	*Hieraaetus fasciatus*	V
156	COMMON KESTREL	*Falco tinnunculus*	W, O
157	MERLIN	*Falco columbarius*	W, R
158	EURASIAN HOBBY	*Falco subbuteo*	V

159	LAGGAR FALCON	*Falco jugger*	R, O
160	PEREGRINE FALCON	*Falco peregrinus*	W, UC
161	LITTLE GREBE	*Tachybaptus ruficollis*	R, C
162	GREAT CRESTED GREBE	*Podiceps cristatus*	W, UC
163	DARTER	*Anhinga melanogaster*	R, UC
164	LITTLE CORMORANT	*Phalacrocorax niger*	R, C
165	INDIAN CORMORANT	*Phalacrocorax fuscicollis*	R, C
166	GREAT CORMORANT	*Phalacrocorax carbo*	R, C
167	LITTLE EGRET	*Egretta garzetta*	R, C
168	WESTERN REEF EGRET	*Egretta gularis*	V
169	GREY HERON	*Ardea cinerea*	R, C
170	PURPLE HERON	*Ardea purpurea*	R, C
171	GREAT EGRET	*Casmerodius albus*	R, UC
172	INTERMEDIATE EGRET	*Mesophoyx intermedia*	R, C
173	CATTLE EGRET	*Bubulcus ibis*	R, C
174	INDIAN POND HERON	*Ardeola grayii*	R, C
175	LITTLE HERON	*Butorides striatus*	R(?), O
176	BLACK-CROWNED NIGHT HERON	*Nycticorax nycticorax*	R, C
177	YELLOW BITTERN	*Ixobrychus sinensis*	R, UC
178	CINNAMON BITTERN	*Ixobrychus cinnamomeus*	R, UC
179	BLACK BITTERN	*Dupetor flavicollis*	R, O
180	GREATER FLAMINGO	*Phoenicopterus ruber*	LM, C
181	BLACK-HEADED IBIS	*Threskiornis melanocephalus*	R, C
182	BLACK IBIS	*Pseudibis papillosa*	R(?), UC
183	EURASIAN SPOONBILL	*Platalea leucorodia*	?, C
184	GREAT WHITE PELICAN	*Pelecanus onocrotalus*	W(?), UC
185	DALMATIAN PELICAN	*Pelecanus crispus*	W, O
186	PAINTED STORK	*Mycteria leucocephala*	R, C
187	ASIAN OPENBILL	*Anastomus oscitans*	R(?), C
188	WOOLLY-NECKED STORK	*Ciconia episcopus*	R(?), O
189	WHITE STORK	*Ciconia ciconia*	W, UC
190	BLACK-NECKED STORK	*Ephippiorhynchus asiaticus*	R(?), O
191	LESSER ADJUTANT	*Leptoptilos javanicus*	M, O
192	GREATER ADJUTANT	*Leptoptilos dubius*	V
193	RUFOUS-TAILED SHRIKE	*Lanius isabellinus*	W, O
194	BROWN SHRIKE	*Lanius cristatus*	V
195	BAY-BACKED SHRIKE	*Lanius vittatus*	R, C
196	LONG-TAILED SHRIKE	*Lanius schach*	R, O
197	SOUTHERN GREY SHRIKE	*Lanius meridionalis*	V
198	RUFOUS TREEPIE	*Dendrocitta vagabunda*	R, C
199	HOUSE CROW	*Corvus splendens*	R, C
200	LARGE-BILLED CROW	*Corvus macrorhynchos*	R, UC
201	EURASIAN GOLDEN ORIOLE	*Oriolus oriolus*	R, UC
202	SMALL MINIVET	*Pericrocotus cinnamomeus*	R, O
203	WHITE-BELLIED MINIVET	*Pericrocotus erythropygius*	W, O
204	LONG-TAILED MINIVET	*Pericrocotus ethologus*	W, O
205	WHITE-BROWED FANTAIL	*Rhipidura aureola*	R, O
206	BLACK DRONGO	*Dicrurus macrocercus*	R, C
207	ASHY DRONGO	*Dicrurus leucophaeus*	V
208	WHITE-BELLIED DRONGO	*Dicrurus caerulescens*	V
209	COMMON WOODSHRIKE	*Tephrodornis pondicerianus*	R, UC
210	ORANGE-HEADED THRUSH	*Zoothera citrina*	W, O
211	RED-THROATED FLYCATCHER	*Ficedula parva*	PM, O
212	VERDITER FLYCATCHER	*Eumyias thalassina*	V

213	GREY-HEADED CANARY FLYCATCHER	*Culicicapa ceylonensis*	W, O
214	SIBERIAN RUBYTHROAT	*Luscinia calliope*	V
215	BLUETHROAT	*Luscinia svecica*	W, PM, UC
216	ORIENTAL MAGPIE ROBIN	*Copsychus saularis*	R, UC
217	INDIAN ROBIN	*Saxicoloides fulicata*	R, C
218	BLACK REDSTART	*Phoenicurus ochruros*	W, O
219	PLUMBEOUS WATER REDSTART	*Rhyacornis fuliginosus*	V
220	COMMON STONECHAT	*Saxicola torquata*	W, C
221	WHITE-TAILED STONECHAT	*Saxicola leucura*	R, C
222	PIED BUSHCHAT	*Saxicola caprata*	R, C
223	DESERT WHEATEAR	*Oenanthe deserti*	V
224	BROWN ROCK-CHAT	*Cercomela fusca*	R, C
225	CHESTNUT-TAILED STARLING	*Sturnus malabaricus*	V
226	BRAHMINY STARLING	*Sturnus pagodarum*	R, C
227	ROSY STARLING	*Sturnus roseus*	W, PM, UC
228	COMMON STARLING	*Sturnus vulgaris*	W, C
229	ASIAN PIED STARLING	*Sturnus contra*	R, C
230	COMMON MYNA	*Acridotheres tristis*	R, C
231	BANK MYNA	*Acridotheres ginginianus*	R, C
232	CHESTNUT-BELLIED NUTHATCH	*Sitta castanea*	R(?), O
233	SPOTTED CREEPER	*Salpornis spilonotus*	R(?), O
234	WHITE-CROWNED PENDULINE TIT	*Remizcoronatus*	V
235	PALE MARTIN	*Riparia diluta*	V
236	PLAIN MARTIN	*Riparia paludicola*	R, C
237	DUSKY CRAG MARTIN	*Hirundo concolor*	R, C
238	BARN SWALLOW	*Hirundo rustica*	W, UC
239	WIRE-TAILED SWALLOW	*Hirundo smithii*	R, C
240	RED-RUMPED SWALLOW	*Hirundo daurica*	R, C
241	STREAK-THROATED SWALLOW	*Hirundo fluvicola*	?, O
242	NORTHERN HOUSE MARTIN	*Delichon urbica*	V
243	RED-WHISKERED BULBUL	*Pycnonotus jocosus*	R, UC
244	RED-VENTED BULBUL	*Pycnonotus cafer*	R, C
245	ZITTING CISTICOLA	*Cisticola juncidis*	R, UC
246	GRACEFUL PRINIA	*Prinia gracilis*	R, UC
247	GREY-BREASTED PRINIA	*Prinia hodgsonii*	R, C
248	YELLOW-BELLIED PRINIA	*Prinia flaviventris*	R, C
249	ASHY PRINIA	*Prinia socialis*	R, C
250	PLAIN PRINIA	*Prinia inornata*	R, C
251	ORIENTAL WHITE-EYE	*Zosterops palpebrosus*	R, C
252	MOUSTACHED WARBLER	*Acrocephalus melanopogon*	V?
253	PADDYFIELD WARBLER	*Acrocephalus agricola*	V
254	CLAMOROUS REED WARBLER	*Acrocephalus stentoreus*	R(?), UC
255	COMMON TAILORBIRD	*Orthotomus sutorius*	R, C
256	COMMON CHIFFCHAFF	*Phylloscopus collybita*	W, C
257	HUME'S WARBLER	*Phylloscopus humei*	W, C
258	GREENISH WARBLER	*Phylloscopus trochiloides*	PM, C
259	WESTERN CROWNED WARBLER	*Phylloscopus occipitalis*	V
260	STRIATED GRASSBIRD	*Megalurus palustris*	R, UC
261	BRISTLED GRASSBIRD	*Chaetornis striatus*	?
262	YELLOW-EYED BABBLER	*Chrysomma sinense*	R, C
263	COMMON BABBLER	*Turdoides caudatus*	R, C
264	STRIATED BABBLER	*Turdoides earlei*	R, C
265	LARGE GREY BABBLER	*Turdoides malcolmi*	R, C
266	JUNGLE BABBLER	*Turdoides striatus*	R, C

267	LESSER WHITETHROAT	*Sylvia curruca*	W, C
268	ORPHEAN WARBLER	*Sylvia hortensis*	W, O
269	INDIAN BUSHLARK	*Mirafra erythroptera*	R, UC
270	BENGAL BUSHLARK	*Mirafra assamica*	R, UC
271	ASHY-CROWNED SPARROW LARK	*Eremopterix grisea*	R, UC
272	GREATER SHORT-TOED LARK	*Calandrella brachydactyla*	W, UC
273	HUME'S SHORT-TOED LARK	*Calandrella acutirostris*	V
274	SAND LARK	*Calandrella raytal*	R, UC
275	CRESTED LARK	*Galerida cristata*	R, UC
276	ORIENTAL SKYLARK	*Alauda gulgula*	R, UC
277	HORNED LARK	*Eremophila alpestris*	V
278	PURPLE SUNBIRD	*Nectarinia asiatica*	R, C
279	HOUSE SPARROW	*Passer domesticus*	R, C
280	CHESTNUT-SHOULDERED PETRONIA	*Petronia xanthocollis*	?, O
281	FOREST WAGTAIL	*Dendronanthus indicus*	V
282	WHITE WAGTAIL	*Motacilla alba*	W, C
283	WHITE-BROWED WAGTAIL	*Motacilla maderaspatensis*	R, UC
284	CITRINE WAGTAIL	*Motacilla citreola*	W, C
285	YELLOW WAGTAIL	*Motacilla flava*	W, C
286	GREY WAGTAIL	*Motacilla cinerea*	W, UC
287	PADDYFIELD PIPIT	*Anthus rufulus*	R, C
288	TREE PIPIT	*Anthus trivialis*	?, O
289	OLIVE-BACKED PIPIT	*Anthus hodgsoni*	W, O
290	RED-THROATED PIPIT	*Anthus cervinus*	V
291	ROSY PIPIT	*Anthus roseatus*	W, UC
292	BLACK-BREASTED WEAVER	*Ploceus benghalensis*	R, UC
293	STREAKED WEAVER	*Ploceus manyar*	R, C
294	BAYA WEAVER	*Ploceus philippinus*	R, UC
295	FINN'S WEAVER	*Ploceus megarhynchus*	?
296	RED AVADAVAT	*Amandava amandava*	R, O
297	INDIAN SILVERBILL	*Lonchura malabarica*	R, C
298	SCALY-BREASTED MUNIA	*Lonchura punctulata*	R(?), O
299	COMMON ROSEFINCH	*Carpodacus erythrinus*	W, O
300	WHITE-CAPPED BUNTING	*Emberiza stewarti*	PM, R
301	BLACK-HEADED BUNTING	*Emberiza melanocephala*	V?
302	RED-HEADED BUNTING	*Emberiza bruniceps*	V?, PM

W = Wintering; R = Resident; M = Migrant (summer or monsoon migrant); PM = Passage Migrant; LM = Local Migrant; ? = unknown seasonal status; C = Common (seen in large numbers on the majority of visits); UC = Uncommon (seen in small numbers on the majority of visits); O = Occasional (seen in small numbers on a few occasions); V = Vagrant.

Appendix VI: Checklist of birds recorded in the present study

Sl. No.	Species	Scientific Name	Order
1	GREY FRANCOLIN	*Francolinus pondicerianus*	Galliformes
2	INDIAN PEAFOWL	*Pavo cristatus*	Galliformes
3	LESSER WHISTLING DUCK	*Dendrocygna javanica*	Anseriformes
4	GREYLAG GOOSE	*Anser anser*	Anseriformes
5	BAR-HEADED GOOSE	*Anser indicus*	Anseriformes
6	RUDDY SHELDUCK	*Tadorna ferruginea*	Anseriformes
7	GADWALL	*Anas strepera*	Anseriformes
8	EURASIAN WIGEON	*Anas penelope*	Anseriformes
9	INDIAN SPOT-BILLED DUCK	*Anas poecilorhyncha*	Anseriformes
10	NORTHERN SHOVELER	*Anas clypeata*	Anseriformes
11	NORTHERN PINTAIL	*Anas acuta*	Anseriformes
12	GARGANEY	*Anas querquedula*	Anseriformes
13	EURASIAN TEAL	*Anas crecca*	Anseriformes
14	COMMON POCHARD	*Aythya ferina*	Anseriformes
15	FERRUGINOUS DUCK	*Aythya nyroca*	Anseriformes
16	TUFTED DUCK	*Aythya fuligula*	Anseriformes
17	LITTLE GREBE	*Tachybaptus ruficollis*	Podicipediformes
18	GREAT CRESTED GREBE	*Podiceps cristatus*	Podicipediformes
19	GREATER FLAMINGO	*Phoenicopterus roseus*	Phoenicopteriformes
20	PAINTED STORK	*Mycteria leucocephala*	Ciconiiformes
21	ASIAN OPENBILL	*Anastomus oscitans*	Ciconiiformes
22	WOOLLY-NECKED STORK	*Ciconia episcopus*	Ciconiiformes
23	BLACK-HEADED IBIS	*Threskiornis melanocephalus*	Pelecaniformes
24	RED-NAPED IBIS	*Pseudibis papillosa*	Pelecaniformes
25	EURASIAN SPOONBILL	*Platalea leucorodia*	Pelecaniformes
26	BLACK BITTERN	*Dupetor flavicollis*	Pelecaniformes
27	BLACK-CROWNED NIGHT HERON	*Nycticorax nycticorax*	Pelecaniformes
28	INDIAN POND HERON	*Ardeola grayii*	Pelecaniformes
29	GREY HERON	*Ardea cinerea*	Pelecaniformes
30	PURPLE HERON	*Ardea purpurea*	Pelecaniformes
31	YELLOW-BILLED EGRET	*Egretta intermedia*	Pelecaniformes
32	LITTLE EGRET	*Egretta garzetta*	Pelecaniformes
33	LITTLE CORMORANT	*Microcarbo niger*	Pelecaniformes
34	INDIAN CORMORANT	*Phalacrocorax fuscicollis*	Pelecaniformes
35	GREAT CORMORANT	*Phalacrocorax carbo*	Pelecaniformes
36	ORIENTAL DARTER	*Anhinga melanogaster*	Pelecaniformes
37	BLACK KITE	*Milvus migrans*	Accipitriformes
38	WESTERN OSPREY	*Pandion haliaetus*	Accipitriformes
39	EGYPTIAN VULTURE	*Neophron percnopterus*	Accipitriformes
40	EASTERN MARSH HARRIER	*Circus spilonotus*	Accipitriformes
41	SHIKRA	*Accipiter badius*	Accipitriformes
42	PEREGRINE FALCON	*Falco peregrinus*	Falconiformes
43	BROWN CRAKE	*Amaurornis akool*	Gruiformes
44	WHITE-BREASTED WATERHEN	*Amaurornis phoenicurus*	Gruiformes
45	PURPLE SWAMPHEN	*Porphyrio porphyrio*	Gruiformes
46	COMMON MOORHEN	*Gallinula chloropus*	Gruiformes
47	EURASIAN COOT	*Fulica atra*	Gruiformes
48	BLACK-WINGED STILT	*Himantopus himantopus*	Charadriiformes

49	RIVER LAPWING	*Vanellus duvaucelii*	Charadriiformes
50	RED-WATTLED LAPWING	*Vanellus indicus*	Charadriiformes
51	WHITE-TAILED LAPWING	*Vanellus leucurus*	Charadriiformes
52	GREATER PAINTED SNIPE	*Rostratula benghalensis*	Charadriiformes
53	BRONZE-WINGED JACANA	*Metopidius indicus*	Charadriiformes
54	BLACK-TAILED GODWIT	*Limosa limosa*	Charadriiformes
55	COMMON REDSHANK	*Tringa totanus*	Charadriiformes
56	COMMON GREENSHANK	*Tringa nebularia*	Charadriiformes
57	GREEN SANDPIPER	*Tringa ochropus*	Charadriiformes
58	COMMON SANDPIPER	*Actitis hypoleucos*	Charadriiformes
59	TEMMINCK'S STINT	*Calidris temminckii*	Charadriiformes
60	BROWN-HEADED GULL	*Chroicocephalus brunnicephalus*	Charadriiformes
61	BLACK-HEADED GULL	*Chroicocephalus ridibundus*	Charadriiformes
62	PALLAS'S GULL	*Ichthyaetus ichthyaetus*	Charadriiformes
63	YELLOW-LEGGED GULL	*Larus cachinnans*	Charadriiformes
64	LITTLE TERN	*Sternula albifrons*	Charadriiformes
65	RIVER TERN	*Sterna aurantia*	Charadriiformes
66	BLACK-BELLIED TERN	*Sterna acuticauda*	Charadriiformes
67	WHISKERED TERN	*Chlidonias hybrida*	Charadriiformes
68	BLUE ROCK PIGEON	*Columba livia*	Columbiformes
69	YELLOW-FOOTED GREEN PIGEON	*Treron phoenicopterus*	Columbiformes
70	EURASIAN COLLARED DOVE	*Streptopelia decaocto*	Columbiformes
71	SPOTTED DOVE	*Stigmatopelia chinensis*	Columbiformes
72	LAUGHING DOVE	*Stigmatopelia senegalensis*	Columbiformes
73	ROSE-RINGED PARAKEET	*Psittacula krameri*	Psittaciformes
74	GREATER COUCAL	*Centropus sinensis*	Cuculiformes
75	SIRKEER MALKOHA	*Taccocua leschenaultii*	Cuculiformes
76	ASIAN KOEL	*Eudynamys scolopaceus*	Cuculiformes
77	COMMON HAWK-CUCKOO	*Hierococcyx varius*	Cuculiformes
78	ASIAN PALM SWIFT	*Cypsiurus balasiensis*	Apodiformes
79	HOUSE SWIFT	*Apus nipalensis*	Apodiformes
80	BARN SWALLOW	*Hirundo rustica*	Passeriformes
81	WIRE-TAILED SWALLOW	*Hirundo smithii*	Passeriformes
82	WHITE-THROATED KINGFISHER	*Halcyon smyrnensis*	Coraciiformes
83	GREEN BEE-EATER	*Merops orientalis*	Coraciiformes
84	BLUE-TAILED BEE-EATER	*Merops philippinus*	Coraciiformes
85	EURASIAN HOOPOE	*Upupa epops*	Bucerotiformes
86	BROWN-HEADED BARBET	*Megalaima zeylanica*	Piciformes
87	COPPERSMITH BARBET	*Megalaima haemacephala*	Piciformes
88	EURASIAN WRYNECK	*Jynx torquilla*	Piciformes
89	SMALL MINIVET	*Pericrocotus cinnamomeus*	Passeriformes
90	LONG-TAILED SHRIKE	*Lanius schach*	Passeriformes
91	EURASIAN GOLDEN ORIOLE	*Oriolus oriolus*	Passeriformes
92	BLACK DRONGO	*Dicrurus macrocercus*	Passeriformes
93	RUFOUS TREEPIE	*Dendrocitta vagabunda*	Passeriformes
94	HOUSE CROW	*Corvus splendens*	Passeriformes
95	LARGE-BILLED CROW	*Corvus macrorhynchos*	Passeriformes
96	GREY-HEADED CANARY-FLYCATCHER	*Culicicapa ceylonensis*	Passeriformes
97	ORIENTAL SKYLARK	*Alauda gulgula*	Passeriformes
98	RED-WHISKERED BULBUL	*Pycnonotus jocosus*	Passeriformes
99	RED-VENTED BULBUL	*Pycnonotus cafer*	Passeriformes
100	COMMON CHIFFCHAFF	*Phylloscopus collybita*	Passeriformes

101	GREENISH WARBLER	*Phylloscopus trochiloides*	Passeriformes
102	HUME'S LEAF WARBLER	*Phylloscopus humei*	Passeriformes
103	BLYTH'S REED WARBLER	*Acrocephalus dumetorum*	Passeriformes
104	STRIATED GRASSBIRD	*Megalurus palustris*	Passeriformes
105	YELLOW-BELLIED PRINIA	*Prinia flaviventris*	Passeriformes
106	ASHY PRINIA	*Prinia socialis*	Passeriformes
107	PLAIN PRINIA	*Prinia inornata*	Passeriformes
108	COMMON TAILORBIRD	*Orthotomus sutorius*	Passeriformes
109	YELLOW-EYED BABBLER	*Chrysomma sinense*	Passeriformes
110	JUNGLE BABBLER	*Turdoides striata*	Passeriformes
111	LARGE GREY BABBLER	*Turdoides malcolmi*	Passeriformes
112	LESSER WHITETHROAT	*Sylvia curruca*	Passeriformes
113	ORIENTAL WHITE-EYE	*Zosterops palpebrosus*	Passeriformes
114	BANK MYNA	*Acridotheres ginginianus*	Passeriformes
115	COMMON MYNA	*Acridotheres tristis*	Passeriformes
116	PIED MYNA	*Gracupica contra*	Passeriformes
117	BRAHMINY STARLING	*Sturnia pagodarum*	Passeriformes
118	ROSY STARLING	*Pastor roseus*	Passeriformes
119	COMMON STARLING	*Sturnus vulgaris*	Passeriformes
120	ORIENTAL MAGPIE-ROBIN	*Copsychus saularis*	Passeriformes
121	INDIAN ROBIN	*Saxicoloides fulicatus*	Passeriformes
122	BLACK REDSTART	*Phoenicurus ochruros*	Passeriformes
123	PURPLE SUNBIRD	*Cinnyris asiaticus*	Passeriformes
124	HOUSE SPARROW	*Passer domesticus*	Passeriformes
125	INDIAN SILVERBILL	*Euodice malabarica*	Passeriformes
126	RED AVADAVAT	*Amandava amandava*	Passeriformes
127	CITRINE WAGTAIL	*Motacilla citreola*	Passeriformes
128	GREY WAGTAIL	*Motacilla cinerea*	Passeriformes
129	WHITE WAGTAIL	*Motacilla alba*	Passeriformes
130	WHITE-BROWED WAGTAIL	*Motacilla madaraspatensis*	Passeriformes
131	PADDYFIELD PIPIT	*Anthus rufulus*	Passeriformes
132	OLIVE-BACKED PIPIT	*Anthus hodgsoni*	Passeriformes

Appendix VII: Water Bird Count during 2009-2010

Sl. No.	Birds	14/11/09	9/12/09	17/12/09	6/1/10	19/1/10	9/2/10	21/2/10	7/3/10	17/3/10	Average	Maximum count
1.	Greylag Goose	64	232	362	320	757	588	381	260	82	338	757
2.	Bar-headed Goose	0	114	226	172	235	187	188	112	103	149	235
3.	Ruddy Shelduck	0	12	32	18	20	48	43	24	84	31	84
4.	Gadwall	102	878	1262	356	382	521	435	536	346	535	1262
5.	Eurasian Wigeon	3	82	567	488	411	580	1230	708	233	478	1230
6.	Indian Spot-billed Duck	36	45	78	83	61	102	77	61	29	64	102
7.	Northern Shoveler	117	2048	3359	1808	1464	1981	2108	1565	1183	1737	3359
8.	Northern Pintail	25	280	976	310	392	733	840	644	306	501	976
9.	Garganey	0	0	0	0	0	58	103	72	93	36	103
10.	Common Teal	43	376	988	363	288	1520	1076	860	317	648	1520
11.	Common Pochard	145	532	740	601	370	378	610	515	366	473	740
12.	Ferruginous Pochard	0	0	0	6	6	0	0	0	0	1	6
13.	Tufted Duck	92	434	704	208	318	426	750	529	382	427	750
14.	Little Grebe	20	38	52	54	73	62	65	26	35	47	73
15.	Great Crested Grebe	5	0	0	0	0	0	0	0	0	1	5
16.	Greater Flamingo	0	0	18	21	26	76	92	58	42	37	92
17.	Painted Stork	7	11	35	17	14	16	19	7	3	14	35
18.	Black-headed Ibis	4	16	20	5	4	14	14	5	5	10	20
19.	Black Ibis	0	6	34	46	12	42	37	25	24	25	46
20.	Eurasian Spoonbill	0	5	12	6	3	5	6	0	6	5	12
21.	Black-crowned Night Heron	0	0	12	0	0	0	0	0	0	1	12
22.	Indian Pond Heron	24	10	36	22	37	43	61	32	22	32	61
23.	Grey Heron	4	7	11	7	9	8	8	8	13	8	13
24.	Purple Heron	2	8	6	9	4	4	6	4	2	5	9
25.	Little Egret	6	8	15	17	8	28	35	30	15	18	35
26.	Intermwdiate Egret	1	4	2	3	3	5	5	4	7	4	7
27.	Little Cormorant	6	7	11	6	18	8	4	4	6	8	18
28.	Indian Cormorant	3	5	6	4	7	3	12	4	2	5	12
29.	Great Cormorant	9	12	8	7	10	7	7	2	4	7	12
30.	Oriental Darter	1	2	2	1	2	2	1	1	1	1	2
31.	Purple Swamphen	41	50	81	71	49	103	145	126	79	83	145
32.	Common Moorhen	39	44	102	68	44	85	113	52	60	67	113
33.	Eurasian Coot	56	69	177	125	421	388	438	713	211	289	438

34.	White Breasted Waterhen	12	18	9	17	11	8	10	7	3	11	18
35.	Bronze Winged Jacana	7	14	18	12	33	36	34	12	10	20	36
36.	Gulls	61	125	472	528	476	1200	694	671	187	490	1200
37.	White-throated Kingfisher	2	1	2	2	1	3	2	2	2	2	3
	Total	937	5493	10435	5781	5969	9268	9649	7679	4263	6608	

Appendix VIII: Density and cluster size of 51 bird species

Sl. No.	Species	Density/ha	% Coef. of variance	Expected Cluster Size	% Coef. of variance
1	Ashy Prinia	3.49	18.41	1.37	5.49
2	Asian Koel	0.30	44.34	1.17	14.29
3	Bank Myna	1.87	41.77	5.50	20.04
4	Black Drongo	0.60	28.35	1.00	---
5	Black Redstart	0.47	39.16	1.22	18.18
6	Bluethroat	0.98	25.23	1.00	---
7	Blyth's Reed Warbler	0.09	71.53	1.00	---
8	Brown-headed Barbet	0.04	100.74	1.00	---
9	Citrine Wagtail	2.98	27.64	3.18	9.84
10	Collared Dove	0.81	31.92	1.36	14.67
11	Common Chiffchaff	0.30	44.34	1.17	14.29
12	Common Myna	3.79	28.02	4.68	13.07
13	Common Starling	0.51	63.75	4.00	25.00
14	Common Stonechat	0.17	51.00	1.00	---
15	Coppersmith Barbet	0.13	58.65	1.00	---
16	Golden Oriole	0.21	45.80	1.00	---
17	Greater Coucal	0.60	30.17	1.08	7.14
18	Green Bee-eater	1.06	25.52	1.25	7.95
19	Greenish Warbler	0.17	51.00	1.00	---
20	Grey Francolin	0.17	71.53	2.00	0.00
21	Grey Wagtail	2.56	27.46	3.16	9.15
22	Grey-headed Canary Flycatcher	0.04	100.74	1.00	---
23	Hoopoe	0.17	51.00	1.00	---
24	House Sparrow	3.32	64.11	19.50	38.86
25	Hume's Warbler	1.02	26.81	1.26	10.21
26	Indian Peafowl	0.13	78.92	1.50	33.33
27	Indian Robin	1.66	19.97	1.08	4.31
28	Jungle Babbler	2.30	34.52	4.91	13.86
29	Large Grey Babbler	0.09	100.74	2.00	0.00
30	Laughing Dove	1.28	30.72	2.14	11.84
31	Lesser Whitethroat	1.62	22.64	1.15	5.50
32	Long-tailed Shrike	0.26	41.98	1.00	---
33	Magpie Robin	0.47	34.26	1.10	9.09
34	Olive-backed Pipit	0.04	100.74	1.00	---
35	Paddyfield Pipit	0.51	34.85	1.20	11.11
36	Pied Bushchat	0.30	39.02	1.00	---
37	Pied Starling	2.68	24.96	2.86	8.99
38	Plain Prinia	1.58	22.98	1.23	6.37
39	Purple Sunbird	1.11	22.40	1.00	---
40	Red Munia	0.81	64.67	4.75	17.98
41	Red Whiskered Bulbul	0.38	52.19	2.25	11.11
42	Rose-ringed Parakeet	0.55	38.34	1.63	11.26
43	Rosy Starling	0.26	71.53	3.00	0.00
44	Rufous Treepie	0.21	45.80	1.00	---
45	Red Vented Bulbul	2.09	21.29	1.53	5.85
46	Silverbill	1.62	47.58	7.60	12.89
47	Tailor Bird	1.19	24.16	1.17	6.66
48	White Wagtail	0.30	49.03	1.40	17.50
49	White-browed Wagtail	0.17	51.00	1.00	---
50	Yellow-bellied Prinia	0.04	100.74	1.00	---
51	Yellow-footed Green Pigeon	0.68	62.83	5.33	22.53

Appendix IX: Fish species of Okhla Bird Sanctuary (WII, 2002)

Sl #	Family	Common Name	Scientific Name	Ststus in the region	WPA Status
1	Notopteridae	Humped Feather back	*Notopterus chitala*	Common	-
2		Pallas	*Notopterus notopterus*	Common	-
3	Clupeidae	River shad	*Gadusia chapra*	Common	-
4		Valenciennes	*Setipinna brevifilis*	Common	-
5	Cyprinidae	Chagunio	*Chagunius chagunio*	Common	-
6		Mrigal	*Cirrhinus mrigala*	Common	-
7		Reba	*Cirrhinus reba*	Common	-
8		Catla	*Gibelion catla*	Common	-
9		Bata	*Labeo bata*	Common	-
10		Bora labeo	*Labeo boga*	Common	-
11		Orange-fin labeo	*Labeo calbasu*	Common	-
12		Kalabans	*Labeo dero*	Common	-
13		Gonius	*Labeo gonius*	Common	-
14		Pangusia	*Labeo pangusia*	Common	-
15		Rohu	*Labeo rohita*	Common	-
16		Cotio	*Osteobrama cotio cotio*	Common	-
17		Bitter Barb	*Puntius chola*	Common	-
18		Rosy Barb	*Puntius conchonius*	Common	-
19		Glass Barb	*Puntius guganio*	Common	-
20		Ravi Barb	*Puntius punjabensis*	Common	-
21		Olive Barb	*Puntius sarana sarana*	Common	-
22		Spot-fin Barb	*Puntius sophore*	Common	-
23		Terio Barb	*Puntius terio*	Common	-
24		Fire-fin Barb	*Puntius ticto*	Common	-
25		Red-finned Mahaseer	*Tor tor*	Common	SC I
26		Silver Hatchet	*Chela cachius*	Common	-
27		Common Minnow	*Salmostoma bacaila*	Common	-
28		Short Razor-belly Minnow	*Salmostoma phulo*	Common	-
29		Gora Chela	*Securicula gora*	Common	-
30		Pale Carplet	*Amblypharyngodon mola*	Common	-
31		Aspidoparia	*Aspidoparia morar*	Common	-
32		Barred Baril	*Barilius barila*	Common	-
33		Vagra Baril	*Barilius vagra*	Common	-
34		Flying Barb	*Esomus danricus*	Common	-
35		Common Rasbora	*Parluciosoma daniconius*	Common	-
36		Gangetic Latia	*Crossocheilus latius*	Common	-
37		Stone Sucker	*Garra gotyla gotyla*	Common	-
38		Balitora Minnow	*Psilorhynchus balitora*	Common	-
39	Cobitidae	Corica Loach	*Noemachelius corica*	Common	-
40		Mountain Loach	*Noemacheilus montanus*	Common	-
41		Submontane Loach	*Noemacheilus scaturgina*	Common	-
42		Chaudhuri's Loach	*Botia lohachata*	Common	-
43		Guntea Loach	*Lepidocephalus guntea*	Common	-
44	Bagaridae	Long-whiskered Catfish	*Aorichthys aor*	Common	-
45		Giant River Catfish	*Aorichthys seeghala*	Common	-

46		Days's Mystus	*Mystus bleekeri*	Common	-
47		Gangetic Mystus	*Mystus cavasius*	Common	-
48		Striped Mystus	*Mystus vittatus*	Common	-
50		Rita	*Rita rita*	Common	-
51	Siluridae	Butter Catfish	*Ompok bimaculatus*	Common	-
52		Freshwater Shark	*Wallago attu*	Common	-
53	Schilbeidae	Gangetic Ailia	*Ailia coila*	Common	-
54		Yamuna Ailia	*Ailia punctata*	Common	-
55		Garua Bachcha	*Clupisoma garua*	Common	-
56		Bachwa	*Eutropiichthys vacha*	Common	-
57		Gangetic Silond	*Silonia silondia*	Common	-
58	Sisoridae	Goonch	*Bagarius yarrelli*	Common	-
59		Common Gagata	*Gagata cenia*	Common	-
60		Koel Gagata	*Gagata sexualis*	Common	-
61		Telchitta Sisorid	*Glyptothorax telchitta*	Common	-
62		Kosi Nangra	*Nangra nangra*	Common	-
63		Huddah Nangra	*Nangra viridescens*	Common	-
64		Long-tailed Sisorid	*Sisor rabdophorus*	Common	-
65	Clariidae	Magur	*Clarias batrachus*	Common	-
66	Heteropneustidae	Stinging Catfish	*Heteropneustes fossilis*	Common	-
67	Belonidae	Freshwater Garfish	*Xenentodon cancila*	Common	-
68	Poecilidae	Mosquito-eating Fish	*Gambusia affinis*	Common	-
69	Synbranchidae	Gangetic Mud-eel	*Monopterus cuchia*	Common	-
70	Chandidae	Elongate Glassperchlet	*Chanda nama*	Common	-
71	Ambassidae	Small Glassy Perchlet	*Pseudambassis baculis*	Common	-
72		Dwarf Glass Perchlet	*Pseudambassis ranga*	Common	-
73	Nandidae	Mottled Nandus	*Nandus nandus*	Common	-
74	Cichlidae	Mozambique Cichlid	*Oreochromis mossambica*	Common	-
75	Mugilidae	Corsula Mullet	*Rhinomugil corsula*	Common	-
76		Yellow-tailed Mullet	*Sicamugil cascasia*	Common	-
77	Gobiidae	Tank Goby	*Glossogobius giuris*	Common	-
78	Nandidae	Dwarf Chameleon Fish	*Badis badis*	Common	-
79	Trichogasterinae	Giant Gourami	*Colisa fasciata*	Common	-
80		Dwarf Gourami	*Colisa lalia*	Common	-
81	Gobiidae	Brown Snakehead	*Ophiocephalus gachua*	Common	-
82		Giant Snakehead	*Ophiocephalus marulius*	Common	-
83		Olive-Green Snakehead	*Ophiocephalus punctatus*	Common	-
84		Striped Snakehead	*Ophiocephalus striatus*	Common	-
85	Mastacembelidae	Striped Spiny	*Macrognathus aral*	Common	-
86		Tire-track Spinyeel	*Mastacembelus armatus*	Common	-
87		Spiny eel	*Mastacembelus pancalus*	Common	-

**** WPA:** Wildlife Protection Act**, SC:** Schedule*

Appendix X: Amphibians reported from Okhla Bird Sanctuary (WII, 2002)

Sl. No	Family	Common Name	Scientific Name	Ststus in the region	WPA Status
1	Bufonidae	Common Toad	*Bufo melanostictus*	Common	-
2		Marbled Toad	*Bufo stomaticus*	Common	-
3	Microhylidae	Ornate Frog	*Microhyla ornata*	Common	-
4	Ranidae	Skipping Frog	*Rana cyanophlyctis*	Common	SC IV
5		Cricket Frog	*Rana limnocharis*	Common	SC IV
6		Bull Frog	*Rana tigerina*	Common	SC IV
7		Burrowing Frog	*Tomopterna breviceps*	Common	-

**** WPA:** Wildlife Protection Act**, SC:** Schedule*

Appendix XI: List of Reptiles reported from Okhla Bird Sanctuary (WII, 2002)

Sl. No	Family	Common Name	Scientific Name	Ststus in the region	WPA Status
1	Crocodylidae	Marsh-Crocodile	*Crocodylus palustris*	Rare	-
2	Emydidae	Indian pond terrapin	*Melanochelys trijuga*	Common	-
3		Crowned river turtle	*Hardell thurjii*	Common	-
4		Indian roofed turtle	*Kachuga tecta*	Common	SC I
5		Indian tent turtle	*Kachuga tentoria*	Common	SC I
6		Red crowned roofed turtle	*Kachuga kachuga*	Common	SC I
7		Spotted pond turtle	*Geoclemys hamiltonii*	Common	SC I
8		Three striped roofed turtle	*Kachuga dhongoka*	Common	-
9	Trionychidae	Ganges soft shell turtle	*Aspideretes gangeticus*	Common	SC I
10		Peacock softshell turtle	*Aspideretes hurum*	Common	-
11		Indian flap shell turtle	*Lissemys punctata*	Common	SC I
12	Agamidae	Garden Lizard	*Calotes versicolor*	Common	-
13		Fan-throated Lizard	*Sitana ponticeriana*	Common	SC IV
14		Spiny-tailed Lizard	*Uromastix hardwickii*	Occasional	SC IV
15	Gekkonidae	Spotted Brook's Gecko	*Hemidactylus brooki*	Common	SC IV
16		Yellow-bellied House Gecko	*Hemidactylus flaviviridis*	Common	SC IV
17	Scincidae	Striped Skink	*Riopa punctata*	Common	SC IV
18		Striped Glass Skink	*Mabuya dissimilis*	Common	SC IV
19	Varanidae	Common Monitor	*Varanus monitor*	Common	SC II
20	Boidae	John's Sand Boa	*Eryx johnii*	Common	SC IV
21		Indian/Rock Python	*Python molurus molurus*	Occasional	SC I
22	Colubridae	Banded Rat Snake	*Argyrogena fasciolatus*	Common	SC II
23		Smooth Water Snake	*Enhydris sieboldi*	Common	-
24		Common Wolf Snake	*Lycodon aulicus*	Common	SC IV
25		Leith's Sand Snake	*Psammophis leithi*	Common	SC IV
26		Rat Snake	*Ptyas mucosus*	Common	SC II
27		Royal Snake	*Spalerosophis atriceps*	Common	-
28		Checkered Keel back	*Xenochrophis piscato*	Common	SC II
28	Elapidae	Common Krait	*Bungarus caeruleus*	Common	SC IV
30		Common Cobra	*Naja naja*	Common	SC II
31	Typhlopidae	Common Worm Snake	*Ramphotyphlops braminus*	Common	-
32	Viperridae	Russell's Viper	*Vipera russelli*	Common	SC II

**** WPA:** Wildlife Protection Act**, SC:** Schedule*

Appendix XII: List of Mammals reported from Okhla Bird Sanctuary (WII, 2002)

Sl. No	Family	Common Name	Scientific Name	Status in the region	WPA Status
1	Erinacidae	Long-eared Hedgehog	*Hemiechinus auritus*	Common	SC IV
2	Soricidae	House Shrew	*Suncus murinus*	Common	-
3	Pteropidae	Indian Flying Fox	*Pteropus giganteus*	Occasional	SC II
4	Megadermatidae	Indian False Vampire	*Megaderma lyra*	Common	SC V
5	Rhinopomatidae	Lesser Rat-tailed Bat	*Rhinopoma hardwickeri*	Common	SC V
6	Cercopithecidae	Rhesus Monkey	*Macaca mulatta*	Occasional	SC II
7		Hanuman Langur	*Semnopithicus entellus*	Occasional	SC II
8	Manidae	Indian Pangolin	*Manis crassicaudata*	Occasional	SC I
9	Canidae	Asiatic Jackal	*Canis aureus*	Common	SC II
10		Bengal Fox	*Vulpes bengalensis*	Common	SC II
11	Viverridae	Small Indian Civet	*Viverricula indica*	Occasional	SC II
12	Herpestidae	Small Indian Mongoose	*Herpestes auropunctatus*	Common	SC IV
13		Indian Grey Mongoose	*Herpestes edwardsii*	Common	SC IV
14		Ruddy Mongoose	*Herpestes smithi*	Occasional	SC IV
15	Felidae	Jungle Cat	*Felis chaus*	Common	SC II
16		Leopard Cat	*Felis bengalensis*	Rare	SC I
17	Leporidae	Indian Black-naped Hare	*Lepus nigricolis*	Common	SC III
18	Sciuridae	Five striped Palm Squirrel	*Funambulus pennanti*	Common	SC III
19	Muridae	Indian Crested Porcupine	*Hystrix indica*	Common	SC IV
20		Common Field Mouse	*Apodemus sylvaticus*	Common	SC IV
21		House Rat	*Rattus rattus*	Common	SC IV
22		Brown Rat	*Rattus norvegicus*	Common	SC V
23		House Mouse	*Mus musculus*	Common	SC V
24		Little India Field Mouse	*Mus booduga*	Common	SC V
25		India Mole Rat	*Bandicota bengalensis*	Common	SC V
26		Large Bandicoot Rat	*Bandicota indica*	Common	SC V
27		Short-tailed Bandicoot Rat	*Nesokia indica*	Common	SC V
28		Antelope Rat	*Tatera indica*	Common	SC V
29		Indian Desert Gerbille	*Mariones hurrianae*	Common	-
30	Bovidae	Nilgai	*Boselaphus tragocamelus*	Common	-

**** WPA:** Wildlife Protection Act**, SC:** Schedule*

Appendix XIII: Transfer of adiminstrative control of OBS to Divisional Forest Office, Gautam Buddha Nagar

उत्तर प्रदेश शासन
वन अनुभाग–1
संख्याः–152/14–1–2011–30/2011
लखनऊ दिनांक 24 मई, 2011

कार्यालय–ज्ञाप

तात्कालिक प्रभाव से कार्यहित में ओखला पक्षी विहार के कार्यों को देखने हेतु अस्थायी रूप से उक्त पक्षी विहार को प्रभागीय वनाधिकारी, गौतमबुद्धनगर के अधीन किया जाता है। उक्त कार्य के लिये प्रभागीय वनाधिकारी, गौतमबुद्धनगर को कोई अतिरिक्त वेतन/भत्ता आदि देय नहीं होगा।

चंचल कुमार तिवारी
प्रमुख सचिव

संख्याः–1212–(1)/14–1–2011तद्दिनांक

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषितः–
1– निजी सचिव, मा0 वन मंत्री,उत्तर प्रदेश शासन।
2– प्रमुख वन संरक्षक, उत्तर प्रदेश, लखनऊ।
3– महालेखाकार, उत्तर प्रदेश, इलाहाबाद/केन्द्रीय भवन,अलीगंज, लखनऊ।
4– वित्त नियंत्रक, कार्यालय प्रमुख वन संरक्षक,उ0प्र0 लखनऊ।
5– सम्बन्धित अधिकारी द्वारा प्रमुख वन संरक्षक,उ0प्र0 लखनऊ।
6– सम्बन्धित अधिकारी।
7– गार्ड फाइल।

आज्ञा से,
(संजय सिंह)
विशेष सचिव

Appendix XIV: Status of Land

27 Jun 08 14:04 KAMAL SINGHAL 0562-4003198 P.1

फैक्स द्वारा
011- 26953161
महत्वपूर्ण / तत्काल

कार्यालय उप वन संरक्षक राष्ट्रीय चम्बल सेंचुरी प्रोजेक्ट, उ0प्र0, आगरा।
पत्रांक 2735 /23-1 (ओखला) दिनांक, आगरा, जून 27 2008

सेवा में,

अधिशासी अभियन्ता,
ओखला बैराज,
गौतमबुद्धनगर।

विषयः– ओखला पक्षी विहार के अन्तर्गत आने वाली भूमि के स्वामित्व के सम्बन्ध में।

महोदय,

आज दिनांक 27–06–2008 को आपसे हुई दूरभाष पर वार्ता का सन्दर्भ लें कृपया ओखला पक्षी विहार की सीमा के अन्तर्गत right marginal bund से यमुना नदी के मध्य स्थित भूमि के निम्नलिखित विवरण के स्वामित्व के बारे में सूचना देने का कष्ट करें।

भूमि का विवरण निम्न प्रकार है :–

ग्राम	तहसील	गाटा संख्या	क्षेत्रफल (है0)
ओखला	महरौली	314 से 323	101.42
जसौला	महरौली	465, 466, 467, 468, 471, 472, 473, 474 एवं 475	20.86
		योग	**122.28 है0**

अवगत कराना है कि यह सूचना मा0 मुख्यमन्त्री जी उ0प्र0 को तत्काल ही प्रेषित की जानी है। अतः प्राथमिकता के आधार पर सूचना उपलब्ध कराने का कष्ट करें।

भवदीय,

27/6/08
(नीरज कुमार)
उप वन संरक्षक
राष्ट्रीय चम्बल सेंचुरी प्रोजेक्ट,
उ0प्र0, आगरा।

FAX 05688 251195

प्रेषक,

अधिशासी अभियंता,
हैड वर्क्स खण्ड आगरा नहर,
ओखला, नई दिल्ली–25

प्रेषित,

उप वन संरक्षक,
राष्ट्रीय सेन्चुरी प्रोजेक्ट,
उ0प्र0, आगरा

पत्रांक–2852/हैवखं/ दिनांक 27/6/ 2008

विषय– ओखला पक्षी विहार के अन्तर्गत आने वाली भूमि के स्वामित्व के संबंध में ।

संदर्भ– आपका पत्र संख्या 2735/23–1(ओखल) दि0 27.06.2008

महोदय,

उपरोक्त विषयक अपने संदर्भित पत्र का अवलोकन करने का कष्ट करें, जिसके द्वारा मांगा गया (ओखला पक्षी विहार की सीमा के अन्तर्गत राइट मार्जिनल बन्ध से यमुना नदी के मध्य स्थित भूमि के स्वामित्व का) वांछित विवरण संलग्नकर सूचनार्थ प्रेषित है ।

संलग्नक– उपरोक्तानुसार ।
ग्राम ओखला व
जसौला की भूमि का विवरण
व एवार्ड की प्रति।

अधिशासी अभियंता
हैड वर्क्स खण्ड आगरा नहर,
ओखला, नई दिल्ली–25

पक्षी बिहार ओखला नई दिल्ली के अन्तर्गत आने वाली ग्राम ओखला की सिंचाई विभाग उ0प्र0 के स्वामित्व की भूमि का विवरण जो राइट मार्जिनल बन्ध से यमुना नदी के मध्य स्थित है

क्रमांक	ग्राम	तहसील	खसरा संख्या	क्षेत्रफल हेक्टयर में	विवरण
1.	ओखला	साकेत (दिल्ली	314	0.558	
2.	–तदैव–	–तदैव–	315	4.229	
3.	–तदैव–	–तदैव–	316	1.728	
4.	–तदैव–	–तदैव–	317	3.923	खसरा नं. 317 का कुल रकवा 7.163 हेक्टयर है जिसमें से 3.240 हेक्टयर भूमि राइट मार्जिनल बन्ध से बाहर है तथा विभागीय प्रयोग में है ।
5.	–तदैव–	–तदैव–	318	3.561	
6.	–तदैव–	–तदैव–	319	8.340	
7.	–तदैव–	–तदैव–	320	2.743	
8.	–तदैव–	–तदैव–	321	1.780	
9.	–तदैव–	–तदैव–	322	11.392	
10.	–तदैव–	–तदैव–	323	52.072	
		योग		90.366	

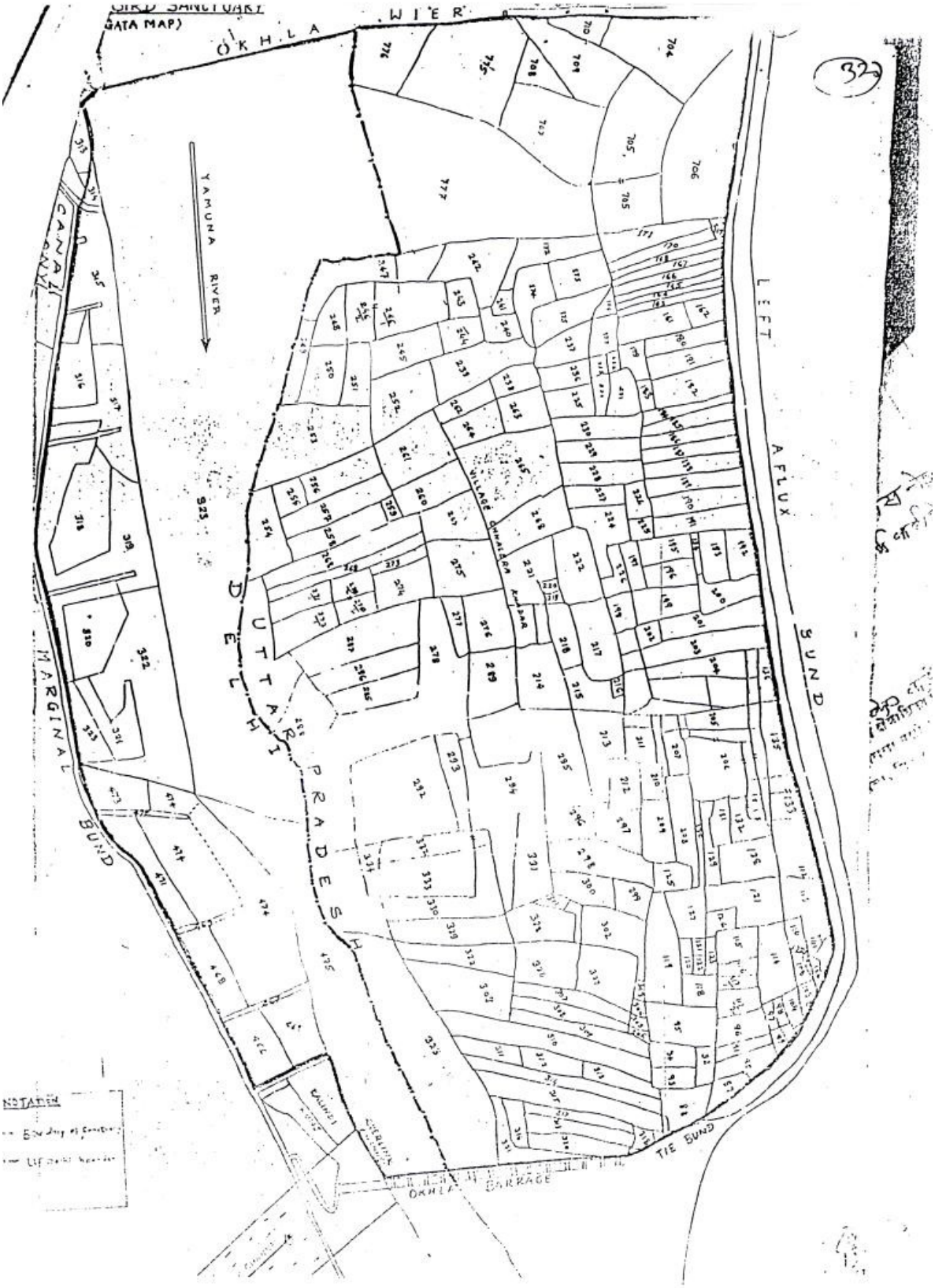
अधिशासी अभियंता
हैड वर्क्स खण्ड आगरा नहर,
ओखला नई दिल्ली–25

पक्षी बिहार ओखला नई दिल्ली के अन्तर्गत आने वाली ग्राम जसौला की सिंचाई विभाग उ0प्र0 के स्वामित्व की भूमि का विवरण जो राइट मार्जिनल बन्ध से यमुना नदी के मध्य स्थित है

क्रमांक	ग्राम	तहसील	खसरा संख्या	क्षेत्रफल हेक्टयर में	विवरण
1.	जसौला	कालकाजी	465	0.200	
2.	–तदैव–	–तदैव–	466	2.140	
3.	–तदैव–	–तदैव–	467	0.200	दिल्ली स्थित यह भूमि सिंचाई विभाग उ0प्र0की मिल्कियत थी परन्तु लैण्ड एक्वीजीशन कलक्टर दिल्ली द्वारा एवार्ड संख्या 21/92–93 दिनांक 19.06.1992 के द्वारा अध्यापित दर्शायी गई है । जो यमुना नदी के अन्तर्गत स्थित है ।
4.	–तदैव–	–तदैव–	468	2.129	
5.	–तदैव–	–तदैव–	471	2.444	
6.	–तदैव–	–तदैव–	472	0.254	
7.	–तदैव–	–तदैव–	473	1.072	
8.	–तदैव–	–तदैव–	474	20.995	
		योग		29.434	

नोट–आपके पत्र में खसरा नं. 475 की अंकित भूमि ग्राम समाज जसौला की है, सिंचाई विभाग,उ0प्र0 की नहीं है ।

अधिशासी अभियंता
हैड वर्क्स खण्ड आगरा नहर,
ओखला नई दिल्ली–25


BIRD SANCTUARY
DATA MAP)
OKHLA WIER
YAMUNA RIVER
CANAL
MARGINAL BUND
DELHI
UTTAR PRADESH
LEFT AFLUX BUND
TIE BUND
OKHLA BARRAGE
NOTATION

Appendix XV: Details of the crimes in OBS

ओखला पक्षी विहार मे वन अपराध

वर्ष	क 0स0ं	प्रभाग/रैंज केस संख्या	अपराध का प्रकार
2005–06	1	19/01/ओखला	यमुना नदी में नाव द्वारा मछली शिकार करते जाल सहित पकडें जाना ।
	2	28/02/ओखला	शिकारियों को शिकार करते पकडा जाना (एफ आर्ड आर)
	3	29/03/ओखला	ओखला वियरबन्द पर खडंजा निमार्ण कार्य करना ।
	4	30/04/ओखला	मछली मारने का प्रयास ।
2006–07	1	04/01/ओखला	ओखला पक्षी विहार की सीमा के सडक से लगे हुए भाग पर दीवाल बनाना ।
	2	30/02/ओखला	मछली के शिकार हेतु घुसने का प्रयास करना ।
2007–08	1	12/01/ओखला	बिजली के तार खीचनें से पेडों की लौपिग तथा वक्षारोपण को क्षति पहुंचाना ।
	2	14/02/ओखला	मछली मारने का प्रयास ।
	3	18/03/ओखला	पावरग्रिड कारपोरेशन द्वारा बिना अनुमति शाख तरासी करना ।
	4	19/04/ओखला	अवैधरूप से हाईटेंशन लाइन के तार खींचना ।
	5	28/05/ओखला	कांटा डोर से मछली मारने का प्रयास ।
	6	29/06/ओखला	मछली मारने का प्रयास ।
	7	33/07/ओखला	मछली मारने का प्रयास ।
	8	89/08/ओखला	टाग लग जाना ।
2008–09	–	रिक्त	रिक्त
2009–10	1	48/01/ओखला	मछली मारने का प्रयास ।

Appendix XVI: Rejuvenation of River Yamuna through a number of measures proposed by DDA

ACTION PLAN FOR UNSEWERED AREA OF NCT OF DELHI

1. Minimum flow in river Yamuna to be ensured by Riparian states by releasing adequate water.

2. Refurbishment of Trunk Sewerage System

DJB has a network of approx. 150 Kms length of trunk sewerage system to convey to collected sewage to different STPs for treatment. Nearly 91 Kms of sewer lines required rehabilitation and desilting. Out of which 41 Kms were completed till 2007 and balance 50 Kms will be completed by 2010. Rehabilitation of following trunk sewers has been taken up;

(a) Rehabilitation of Ring Road trunk sewer under Yamuna Action Plan-II (YAP-II).
(b) Rehabilitation of Bela Road trunk sewer under YAP-II.
(c) Rehabilitation of trunk sewers of North and West Delhi.

3. Treatment of the flows in Najafgarh and Shahdara drains

Laying of interceptor sewers in a 59 Kms length along the three major drains (i.e. Najafgarh, Supplementary and Shahdara) to intercept sewage flowing from subsidiary small drains and convey it to the nearest Sewage Treatment Plants (STPs) to ensure that only treated sewage is discharged.

4. **Laying of Sewer Lines in the un-sewered areas of Delhi**

DJB has stated that it has laid internal sewerage system in 540 unauthorized/regularized colonies and 111 urban villages of Delhi. The sewerage systems in 545 unauthorized/regularized colonies 124 urban villages are likely to be laid by December, 2010.

5. Slum Cluster and Yamuna River Bed

One of the contributory factors to the flow of untreated sewage into river Yamuna is the slum clusters that have come up unauthorisedly on both eastern and western bank of river Yamuna. Local bodies have already removed several JJ Clusters existing on the Western Bank. Slum clusters need to be cleared from riverbed.

6. Treatment of Industrial Effluent

Delhi Small Industries Development Corporation has constructed 10 Common Effluent Treatment Plants (CETPs) having an installed capacity of 133 mld for treating the industrial effluent before they are discharged into the drains/river. Better capacity utilisation and laying of conveyance system wherever required is needed.

7. Utilisation of Treated Effluent

Currently 109.5 MGD of treated deffluent is being supplied by DJB to CPWD, DDA Pragati Power Plant and Minor Irrigation Department. Additional 241 MGD is available for other user agencies. Further, 25 MGD treated Effluent will be supplied to Bawana Power Plant.

8. Removal of Coliform at STPs.

At all the new sewage Treatment Plants standards have been set to remove coliform.

Appendix XVII: Objectives, outputs, activities and assumptions of the management of OBS in a logical framework

	Objectively Verifiable indicators	Means of Verification (MoV)	Activities	Assumptions
Goal				
To restore the ecological integrity of Okhla Bird Sanctuary	• Increase inflow of native and migratory species of birds • Increase in the productivity of wetland ecosystem	• Bird count techniques • Measuring wetland productivity		• Regular monitoring is done • Continued legal protection • No external interference/threats
Objectives				
1. To strengthen the existing management of OBS	• Presence of effective management plan • Secured and improved Sanctuary ecosystem	• Field survey • Official records		• Timely availability of resources • Adequate support from line departments • Political Willingness
2. To promote compatible urban development in the surrounds of OBS	• No new unsustainable development in the surroundings	• Field Survey • Satellite images		• Strict enforcement • Responsive target groups
3 To improve the habitat quality of OBS	• DO, Coli form count, pH, heavy metals • Aquatic weed coverage • Good congregation of migratory birds	• Water Analysis • Vegetation quantification technique • Bird survey techniques		• Treatment facilities in place • No constrain on budget
4. To mitigate the anthropogenic pressures of OBS	• Less presence of human involved in illegal activities • Reduction in illegal	• Regular surveys by forest department • Official records		• Responsive target groups • Regular interaction

	resource extraction • Reduced encroachment inside the Sanctuary			between forest department staff and local people
5. To promote OBS as an important centre for conservation education and research	• Interpretive facilities • Increased educational camps and trips • Increased research activities	• Official records • Research publications		• Timely availability of resources • Enough budget • Cooperating staff
Outputs				
1.1 Establishment of a system of coordination between UP and Delhi Forest departments and other stakeholders	• Unified coordinated body • Joint meetings • Level of participation in meetings	• Minutes of meeting	• To establish a unified management committee for OBS • To clearly define the roles and responsibilities of different line agencies • To put in place a system of regular meetings of management committee for ensuring effective management	• Responsive target groups • Department willingness
1.2 Strengthening of existing staff and their capacities	• Proper management of Sanctuary on both Delhi and U.P. sides • Reduction in offence cases inside the Sanctuary	• Field survey • Official records	• To augment the existing management team of OBS and promote partnerships with other agencies • To put in place a	• Timely availability of resources

			system of regular trainings for the staff • To provide adequate infrastructure and equipments to the staff	
1.3 Establishment of a conservation trust for OBS for continuity and sustainability of programme	• Proper management of Sanctuary	• Field Survey	• Coordination meetings of line departments	• Timely availability of budget • Department willingness
2.1 Identification of eco-sensitive zone around OBS	• Land use in the surroundings • Reduced disturbance • Biodiversity in the area • Greenery in the surrounding •	• Satellite images • Field survey • Increased green space	• Implementation of Supreme Court notification regarding eco-sensitive zones around a protected area • Plantation of native species	• Responsive target group • Stakeholders aware of the status
2.2 Preparation of a plan for promoting compatible development practices in the zone of influence	• Eco-friendly and scientific development	• Field Survey	• Conduction of coordination meetings between planners and environmentalists	• Responsive target groups • Proper implementation of plan
2.3 Delineation of buffer zone and initiating protection in this area	• Reduced disturbance • Land use • Biodiversity in the area	• Satellite imageries • Field surveys	• Collection of baseline information • Biodiversity monitoring • Providing protective measures like competent staff	• Responsive target groups • Departmental willingness

3.1 Regulating sharp fluctuations in water level	• Ecologically sensitive water level • Increase in avian diversity and abundance • Diverse vegetative community	• Official hydro-meteorological records • Bird Survey techniques • Vegetation quantification techniques	• Conduction of meetings between managing body and irrigation department • Maintenance of a water level a feet lower from November to March every year	• No external interference (high demand for water/ flood)
3.2 Strengthening the existing weed management programs	• Extent of weed	• Regular monitoring of vegetation	• Providing sufficient resources for weed management practices • Capacity building programme for frontline staff • Timely removal of silt	• Timely availability of resources • Availability of competent people • Departmental willingness
3.3 To manage the pollution levels in the water of OBS	• DO, BOD, Coli form count, pH, heavy metals • Reduced illegal entry • Number of livestock inside the sanctuary	• Water analysis • Survey by forest department • Existing records of forest department for illegal entry	• Strengthening existing treatment facilities • Proper implementation of environmental legislation for Yamuna and Hindon	• Efficient treatment facilities are available • No constraints on budget • Chemical and physical analysis of water at regular basis • Responsive target groups
4. 1 To promote livelihood opportunities to the adjoining dependent village communities	• Less dependency of local people on Sanctuary resources	• Official records • Socio-economic survey	• Establishment of Eco-development committees	• Involvement of local people in PA management

	• Increased purchasing power of the local people		• Training programs for local youth • Engagement of locals in the protection of Sanctuary	• Adequate participation of local people
4.2 Settlement of disputes of rights for the adjoining villages and reduce the impact of incompatible land use practices	• Presence of documents containing resolved compensation issues • Land use inside and around the Sanctuary	• Documents of resolved compensation issues • Field survey	• Establishment of an administrative body • Interaction of Sanctuary managing body and local communities	• Administrative body has authority to take decisions • Administrative body works properly • Departmental willingness
5. 1 Establishment of an interpretation cum education centre in OBS	• Properly functional Interpretation centre	• Tourist feedback forms	• Establishment of interpretation and visitor centr.	• Timely availability of budget • Enough space
5.2 Initiation of awareness programs for different stakeholders with the support of local NGOs and institutions	• Workshops and nature camps • Information brochure • Participation of stakeholders	• Official records • Feedback forms	• Developing publications for creation of awareness amongst visitors • Regular awareness programs conducted on special days like world environment day, wildlife week, wetland day • Awareness creation programs amongst the school children through conservation	• Responsive target groups • Departmental willingness • Availability of resource persons

			education	
5.3 Improving the interpretation facilities and interpretive materials in the area	• Proper signage • Publications • Movie shows • Functional interpretation centre • Increased inflow of tourist	• Tourist feedback forms • Official records	• Location of OBS highlighted in tourists maps • Signage on roads with proper direction for OBS established • Construction of two additional watchtowers on proposed sites. • Provision of basic amenities like drinking water and toilet	• No constrain on budget • Availability of resource persons
To training and involving local youth as guides for running above programs	• Less dependency of locals on Sanctuary resources • Capacity building programs for local youth	• Official records	• Awareness creation programs amongst the local youth for conservation education • Engagement of local youth as guides	• Responsive target group • Availability of resource person • Need for enough guides • No discrimination while engagement

Appendix XVIII: Decision of CEC regarding OBS in March 2006

CENTRAL EMPOWERED COMMITTEE

DECISIONS TAKEN DURING THE MEETING HELD ON 21.3.2006 IN RESPECT

OF APPLICATION NO 559 FILED BEFORE THE CEC REGARDING THE OKHLA

BIRD SANCTUARY

The list of the participants is enclosed.

2. After hearing the views of the participants, the following decisions were taken:

i) Two gates will be constructed by the NOIDA to regulate the movement of persons in the sanctuary. It was agreed by the representative of the NOIDA that the gates will be constructed within a period of one month.

ii) The road which was constructed within the sanctuary has been dismantled by the NOIDA. In future no new road will be allowed to be constructed within the sanctuary.

iii) The fishing contract(s), which provide for fishing rights within the sanctuary is in violation of the Hon'ble Supreme Court's order dated 14.2.2000. All such contracts will be reviewed by the Zila Panchayat to ensure that no fishing is permitted inside the sanctuary. The Chief Wildlife Warden will take up the matter with the Principal Secretary, Panchayat Raj and ensure that the above is strictly enforced.

iv) All encroachments which have taken place inside the sanctuary, including the debris of the structures already demolished, will be immediately removed. The Irrigation Department has agreed to complete the exercise by 15th April 2006.

v) Expeditious action will be taken by the concerned authority for the settlement of rights within the sanctuary. The Chief Wildlife Warden will pursue the matter with the concerned authorities in so far as it relates to the portion of the sanctuary falling in Uttar Pradesh. As regards the portion of the sanctuary falling within the National Capital Territory of Delhi, the same will be pursued by the Forest Department of Delhi Government.

vi) A 10 year Action Plan for the integrated development of the sanctuary with provisions for the construction of boundary wall, garbage disposal, staff quarters, bird interpretation centre, watch tower, construction of islands, plantation of fruit bearing trees, etc. involving an expenditure of about Rs 9.00 crores spread over a period of 10 years has been prepared by the Chief Wildlife Warden. After this Action Plan is examined by the Forest and Irrigation Departments respectively a decision including the source of funding and involvement of the NOIDA will be taken at the State Level. Construction of boundary wall which is absolutely essential for the protection of the area will be considered on priority basis.

vii) On the Delhi side construction of boundary wall on priority basis will be considered; and

viii) Specific activities/responsibilities will be assigned to the various implementing agencies working in the area; this will avoid duplication of works as well as ensure a proper chain of command. Necessary coordination and follow up action in this regard will be ensured by the Principal Secretary (Forests) and the Principal Secretary (Irrigation). The other concerned officials will also be involved.

The meeting ended with a Vote of Thanks to the Chair.

S/d

(M.K. Jiwrajka)

Member Secretary

Dated: 24.3.2006

Appendix XIX: Relevent portions of the judgement of the Hon'ble Supreme Court dated 3rd December 2010

REPORTABLE

IN THE SUPREME COURT OF INDIA
CIVIL ORIGINAL JURISDICTION

I.A. NOS.2609-2610 OF 2009
IN

WRIT PETITION (CIVIL) NO.202 OF 1995

IN RE.:

CONSTRUCTION OF PARK AT NOIDA NEAR OKHLA BIRD SANCTUARY

ANAND ARYA & ANR.
T.N. GODAVARMAN THIRUMULPAD — APPLICANTS/ PETITIONER

Versus

UNION OF INDIA & ORS. — RESPONDENTS

WITH

I.A. NOS.2896/10 & 2900/10 IN I.A. NOS.2609-2610 OF 2009

AND

I.A. NO.2928/10 IN I.A. NOS.2609-2610/09 IN W.P. (C) NO.202 OF 1995

JUDGMENT

75. It is significant to note that none of the expert bodies has taken the view that the project is so calamitous or ruinous for the bird sanctuary that it needs to be altogether scrapped in order to save the Sanctuary. The expert bodies have given recommendations which allow the completion of the project subject to certain conditions. On behalf of the State of U.P. it is unequivocally stated that all the conditions laid in the reports of the Expert Bodies are acceptable to the State Government/ NOIDA in their entirety. In light of the two study reports and the report submitted by the EAC, we see no justification for directing the demolition of the constructions made in the project, as prayed for on behalf of the applicants. We would rather allow the

project to be completed, subject, of course to the conditions suggested by the three expert bodies and further subject to the directions contained herein below.

76. It may be noted that the report of the WII has focused on the felling of trees resulting in the disappearance of the woodland that acted as a protective buffer for the bird sanctuary and its first recommendation is to compensate the loss of vegetation. It has secondly focused on the increased artificial light at the project site, which is likely to affect the migratory bird population in the long run. Apart from this, we feel that the extent of stone and concrete constructions in the name of "hard landscaping" is highly out of proportion. In the modified layout plan, the project proponents have reduced the area under hard surface to 35.54% of the total project area. In our opinion, even that is unacceptable from the environmental point of view. The area under hard surface, whether covered, uncovered (including pathways and boundary wall etc.) or of any kind whatsoever must not exceed 25% of the total

project area; of the rest, 25% should be used for soft/green landscaping and the remaining, preferably 50% must have a thick cover of trees of the native variety, a list of which is given by the State of UP (Annexure 4(b), Paper book Volume IV) The plantation of trees should be especially dense towards the Okhla Bird Sanctuary on the western side of the project area. Any construction work should commence only on completion of the planting of the trees.

77. In order to ensure full compliance with the recommendations of the expert bodies (which form part of the judgment) and the directions of this Court, the construction of the project needs to be overseen by an expert committee. One member of the committee, preferably an ornithologist will be nominated by the MoEF, the other member will be nominated by the CEC in consultation with the *amicus* and the Chairman-cum-CEO of NOIDA will be the member-secretary of the committee. The committee should be constituted within two weeks from today.

78. It is made clear that the above directions are given in the peculiar facts of this case and nothing said in the judgment shall form precedent when the

court is hearing the matter of the "buffer zones".

79. Before putting down the records of the case a few observations may not be out of place. The EIA notification dated September 14, 2006 urgently calls for a close second look by the concerned authorities. The projects/activities under items 8(a) and 8(b) of the schedule to the notification need to be described with greater precision and clarity and the definition of built-up area with facilities open to the sky needs to be freed from its present ambiguity and vagueness. The question of application of the general condition to the projects/activities listed in the schedule also needs to be put beyond any debate or dispute. We would also like to point out that the environmental impact studies in this case were not conducted either by the MoEF or any organization under it or even by any agencies appointed by it. All the three studies that were finally placed before the Expert Appraisal Committee and which this Court has also taken into consideration, were made at the behest of the project proponents and by agencies of their choice. This Court

would have been more comfortable if the environment impact studies were made by the MoEF or by any organization under it or at least by agencies appointed and recommended by it.

80. The IAs stand disposed of with the above observations and directions.

.....CJI.

.....J.
(AFTAB ALAM)

.....J.
(K.S. PANICKER RADHAKRISHNAN)

New Delhi,
December 3, 2010

Appendix XX: Status of land settlement in OBS
Letter from DFO National Chambal Sanctuary Project, Agra
regarding status of settlement in OBS

कार्यालय उप वन संरक्षक, राष्ट्रीय चम्बल सेंचुरी प्रोजेक्ट, उ0प्र0, आगरा।

पत्रांक 708 /23–1.(ओखला), दिनांक, आगरा, अक्टूबर, 18 2010

सेवा में,

डा0 धनन्जय मोहन,
भारतीय वन्य जीव संस्थान,
देहरादून।

विषयः– ओखला पक्षी विहार से सम्बन्धित सूचनाएं।

सन्दर्भः– आपका पत्र दिनांक 14–10–2010

महोदय,

सन्दर्भित पत्र द्वारा वांछित सूचनाएं निम्न प्रकार हैं :–

1– ओखला पक्षी विहार के बन्दोवस्त की कार्यवाही जिलाधिकारी, गौतमबुद्धनगर के स्तर पर विचाराधीन है।

2– ओखला पक्षी विहार से सम्बन्धित सेन्ट्रल इम्पावर्ड कमेटी के द्वारा वर्ष 2006 में दिये गये निर्देश संलग्न कर प्रेषित हैं।

3– गत 5 वर्षो में ओखला पक्षी विहार में वन अपराध में इजरा किये गये केसों का विवरण निम्न प्रकार है :–

वर्ष	क्र0 सं0	प्रभाग/रेंज केस संख्या	अपराध का प्रकार
2005–06	1	19/01/ओखला	यमुना नदी में नाव द्वारा मछली शिकार करते जाल सहित पकड़ें जाना।
	2	28/02/ओखला	शिकारियों को शिकार करते पकड़ा जाना (एफआईआर)
	3	29/03/ओखला	ओखला वियरबन्द पर खड़ंजा निर्माण कार्य करना।
	4	30/04/ओखला	मछली मारने का प्रयास।
2006–07	1	04/01/ओखला	ओखला पक्षी विहार की सीमा के सड़क से लगे हुए भाग पर दीवाल बनाना।
	2	30/02/ओखला	मछली के शिकार हेतु घुसने का प्रयास करना।
2007–08	1	12/01/ओखला	बिजली के तार खींचने से पेड़ों की लौपिंग तथा वृक्षारोपण को क्षति पहुँचाना
	2	14/02/ओखला	मछली मारने का प्रयास
	3	18/03/ओखला	पावरग्रिड कारपोरेशन द्वारा बिना अनुमति शाख तरासी करना
	4	19/04/ओखला	अवैध रूप से हाईटेंशन लाइन के तार खींचना।
	5	28/05/ओखला	कांटा डोर से मछली मारने का प्रयास।
	6	29/06/ओखला	मछली मारने का प्रयास
	7	33/07/ओखला	मछली मारने का प्रयास
	8	89/08/ओखला	आग लग जाना।
2008–09	–	रिक्त	रिक्त
2009–10	1	48/01/ओखला	मछली मारने का प्रयास

संलग्नकः–उपरोक्तानुसार।

भवदीय,

(नीरज कुमार)
उप वन संरक्षक,
राष्ट्रीय चम्बल सेंचुरी प्रोजेक्ट,
उ0प्र0, आगरा।

Appendix XXI: Report of Consultative workshop organized in New Delhi on 11th November, 2010

Background

As part of the project activities, a stakeholder workshop/ consultation meeting was organized in Van Vigyan Bhawan, Sector 5, R.K. Puram, New Delhi on 11 November 2010. The central aim of this workshop was to bring all stakeholders together at a place to explore their perspectives about current status of management of Okhla Bird Sanctuary and their opinions as to how to improve this.

Prior to this workshop, a questionnaire (Attachment-I) was circulated to 26 individuals representing various stakeholders (Attachment-II) and were invited to attend this workshop. Also, the researchers personally met, interviewed 13 stakeholders and filled up the questionnaire. All together 21 participants attended the workshop (Attachment-III).

Workshop proceedings

Dr. S. A. Hussain opened the workshop with a brief welcome address and requested the participants to introduce themselves. Dr. B. K. Mishra set the context and flagged off the issues for discussion in the workshop. Dr. A. K. Bhardwaj translated it in Hindi to make participants representing local communities familiar with the workshop objectives and the issues emerged. Dr. Dhanjay Mohan and Mrs. Bitapi C. Sinha presented the broad findings of the research team based on which the preliminary management strategies of the protected area are being prepared. Suggestions were sought from the participants for improvement. Following this, there was open discussion, participants shared information, raised concerned and expressed views for better management of the protected area which are summarized below:

Delhi Bird Club representative:

Mr. Anand Arya reiterated that the primary aim of sanctuary is conservation of both resident and migratory birds. The number of birds, especially that of the migratory species those have been using the Okhla and surrounding area as a stopover, is declining drastically. The reasons are:

- Habitat has changed a lot over time.
- Money is not an issue, quality of management being provided to this area is a major issue.
- Attitude and knowledge of staff and managers posted in the area is important.
- *Typha* is spreading as a weed and has dominated many parts of sanctuary.

Suggestions**:**

- Declaration of eco-sensitive zones around the sanctuary, inclusion of Pushta road in it. Area downstream the barrage be made a part of it (order from Delhi Chief Minister in December 2007 supports this).

- Weed management most important strategy. Manage Typha as part of habitat management; take help from CEMDE, university of Delhi.
- Compensation to communities and settlement of rights.
- Ecosystem zone to be defined and established.
- Delhi Bird Club can help local youth as ecotourism guides.
- Facilities for visitors like toilets and drinking water should be provided.

Community representative:

- Many families did not get compensation for their lands or got a meager amount.
- The path along the weir bund, to crematorium near the northeastern boundary gets submerged under water during rain and they have to use weir bund then.
- Annual *Bhandara* in the temple to be controlled- no cooking and will try to minimize pollution.

Uttar Pradesh Forest Department representative:

- Western side has many problems e.g. livestock grazing, poaching, fishing, etc. Delhi govt. (forest department) should provide two employees to help U.P. Forest Department in better management and protection as U.P. Forest Department face problems in lodging a complaint with Delhi police.
- Whole 4 sq. km area falls under the jurisdiction of UP irrigation department.

Delhi Forest Department representative:

- Habitat management: Plan by WII will be acceptable. Delhi forest department is working with BNHS for management of western side and they have submitted a plan with Delhi forest department.
- From Delhi, there are two stakeholders; Forest department and DDA. DDA should be involved in this as this area falls in zone-O of DDA and they have zonal plans for the surroundings (that involves widening of road along right marginal bund).
- Delhi Forest Department will notify this area.
- Waste (sewage and sludge) discharged in river Yamuna a big issue in conservation of sanctuary. There should be treatment plants on each drain out falling into the river.

BNHS representative:

- They are working in collaboration with Delhi Forest Department in the western side of sanctuary and have planned a wetland interpretation center.
- They are limited to western side only.

Wetland International representative:

- There should be awareness programmes and involvement of local communities.
- Partnership of the organization.

Recommendations:

Based on elaborate deliberations, discussions and consensus, participants recommended the followings:

1. Crematorium in E2 sub-section (outside sanctuary, check post no. 2 to bank of Hindon cut near banyan tree)-

   - Communities using this crematorium can use electric crematorium situated in sector 94 and sector 44 in Noida. According to villagers, the one in Noida sector 94 does not have electricity supply. Some 70 % villagers use these crematoriums, but rests still come to the sanctuary because of sentimental attachments.

   - Till that time a amicable settlement of rights of local people is done and villagers persuaded for use of an alternate site, a temporary raised foot path can be prepared by U.P. Forest Department along the weir bund boundary (but outside the boundary) for use of local people using the crematorium.

2. *Kanwadiya* camp outside sanctuary near check post No 2-

   A camp near sanctuary has following impacts:

   - Noise due to loud music being played.
   - Defecation in and around sanctuary making sanctuary inapproachable for many days during this event.

   This camp therefore be shifted near SSP office, Chilla regulator and *Kanwadiya* can use road running along the Shahadra drain. The distance of proposed new route for *Kanwadiya* will be a few kilometers longer compared to the distance of route currently being used. However, village representatives need to discuss this issue with the organizers of the camp and district administration for a mutually agreeable new camp site and shift of this camp in due course of time.

3. Interpretive facilities-

   BNHS has prepared a plan for a wetland interpretation center in the western side, either near the sand mound or near flamingo point (back gate of Kalindi kunj). Two small interpretation centers can be built for visiting public in both the western and eastern sides.

4. Trust and foundation-

   For program continuity and sustainability, formation of a trust for management of sanctuary can be helpful. As two state governments are involved in the affair of Okhla Sanctuary, a micro level trust that is represented by stakeholders of both sides will be

helpful. Integrated Management Committee and institution building for management with coordination of local people may be thought of.

5. Temple inside the sanctuary (E-2 subsection)-

   Since the *Bhandara* is organized once in a year, care will be taken not to prepare food inside or near the sanctuary. Care will also be taken to avoid making any type of fire and devotees will be instructed not to throw any kind of food waste or garbage inside or near the sanctuary.

Workshop in progress

ATTACHMENT-I

OKHLA BIRD SANCTUARY MANAGEMENT PLAN PREPARATION-STAKEHOLDER CONSULTATION QUESTIONNAIRE

(Please fill up the questionnaire and bring this with you to the consultation meeting on 11.11.10 or kindly post in advance to the address below)

1. Name of the respondent:
2. Post held:
3. Department/ Organization:
4. Your role in Okhla Bird Sanctuary (OBS):
5. Are you in a position to influence certain decisions related to OBS?
6. What are the **three** major problems being faced by OBS, their causes and possible solutions:

Sl. No	Major problems	Causes	Possible solutions
1.			
2.			
3.			

7. In what ways you can contribute for Conservation of Okhla Bird Sanctuary:

(Signature)
Date:

(Our postal address: Dr. V.B.Mathur, Dean, FWS, Wildlife Institute of India, Box # 18, Chandravani, Dehradun-248001)

ATTACHMENT-II

LIST OF INVITEE

(Communicated by registered post)

1. Sri D.M. Shukla,
   Conservator of Forests and Chief Wildlife Warden,
   Forest Department, Government of NCT of Delhi,
   IIND FLOOR, A-BLOCK,
   Vikas Bhawan, I.P. ESTATE,
   New Delhi

2. Sri Neeraj Kumar, DFO
   Mau Forest Block,
   Khandani,
   Agra, Uttar Pradesh.

3. Sri B.K.Pattanaik,
   Principal Chief Conservator of Forests,
   Govt of Uttar Pradesh,
   17 Rana Pratap Marg,
   Lucknow-226001

4. Dr. Anil Kumar,
   Director, Department of Environment
   Room No. C-605, Level-6, C-Wing,
   Delhi Secretariat, I.P Estate,
   New Delhi-02

5. Sri B. Prabhakar
   Director (Horticulture)
   NOIDA,
   Sec -39,
   Noida- 201301
   Dist: Gautam Budh Nagar, Uttar Pradesh

   Copy to: Sri Mohinder Singh, CEO, New Okhla Industrial Development Authority,
   Admin Block, Sector 6, Noida-201301, Dist: Gautam Budh Nagar, Uttar Pradesh

6. Dr. Anil Kumar Singh,
   Coordinator,
   Wildlife Trust of India,
   B-13, 2nd Floor, Sector-6,
   Noida-201301, Uttar Pradesh

   Copy to: Dr. Vivek Menon, Wildlife Trust of India, B-13, 2nd Floor, Sector-6,
   Noida-201301, Uttar Pradesh

7. Dr A.K. Ambasht,
   Member Secretary, Delhi Pollution Control Committee,
   Govt. of National Capital Territory of Delhi
   4th Floor, ISBT Building
   Kashmere Gate,
   Delhi- 110006

8. Executive Engineer,
   Head Works Department,
   Agra Canal Okhla
   New Delhi- 110025

9. Sri Anand Arya
   353, Sector 15A
   NOIDA 201301
   Uttar Pradesh

10. Shri Paras Nath,
    Regional Officer (Noida region),
    UPPCB, E-12/1, Sector 1,
    NOIDA 201301, Uttar Pradesh

11. Assistant Director-I,
    Upper Yamuna River Board,
    Ministry of Water Resources, West Block-1, Wing-4, Ground Floor,
    R.K. Puram, New Delhi – 110066

    Copy to: Shri M.S. Agrawal, Member Secretary, Upper Yamuna River Board,
    West Block – 1, Ground Floor, Wing – 4, R.K. Puram, New Delhi 110066

12. Mrs. Rina Ray,
    Managing Director,
    Delhi Tourism and Transport Development Corporation
    18-A, D.D.A.SCO Complex,
    Defence Colony, New Delhi - 24

13. Dr. Parikshit Goutam,
    Director, Freshwater and Wetlands Programme,
    WWF India, 172 B, Max Mueller Marg,
    Lodi Estate,
    New Delhi 110003

    Copy to: Sri Ravi Singh, Secretary General, WWF India, 172 B, Max Mueller Marg,
    Lodi Estate, New Delhi 110003

14. District Collector (South)
    M. B. Road,
    Saket,
    New Delhi-110068

    Sri B. Prabhakar
    Director (Horticulture)
    NOIDA,
    Sec -39,
    Noida- 201301
    Dist: Gautam Budh Nagar, Uttar Pradesh

15. Copy to: Sri Mohinder Singh, CEO, New Okhla Industrial Development Authority, Admin Block, Sector 6, Noida-201301, Dist: Gautam Budh Nagar, Uttar Pradesh

    Dr. Anil Kumar Singh,
    Coordinator,
    Wildlife Trust of India,
    B-13, 2nd Floor, Sector-6,
    Noida-201301, Uttar Pradesh

16. Copy to: Dr. Vivek Menon, Wildlife Trust of India, B-13, 2nd Floor, Sector-6, Noida-201301, Uttar Pradesh

    Assistant Director-I,
    Upper Yamuna River Board,
    Ministry of Water Resources, West Block-1, Wing-4, Ground Floor,
    R.K. Puram, New Delhi – 110066

17. Copy to: Shri M.S. Agrawal, Member Secretary, Upper Yamuna River Board, West Block – 1, Ground Floor, Wing – 4, R.K. Puram, New Delhi 110066

    Dr. Parikshit Goutam,
    Director, Freshwater and Wetlands Programme,
    WWF India, 172 B, Max Mueller Marg,
    Lodi Estate,
    New Delhi 110003

18. Copy to: Sri Ravi Singh, Secretary General, WWF India, 172 B, Max Mueller Marg, Lodi Estate, New Delhi 110003

19. Shri Prasadi Ram
    Nayabans, Sector-15
    Noida- 201301
    Uttar Pradesh

20. Shri Ved Prakash
    Harolla, Sector- 5
    Noida- 201301
    Uttar Pradesh

21. Shri Satish (Pramukh)
    Harolla, Sector-5
    Noida- 201301
    Uttar Pradesh

22. Ram Pal (BDC- Nayabans)
    Nayabans, Sector- 15,
    Noida- 201301
    Uttar Pradesh

23. Ram Bhul (BDC- Harolla)
    Harolla, Sector- 5,
    Noida- 20130
    Uttar Pradesh

24. Mr. Ritesh Kumar
    Sr. Technical Officer
    Wetland International
    A-25, Second Floor, Defence Colony,
    New Delhi - 110024

25. Shri T.U. Khan
    Regional Officer
    UPPCB
    2 I.N.S. Sector-16, Vasundhra, Post-Prahalad Garhi,
    Ghaziabad, UP

26. Shri J. S. Kamyotra
    Member Secretery
    Central Pollution Control Board
    Parivesh Bhawan, CBD-cum-Office Complex
    East Arjun Nagar,
    Delhi-110032

ATTACHMENT-III

LIST OF WORKSHOP PARTICIPANTS

Sl. No.	Name and Postal Address	Telephone No. and Fax No.	Email address
1.	Sh. Prabhat Tyagi, DCF (South), NCT of Delhi Near Dr. Karni Singh Shooting Range, Tughlakabad, New Delhi – 110044	011-26044711 011-26047239	ptyagiits@yahoo.co.in
2.	Sh. Nisheeth Saxena DCF (PXM) & DCF (North) Kamla Naga Ridge, Delhi – 7	011-23853474 (O) 011-26192650 (R) # 9968312090	saxenanisheeth@yahoo.co.in
3.	Sh. Neeraj Kumar Deputy Conservator of Forests National Chambal Sanctuary Project U.P. Mau Forest Block, Near Central Hindi Institute Agra – 282005 (U.P.)	0562-2530091 9412808999 0562-2530091	dfochambal@rediffmail.com
4.	Sh. J.M. Banerjee Forest Range Officer, Okhla C/o Canal Colony, Okhla head New Delhi-25	9350854700	
5.	Sh. Kanhya Lal Sharma Asstt. Wildlife Warden Okhla Canal Colony, New Delhi – 25	9540137391	
6.	Sh. Anand Arya 353, Sector 15-A NOIDA-201301	9818261909	anandarya@anandarya.com
7.	Ms. Usha Dangwal Research Assistant Wetland International-South Asia A-25, Defence Colony, New Delhi	011-24338906 9650679227	usha.dangwal@wi-sa.org

Sl. No.	Name and Postal Address	Telephone No. and Fax No.	Email address
8.	Sh. C.R. Naveen Central Manager, Bombay Natural History Society Conservation Education Centre Office of the Conservator of Forests (South) Asola-Bhatti Wildlife Sanctuary, Tughlakabad, New Delhi – 110 044	011-26042010 (O) 011-40670387(R) 9910108097	crnaveen@gmail.com
9.	Sh. Rambhul Member, Chhetra Panchayat (B.D.C.) Ward No. 111, Block Bisrakh (Dadri), Sector-5, V-54, Harolla Noida	9873359367	
10.	Sh. Tejpal, Member B-54, Sector-5, Harolla Noida		
11.	Sh. Prasadi Ram Sector-15, Naya Bans, Harolla Noida	9871284070	
12.	Dr. Anil Kumar Bhardwaj Professor & Scientist-F Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117 9412056376	anilbhardwaj@wii.gov.in
13.	Dr. B.K. Mishra Professor & Scientist-F Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117 9411101689	bidyut@wii.gov.in
14.	Dr. S.A. Hussain Scientist-F Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117	hussain@wii.gov.in
15.	Sh. D. Mohan Scientist-F Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117	dmohan@wii.gov.in

Sl. No.	Name and Postal Address	Telephone No. and Fax No.	Email address
16.	Smt. Bitapi C. Sinha Scientist-F Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117	bcs@wii.gov.in
17.	Dr. Gopi G.V. Scientist-C Wildlife Institute of India Chandrbani, Dehradun	0135-2640112-115 Fax: 0135-2640117	
18.	Ms. Upma Manral Project Assistant Wildlife Institute of India Chandrbani, Dehradun C-9, Kunwar Singh Chowk Baljeet Nagar New Delhi – 110008	9458315271	upma_manral@yahoo.com
19.	Ms. Ridhima Solanki Project Assistant Wildlife Institute of India Chandrbani, Dehradun	9458315282	ridhimasolanki22@gmail.com
20.	Mr. Angshuman Raha Project Assistant Wildlife Institute of India Chandrbani, Dehradun	9456513804	adroitangshuman@gmail.com
21.	Mr. Neeraj Gupta Wildlife Institute of India Chandrbani, Dehradun		

Appendix XXII: List of works done in the past five years in OBS

Year 2004-05

क 0स0ं	भौतिक	वित्तीय (लाख मे)
1	अवांछनीय खरपतवार का निकालना	4.90
2	नैचर कैम्प	1.00
3	प ु स्वास्थ्य ि ाविर	0.60
4	प्रोजेक्टर का क्रय	1.00
5	प्रचार–प्रसार	1.15
6	मोटर साइकिल का क्रय	1.10
7	कैमरे का क्रय	0.70
8	अवेयरनैस कैम्प	1.50
	योग	**11.95**

Year 2005-06

क 0स0ं	भौतिक	वित्तीय (लाख मे)
1	वासस्थल सुधार कार्य	0.90
2	नैचर कैम्प	0.50
3	रोगिनार	1.00
4	इन्फ्लेटेबुल वोट मय इंजन	2.00
5	जेटी	1.00
6	प्रचार–प्रसार	4.00
7	वीड रिमूवल	4.00
8	ब्रो ार्स चेकलिस्ट आदि	0.50
	योग	**10.25**

Year 2006-07

क 0स0ं	भौतिक	वित्तीय (लाख मे)
1	वीड रिमूवल	2.50
2	हैविटैट इम्प्रूवमेन्ट	2.50
3	हैविटैट इम्प्रूवमेन्ट तथा ब्यूटीफिके ान	0.75
4	नैचर कैम्प	0.50
5	एनीमल हैल्थ कैम्प	0.50
6	हयूमन हैल्थ कैम्प	0.50
7	इन्स्टाले ान आफ टेलिफोन रैंज	0.05
8	कान्स्ट्रक ान आफ हट	0.30
9	रिवार्ड टू इन्फारमर	0.25
10	प्रचार–प्रसार	1.40
11	धेनिग	0.25
12	पेट्रोलिग / सरवाइवलकिट	0.16
13	बर्ड फ्लूकिट	0.20
14	रिसर्च मानीटरिंग	0.20
15	परचेज आफ इन्फ्लेटेबुल वोट मय इंजन	2.00
16	कान्स्ट्रक ान आफ आईलैण्ड	1.25
17	कान्स्ट्रक ान आफ बैरियर	2.00
	योग	**15.41**

Year 2007-008

क 0स0ं	भौतिक	वित्तीय (लाख मे)
1	परचेज आफ सर्वे इक्यूमेन्ट	1.00
2	कान्स्ट्रक ान आफ ब्रिक (खडंजा) रोड	1.50
3	आगमेन्टे ान आफ पाटेबुल वाटर	1.00
4	कान्स्ट्रक ान आफ स्टोर	1.00
5	हैविटैट इम्प्रूवमेन्ट	2.00
6	वीड रिमूवल	8.00
7	रिनोवे ान आफ स्टाफ क्वार्टर टाइप ।।।–1, टाइप 1–2	3.00
8	रिनोवे ान आफ बैरियर	0.30
9	नैचर कैम्प	0.50
10	अवेयरनैस कैम्प	0.50
11	एनीमल हैल्थ कैम्प	1.00
12	प्रचार–प्रसार	0.20
13	लीगत एक्सपेन्सेज	0.10
	योग	**20.10**

Year 2008-09

क 0स0ं	भौतिक	वित्तीय (लाख मे)
1	कान्स्ट्रक ान आफ इन्टैन्स गेट	1.00
2	नैचर ट्रैल विद साइनेज	1.00
3	पब्लिक यूटीलिटी आर0 सी0 सी0 बैन्च	0.50
4	कान्स्ट्रक ान आफ वाच टावर	0.33
5	फेन्सिंग आफ द सेंचुरी	4.00
6	क्रिये ान आफ न्यू फायर लाइन	1.00
7	इन्स्टाले ान आफ न्यू सोलर पैनल्स	1.00
8	रिमूवल आफ वाटर हाईसिम्थ	5.00
9	हैविटेट इम्प्रूवमेन्ट	1.00
10	फायर वाचर	0.36
11	रिनोवे ान आफ बैरियर	0.30
12	ठंगेजिंग गेटमैन	0.72
13	नैचर कैम्प	0.40
14	अवेयरनैस कैम्प	0.40
15	एनीमल हैल्थ कैम्प	0.50
16	प्रचार–प्रसार	0.50
	योग	**18.01**

Appendix XXIII: Existing and proposed staff for OBS

S.No.	Level	Existing no.	Proposed no.	Rationale
1	Range Forest Officer (RFO)	1	1	-
2	Forester/AWLW/Dy. RFO	1	2	To manage the western and eastern sectors
3	Wildlife Guard	3	6	Keeping in mind the proposed addition of buffer areas, increased tourism related activity and the beefing up the protection and basic requirements for the sanctuary
4	Boatman	1	1	-
5	Chowkidar		2	1 for the range campus and 1 for the facilities, like NIC, Reception centre, Guard Chaukis etc, in the sanctuary likely to be created during this plan period.
6	Mali/Gardner		1	For the external upkeep of the interpretation facilities
7	Driver		1	For the proposed four wheel vehicle for OBS

Appendix XXIV: List of trees planted in and around the Sanctuary

	Trees Planted	Plants exisiting in & around Sec.95(Sec 14A, 15A, 16A, Mahamaya & adjoining Delhi Areas)
1	*Acacia auriculiformis*	50
2	*Alstonia scholaris*	2500
3	*Cassia fistula*	400
4	*Terminalia Arjuna*	750
5	*Polyalthia longifolia*	800
6	*Saraca asoca*	300
7	*Acacia nilotica*	300
8	*Melia azedarach*	300
9	*Bamboo*	300
10	*Ficus Banghalensis*	41
11	*Callistemon laceolatous*	500
12	*Casuarina equisetifolia*	47
13	*Calendra*	1500
14	*Cassia siamea*	300
15	*Cassia biflora*	1000
16	*Cassia levigata*	500
17	*Ceiba pentandra*	3
18	*Chukrasia tabularis*	150
19	*Plumeria obtusa*	300
20	*Chandni double*	1500
21	*Tabernaemontana divaricata*	3000
22	*Citrus raticulata*	25
23	*Croton roxburghii*	100
24	*Cycas revoluta*	50
25	*Capparis decidua*	200
26	*Butea monosperma*	3
27	*Duranta erecta*	350
28	*Eucalyptus*	1500
29	*Ixora pavetta*	500
30	*Ficus benjamina*	2000

31	*Ficus black*	300
32	*Ficus longusisland*	30
33	*Ficus panda*	100
34	*Ficus rignold*	40
35	*Ficus topery*	150
36	*Ficus varigated*	150
37	*Ficus ceila*	150
38	*Caryota urens*	5
39	*Wodyetia bifurcata*	115
40	*Melaleuca bracteata*	125
41	*Gardenia*	200
42	*Ficus racemosa*	30
43	*Delonix regia*	800
44	*Hamelia patens*	1000
45	*Hibiscus rosa-sinensis*	1500
46	*Tamarindus indica*	10
47	*Syzigium cumini*	7500
48	*Jatropha curcas*	50
49	*Pithecellobium dulce*	150
50	*Bauhinia variegeta*	150
51	*Neolamarckia cadamba*	400
52	*Phoenix sylvestris*	16
53	*Pterospermum acerifolium*	2500
54	*Chorisia speciosa*	175
55	*Lagerstroemia indica*	400
56	*Lagerstroemia speciosa*	1500
57	*Nerium oleander*	500
58	*Lasuradha*	40
59	*Plumeria rubra*	40
60	*Limonia acidissima*	500
61	*Mangifera indica*	35
62	*Mimusops elengi*	350

63	*Murraya paniculata*	4000
64	*Azadirachta indica*	300
65	*Holoptelea integrifolia*	4000
66	*Ficus religiosa*	50
67	*Thevetia peruviana*	500
68	*Phoenix sylvestris*	70
69	*Ficus virens*	125
70	*Caesalpinia Pulcherrima*	300
71	*Populus tremula*	50
72	*Putranjica roxburghii*	18000
73	*Rhapis excelsa*	50
74	*Rosa sps.*	5000
75	*Roystonea regia*	75
76	*Syzigium nervosum*	150
77	*Tectona grandis*	150
78	*Bombax ceiba*	20
79	*Morus alba*	25
80	*Delbergia sissoo*	450
81	*Grevillea robusta*	50
82	*Albizia lebbeck*	300
83	*Leucaena leucocephala*	20000
84	*Tota Pari*	15
85	*Ravenala madagascariensis*	80
86	*Tecoma gorichori*	1080
87	*Tecoma stans*	3000
		96120

Impact Assessment of Development of City Level Park at NOIDA, Sector 95 on Okhla Bird Sanctuary

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

CONTENT

1. BACKGROUND

The present assessment pertains to the development and beautification of a City Level Park by the New Okhla Industrial Development Authority (NOIDA) located at Sector - 95. The project involves renovation, preservation and beautification of an existing woodland area of 33.43 ha (IA no. 2609-2610/2009). In the process the NOIDA felled 6803 trees from the project area adjacent to the eastern boundary of Okhla Bird Sanctuary, Gautam Budh Nagar. Vide its letter F.No. 21-18/2010-IA-III dated 4th May 2010 the Ministry of Environment and Forests, Government of India directed NOIDA to have an assessment done on the impact of the construction and felling of 6803 trees for the creation of the Park on the environs of the Okhla Bird Sanctuary (OBS). Vide letter No. NOIDA/D9H)/2010/137 dated 5th May 2010 the NOIDA requested the Wildlife Institute of India to take up this impact assessment.

As per revenue records of the district Gautam Budh Nagar, the project site is located on agricultural, banjar and common use land (Annexure 1). This piece of land was acquired by the land acquisition and resumption authority in favour of NOIDA (IA no. 2609-2610/2009). As per the data provided by the NOIDA, of the total 6803 trees felled from the project site majority of the species were exotic (83.6%) (i.e. 5688 trees belonging to 19 species) and the rest were native to India. The species wise density (trees ha-^{1}) of the felled trees and their Girth at Breast Height (GBH) has been enumerated in Annexure 2 and additional details of dominant species have been provided in Annexure 3. Based on the species composition the project area appears to be man-made woodland with native and exotic species.

2. OKHLA BIRD SANCTUARY

The Okhla Bird Sanctuary (OBS) is located in the NCR, Delhi at the point where the Yamuna River leaves the territory of Delhi and enters the state of Uttar Pradesh. The greater part of the Sanctuary is inundated Yamuna River Flood Plains which was formed due to the construction of the Okhla barrage across the Yamuna River.

This inundated water body along with the main channel of the Yamuna River approximating 400 ha was declared as a Bird Sanctuary under section 18 of Wildlife Protection Act, 1972 vide Gazette notification no. 577/14-4-82/89 dated 08.05.1990. The Sanctuary is one among

the several ornithologically significant sites along the 50 km stretch of the river Yamuna in Delhi (Ganguli 1975). The boundary of the Sanctuary in the north is Okhla weir and Okhla weir bund, in south is Barrage itself and the tie bund, in east left afflux bund and in west right afflux bund. The sanctuary lies in the Biogeographic provinces 7A, Upper Gangetic plains as defined by Rodgers and Panwar (1988).

The aquatic vegetation of the Sanctuary and the adjacent flood plains primarily consists of *Hydrilla - Najas – Nymphaea* communities in deeper area with mud, *Eichhornia - Spirodela* in open water areas, *Paspalum – Ipomoea - Corchorus* in relatively shallow water areas and *Phragmites – Typha- Saccharum* in draw down areas. The vegetation of the area is represented by 116 plants species belonging to 43 families. Of the 116 species, 15 species are trees, 18 species are shrub and 53 species consisted of herbs. Besides, 18 species of grasses and 4 species of sedges were also reported (WII, 2002). *Zizyphus mauritiana, Prosopis juliflora, and Dalbergia sissoo* are the most common tree species of the Sanctuary (WII, 2002).

Around 278 species of birds are using this sanctuary, out of which 89 species are aquatic and 189 are terrestrial. Of all the species 75 species are winter visitors, 8 species are summer visitors, 3 species are autumn/spring visitor 11 species have been reported occasionally. Of the aquatic species, 39 species are winter visitors, one species is summer visitor and six species are reported occasionally. Being situated in the Yamuna River flood plains the Okhla Bird Sanctuary has a very good population of fish represented by 87 species, belonging to 54 genera and 23 families. The other faunal diversity of the Sanctuary includes six species of anurans belonging to 5 genera and 3 families; 11 species of turtles, 13 species of snakes, and four species of lizards. In addition, twenty nine species of mammals belonging to 13 families have been reported from the Sanctuary (WII, 2002). Subsequently Urfi (2003) published a list of 302 birds including the historical records available in the literature.

Apart from being a biologically important area, the Sanctuary performs host of ecosystem services, primarily source of water for irrigation, ground water recharge, flood abatement and reduction in pollution level due to uptake by plant species. Being an urban wetland

Sanctuary having high bird diversity, it has significant recreational value as well as its buffer area is a source of biomass for local communities.

3. METHODS OF IMPACT ASSESSMENT

The assessment of the impact of felling of trees and construction of the Park on OBS is based on comparison of the ecological role played by felled trees/erstwhile woodland in terms of (i) wildlife habitat (ii) protective roles that it was performing as buffer of the OBS and (iii) its ecosystem service values in terms of carbon stock/sequestration, with surrogate habitat adjacent to the project location and the terrestrial habitat of the OBS. This was done through both primary observation and by consulting published information. To examine the wildlife value of the erstwhile woodland we derived the possible number of bird species which would have been using the said woodland prior to the felling, by consulting literature and corroborating it using observation in similar patches of adjoining woodlands i.e. along the left afflux bund and the strip of woodland immediately to the north of it (Fig. 1). Primary data on number of terrestrial bird species occurring in these woodlands was obtained from rapid assessment of these strips of woodland by conducting surveys during morning and evening for three consecutive days assuming that the bird species observed in the existing patches will be similar to the erstwhile woodland. The winter data for birds in the two areas (left afflux dam and northern strip of woodland) was collated from earlier observations made by the Wildlife Institute of India.

The vehicular traffic was monitored for ten minutes at an interval of two hours between 6:00 am to 8:00 pm to get an idea of its volume so as to relate with the ecological values of felled trees in terms of protective role that it was performing for the OBS from the disturbance caused due to traffic on the Dadri road. We also examined the carbon stored/sequestration value of the erstwhile woodland by comparing the similar urban woodlands.

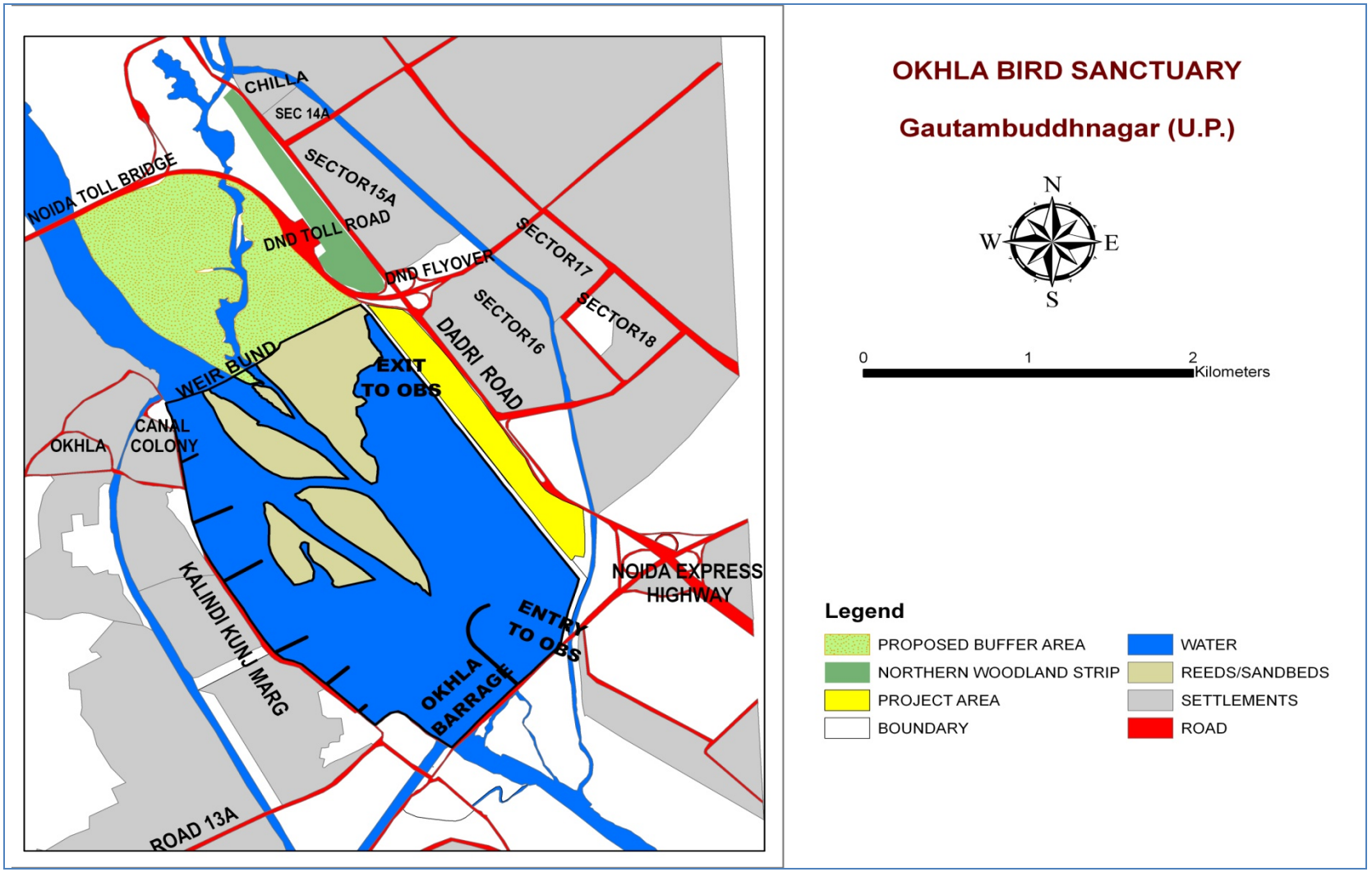


Fig. 1. Map of Okhla Bird Sanctuary showing project area, Northern woodland strip and proposed addition/buffer area

4. ASSESSMENT OF THE IMPACT

From available literature it was concluded that around 101 species of terrestrial birds are using woodlands of OBS (Urfi, 2003) and in similar wooded areas adjacent to it (excluding vagrants and large raptors). During our survey 58 species of birds in the terrestrial habitats of left afflux bund road and 51 species in the existing woodland north to the project area were observed (Annexure 4). From this, it is concluded that the erstwhile woodland would have been used by 51-101 species of terrestrial birds and was an extended habitat for the wildlife of the Okhla Bird Sanctuary, primarily terrestrial birds. Some of these birds may be using the erstwhile woodland for breeding as well.

Traffic monitoring shows the stretch of Dadri road adjoining to the project area receives heavy traffic everyday nearly 12,719 vehicles pass per hour. The disturbances like noise, air pollution and distraction caused by light due to heavy traffic during night have a negative impact on the Sanctuary. The erstwhile woodland was acting as a buffer against these disturbances. The project area which was in continuation with the vegetation along the left afflux bund was providing a green belt approximately 2 km long and 218 m wide on an average. Before the felling of trees this patch might have acted as a protective green belt of approximately 190 m width with a tree density of 203.5 trees ha^{-1} (density of trees felled) which is now reduced to approximately 28 m (between the western wall of the project and OBS boundary of left afflux dam). From this it is concluded that the Sanctuary lost its buffer of around 33. 43 ha that will have significant impact on the OBS and its tranquility.

The urban forest contributes to the removal of air pollution, sequestration of atmospheric carbon dioxide, hydrologic benefits, energy conservation, and improves aesthetics (McPherson et al., 1994; McPherson, 2004). Vegetative canopies in urban areas provide a cooling effect on microclimates directly by shading the ground surface and indirectly through transpiration (Scott et al., 1999). Because they lower air temperatures, shade buildings in the summer, and block winter winds, trees also reduce energy use associated with heating/cooling (Miller, 1997; McPherson, 2004). The aesthetic value of the urban forest translates into human health values. Urban trees benefit mental health by creating feelings of relaxation and well-being (Kuo 2003). They can also provide privacy in the form

of a natural fence and a sense of solitude and security (Kuo 2003). At a larger scale, urban greening projects can also help to build stronger neighborhoods and improve community involvement (Westphal 2003). Urban forests are necessary green infrastructure and a cost efficient way to effectively address urban ecosystem issues.

The erstwhile woodland was providing above benefits and also acted as natural sink for the atmospheric carbon. Carbon sequestration is the removal of carbon from the atmosphere by storing it in the biosphere. About two-thirds of terrestrial carbon is sequestered in the standing forests, forest under-storey plants, leaf and forest debris, and in forest soils (Sedjo et al., 1998). The 1997 Kyoto protocol specifically mentioned afforestation and reforestation as tools that can be used to reduce level of carbon dioxide from the atmosphere. A study conducted on urban mixed woodland reported *Leucanea leucoephala* stored 3.54 tons of carbon ha^{-1} with a density of 4.78 trees ha^{-1}(Gupta 2008). A study in Tehran reported urban forest sequesters about 3.7 tons of carbon ha^{-1} $year^{-1}$ (Ashraghi 2004). Such carbon sequestration value of the erstwhile woodland was lost, though the NOIDA has already taken up ameliorative steps in form of afforestation in and around the project site.

Many studies indicates that the increasing use of artificial light at night have an adverse impact on populations of birds, particularly those that typically migrate at night (Gauthreaux and Belser 2006). In fact, artificial night lighting affects the natural behavior of many animal species. It can disturb development, activity patterns, and hormone-regulated processes, such as the internal clock mechanism (Rich and Longcore 2006). This may cause direct mortality, or may have indirect negative effects through the depletion of their energy reserves (Poot et al, 2008). Birds do respond significantly differently to various colours. Migratory birds react strongest to white and red light (long wavelength); little to green light (shorter wavelength); and blue light (short wavelength) hardly causes any observable effect on the birds' orientation (Poot et al, 2008).

With the loss of buffer and increased artificial light at the project site, it is likely that the migratory bird population may get affected in long run. Bird friendly diffused light with blue tinge may reduce the negative impacts, though much research on this aspect is required.

5. SUGGESTED MITIGATION MEASURES

To mitigate the loss of tree cover and the change in landscape structure due to the construction of the Park and subsequent anticipated increase in disturbance due to the increased human activities adjacent to the OBS, following mitigation measures have been suggested:

(1) **Re-vegetation of the Project site to compensate the loss of vegetation**: Ameliorative measures have already been taken up by the NOIDA by planting both native and exotics species within in the project area and on the eastern flank of left afflux bund of the Yamuna River/OBS at close spacing. However, emphasis should be given to propagate only the native species.

(2) **Reduction of adverse impact on the OBS**: It is suggested that buffer at the north and north eastern side of the Sanctuary to reduce direct disturbance to the OBS may be created. The area north of the weir bund of the OBS is a promising site for waterbirds which prefer shallow water or grass growth particularly geese and waders. It is suggested that the waterlogged Yamuna floodplain north to the OBS and up to the DND flyover having an area of 130 ha (Fig. 1) may be included with the OBS or protection to it as the buffer under the provision of WPA, 1972 be provided.

The strip of woodland with an area of 24 ha immediately to the north of the project area (Fig. 1) needs to be protected as buffer of the OBS also and its land-use needs to be maintained unaltered. Being in close proximity of the OBS it will have an ameliorative effect on the Sanctuary. It would also provide additional habitat to the terrestrial bird species of the OBS.

Efforts should also be made to keep the intensity of artificial light and noise at the project site to a bare minimum during night, especially after sunset in migratory seasons of birds (October - March). Bird friendly diffused light with blue tinge during night, may reduce the negative impacts if any on OBS, though much research on this aspect is required.

It is suggested that at the periphery of the OBS, fence wherever not existing be created and the breach in the existing fence be mended on priority.

(3) **Eliciting support from the Government of Delhi for the conservation of OBS**: As the OBS is a interstate Protected Area having open access from all side it is imperative that the Government of Delhi may also be persuaded to take active part in its management.

(4) **Ensuring financial commitment for the improved conservation management of the Park**: As per the Order of the Honorable Supreme Court granted for other development project adjacent to Protected Areas (e.g. IA No 856/2006), 5% of the total costs of the project be deposited with the Forest Department, Government of U.P. to improve the ecosystem structure and functions, waterbird habitat, public amenities and interpretation centre and improved management of the of the OBS.

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Annexure 1. Revenue record certificate of the Project Site

कार्यालय जिलाधिकारी, गौतमबुद्ध नगर

पत्रांकः- 1793 /रा० का० दिनांकः- 16.07.2009

प्रमाण पत्र

प्रमाणित किया जाता है कि राजस्व ग्राम नयाबाँस, छलेरा खादर एवं छलेरा बाँगर तहसील व परगना, दादरी, जिला गौतम बुद्ध नगर में सैक्टर 95, नौएडा के अन्तर्गत स्थित सभी खसरा नम्बरान का कोई भू-भाग बन्दोबस्त वर्ष 1359 फसली से अब तक राजस्व अभिलेखों में जंगल अथवा वन विभाग के रूप में अंकित नहीं रहा है। सैक्टर 95 के अन्तर्गत आने वाले सभी खसरा नम्बरान राजस्व अभिलेखों के अनुसार बन्दोबस्त वर्ष 1359 फसली से कृषि योग्य भूमि या बंजर व परती के रूप में दर्ज रहे है ।

(राजबीर सिंह)
क्षेत्रीय लेखपाल

(माँगे राम)
राजस्व निरीक्षक

(जितेन्द्र सिंह)
नायब तहसीलदार

(अशोक कुमार मौर्य)
तहसीलदार दादरी

(सौम्य श्रीवास्तव)
उप जिलाधिकारी, दादरी

Annexure 2. Origin, number and density of tree species felled according to their GBH classes.

GBH classes: 1- up to 30 cm; 2- 30-60 cm; 3- 60-75 cm; 4- 75-125 cm; 5- >125 cm
Origin: E - Exotic to India; N - Native to India

S. No.	Species name	Origin	No. of individuals	Density (per hectare)					
				On the basis of GBH					Total
				1	2	3	4	5	
1	*Leucaena leucocephala*	E	4483	16.65	61.71	41.37	8.64	1.17	134.1
2	*Senna siamea*	E	94	-	0.21	0.93	1.55	0.12	2.81
3	*Callistemon laceolatous*	E	216	0.42	4.01	1.59	0.36	0.03	6.46
4	*Chorisia speciosa*	E	20	-	-	0.51	0.09	-	0.6
5	*Spathodea campanulata*	E	2	-	-	0.06	-	-	0.06
6	*Grevillea robusta*	E	5	-	-	0.06	-	-	0.15
7	*Polyalthia longifolia*	E	6	-	-	-	0.18	-	0.18
8	*Roystonea regia*	E	166	-	1.49	0.18	2.96	0.33	4.97
9	*Delonix regia*	E	16	-	0.12	0.34	0.03	-	0.48
10	*Ficus benjamina*	E	236	-	3.29	2.99	0.78	-	7.06
11	*Eucalyptus hybriba*	E	43	-	0	0.24	0.06	-	1.29
12	*Plumeria obtusa*	E	13	-	3.38	-	-	-	3.38
13	*Ficus panda*	E	78	-	2.33	-	-	-	2.33
14	*Platycladus orientalis*	E	113	-	3.38	-	-	-	3.38
15	*Acacia auricliformis*	E	104	-	1.05	1.38	0.63	0.06	3.11
16	*Casuarina equisetifolia*	E	8	-	-	0	0.24	-	0.24
17	*Azadirachta indica*	E	72	0.84	0.75	0.42	0.15	-	2.15
18	*Ceiba pentandra*	E	3	0.03	0.06	-	-	-	0.09
19	*Jacaranda mimosifolia*	E	10	-	0.15	0.12	0.03	-	0.3
20	*Delbergia sissoo*	N	464	3.68	5.56	2.96	1.23	0.36	13.88

21	*Bauhinia variegeta*	N	43	0.09	0.33	0.66	0.15	0.03	1.29
22	*Syzigium cumini*	N	154	0.63	0.6	0.6	2.78	-	1.61
23	*Alstonia scholaris*	N	4	-	-	-	0.12	-	0.12
24	*Mimusops elengi*	N	119	0.06	0.48	1.91	1.11	-	3.56
25	*Pterospermum acerifolium*	N	63	-	0.3	1.23	0.36	-	1.88
26	*Acacia nilotica*	N	6	-	-	-	-	-	0.18
27	*Caryota urens*	N	62	-	-	-	1.85	-	1.85
28	*Lagerstroemia speciosa*	N	54	0.06	0.87	0.3	-	-	1.61
29	*Albizia lebbeck*	N	53	0.03	0.48	0.24	0.36	0.3	1.59
30	*Mangifera indica*	N	1	0.03	-	-	-	-	0.03
31	*Bombax ceiba*	N	10	0.03	0.06	0.15	0.03	-	0.3
32	*Chukrasia tabularis*	N	7	0.03	0.06	0.06	0.06	-	0.21
33	*Ficus religiosa*	N	4	-	0.06	0.06	-	-	0.12
34	*Morus alba*	N	4	-	0.06	0.03	0.03	-	0.12
35	*Neolamarckia cadamba*	N	8	-	-	-	0.21	0.03	0.24
36	*Ficus virens*	N	5	0.03	0.09	-	0.03	-	0.15
37	*Terminalia Arjuna*	N	3	-	-	0.09	-	-	0.09
38	*Ficus Elastica*	N	2	-	-	0.03	0.03	-	0.06
39	*Butea monosperma*	N	12	-	-	0.36	-	-	0.36
40	*Phoenix sylvestris*	N	1	-	-	-	0.03	-	0.03
41	*Ficus racemosa*	N	3	-	0.06	0.03	-	-	0.09
42	*Holoptelea integrifolia*	N	4	-	0.03	0.09	-	-	0.12
43	*Ficus Banghalensis*	N	21	-	-	0.03	0.51	0.03	0.63
Total			6803						

Annexure 3. Density and percentage of dominant exotic and native tree species which were felled

Sl. No.	Tree Name	Origin	Number	(%)	Density (per hectare)
1	*Leucaena leucocephala*	E	4483	65.9	134.1
2	*Ficus benjamina*	E	236	3.47	7.06
3	*Callistemon laceolatous*	E	216	3.17	6.46
4	*Roystonea regia*	E	166	2.44	4.97
5	*Platycladus orientalis*	E	113	1.66	3.38
6	*Delbergia sissoo*	N	464	6. 82	13.88
7	*Syzigium cumini*	N	154	2.26	1.61
8	*Mimusops elengi*	N	119	1.75	3.56
9	*Pterospermum acerifolium*	N	63	0.93	1.88
10	*Caryota urens*	N	62	0.91	1.85
11	*Lagerstroemia speciosa*	N	54	0.79	1.61
12	*Albizia lebbeck*	N	53	0.77	1.59
13	*Bauhinia variegeta*	N	43	0.63	1.29

Annexure 4. List of terrestrial birds of OBS and its environs prepared from Literature survey and birds observed during rapid assessment

	Status as in Urfi, 2003			Observations by WII	
BIRDS	**SCIENTIFIC NAME**	**STATUS**	**ABUND.**	**LA BUND**	**NORTHERN STRIP OF WOODLAND**
BLACK FRANCOLIN	*Francolinus francolinus*	R	UC		
GREY FRANCOLIN	*Francolinus pondicerianus*	R	C	R	
INDIAN PEAFOWL	*Pavo cristatus*	R	UC	R	R
YELLOW-LEGGED BUTTONQUAIL	*Turnix tanki*	?	O		
BARRED BUTTONQUAIL	*Turnix suscitator*	R	O		
EURASIAN WRYNECK	*Jynx torquilla*	W	O	W	
YELLOW-CROWNED WOODPECKER	*Dendrocopos mahrattensis*	R	UC		
BLACK-RUMPED FLAMEBACK	*Dinopium benghalense*	R	UC	W	W
BROWN-HEADED BARBET	*Megalaima zeylanica*	R	C	S	S
COPPERSMITH BARBET	*Megalaima haemacephala*	R	C	S	S
INDIAN GREY HORNBILL	*Ocyceros birostris*	R	C		
COMMON HOOPOE	*Upupa epops*	R	C		
INDIAN ROLLER	*Coracias benghalensis*	?	C	R	R
WHITE-THROATED KINGFISHER	*Halcyon smyrnensis*	R	C	R	R
GREEN BEE-EATER	*Merops orientalis*	R	C	R	R
PIED CUCKOO	*Clamator jacobinus*	M	UC		
COMMON HAWK CUCKOO	*Hierococcyx varius*	?	UC		
ASIAN KOEL	*Eudynamys scolopacea*	R	C	S	S
GREATER COUCAL	*Centropus sinensis*	R	UC	R	R
ALEXANDRINE PARAKEET	*Psittacula eupatria*	R	UC	W	
ROSE-RINGED PARAKEET	*Psittacula krameri*	R	C	R	R
PLUM-HEADED PARAKEET	*Psittacula cyanocephala*	R	UC		
EURASIAN EAGLE OWL	*Bubo bubo*	R(?)	O		
INDIAN NIGHTJAR	*Caprimulgus asiaticus*	?	O		
LAUGHING DOVE	*Streptopelia senegalensis*	R	C	R	S

SPOTTED DOVE	*Streptopelia chinensis*	?	O	W	W
RED COLLARED DOVE	*Streptopelia tranquebarica*	?	UC		
EURASIAN COLLARED DOVE	*Streptopelia decaocto*	R	C	R	R
YELLOW-FOOTED GREEN PIGEON	*Treron phoenicoptera*	R	UC	W	S
YELLOW-WATTLED LAPWING	*Vanellus malarbaricus*	R	O		
RED-WATTLED LAPWING	*Vanellus indicus*	R	C		
ORIENTAL HONEY-BUZZARD	*Pernis ptilorhyncus*	R(?)	O	W	
BLACK-SHOULDERED KITE	*Elanus caeruleus*	R	O		
BLACK KITE	*Milvus migrans*	R	C	R	R
COMMON KESTREL	*Falco tinnunculus*	W	O	W	
SHIKRA	*Accipiter badius*	R	UC		S
LAGGAR FALCON	*Falco jugger*	R	O		
BAY-BACKED SHRIKE	*Lanius vittatus*	R	C		
LONG-TAILED SHRIKE	*Lanius schach*	R	O	R	S
RUFOUS TREEPIE	*Dendrocitta vagabunda*	R	C	R	R
HOUSE CROW	*Corvus splendens*	R	C	R	R
LARGE-BILLED CROW	*Corvus macrorhynchos*	R	UC	W	
EURASIAN GOLDEN ORIOLE	*Oriolus oriolus*	R	UC	S	S
SMALL MINIVET	*Pericrocotus cinnamomeus*	R	O		W
WHITE-BELLIED MINIVET	*Pericrocotus erythropygius*	W	O		
LONG-TAILED MINIVET	*Pericrocotus ethologus*	W	O		
WHITE-BROWED FANTAIL	*Rhipidura aureola*	R	O		
BLACK DRONGO	*Dicrurus macrocercus*	R	C	R	R
COMMON WOODSHRIKE	*Tephrodornis pondicerianus*	R	UC		
ORANGE-HEADED THRUSH	*Zoothera citrina*	W	O		
RED-THROATED FLYCATCHER	*Ficedula parva*	PM	O	W	
GREY-HEADED CANARY FLYCATCHER	*Culicicapa ceylonensis*	W	O	W	W
ORIENTAL MAGPIE ROBIN	*Copsychus saularis*	R	UC	W	R
INDIAN ROBIN	*Saxicoloides fulicata*	R	C	R	R
BLACK REDSTART	*Phoenicurus ochruros*	W	O	W	W
COMMON STONECHAT	*Saxicola torquata*	W	C	W	S

PIED BUSHCHAT	*Saxicola caprata*	R	C	R	R
BROWN ROCK-CHAT	*Cercomela fusca*	R	C		
BRAHMINY STARLING	*Sturnus pagodarum*	R	C	W	W
ROSY STARLING	*Sturnus roseus*	W	PM		W
ASIAN PIED STARLING	*Sturnus contra*	R	C	R	R
COMMON STARLING	*Sturnus vulgaris*	W	C	W	W
COMMON MYNA	*Acridotheres tristis*	R	C	R	R
BANK MYNA	*Acridotheres ginginianus*	R	C	R	R
CHESTNUT-BELLIED NUTHATCH	*Sitta castanea*	R(?)	O		
SPOTTED CREEPER	*Salpornis spilonotus*	R(?)	O		
RED-WHISKERED BULBUL	*Pycnonotus jocosus*	R	UC	R	R
RED-VENTED BULBUL	*Pycnonotus cafer*	R	C	R	R
ZITTING CISTICOLA	*Cisticola juncidis*	R	UC		
GRACEFUL PRINIA	*Prinia gracilis*	R	UC		
GREY-BREASTED PRINIA	*Prinia hodgsonii*	R	C		
YELLOW-BELLIED PRINIA	*Prinia flaviventris*	R	C		S
ASHY PRINIA	*Prinia socialis*	R	C	R	R
PLAIN PRINIA	*Prinia inornata*	R	C	R	R
ORIENTAL WHITE-EYE	*Zosterops palpebrosus*	R	C		S
BLYTH'S REED WARBLER	*Acrocephalus dumatorum*	PM	O	PM	PM
COMMON TAILORBIRD	*Orthotomus sutorius*	R	C	R	R
COMMON CHIFFCHAFF	*Phylloscopus collybita*	W	C		
HUME'S WARBLER	*Phylloscopus humei*	W	C	W	W
GREENISH WARBLER	*Phylloscopus trochiloides*	PM	C	PM	PM
YELLOW-EYED BABBLER	*Chrysomma sinense*	R	C	W	
COMMON BABBLER	*Turdoides caudatus*	R	C	W	
LARGE GREY BABBLER	*Turdoides malcolmi*	R	C		S
JUNGLE BABBLER	*Turdoides striatus*	R	C	R	R
LESSER WHITETHROAT	*Sylvia curruca*	W	C	W	W
ORPHEAN WARBLER	*Sylvia hortensis*	W	O	W	
INDIAN BUSHLARK	*Mirafra erythroptera*	R	UC		

BENGAL BUSHLARK	*Mirafra assamica*	R	UC		
ASHY-CROWNED SPARROW LARK	*Eremopterix grisea*	R	UC		
GREATER SHORT-TOED LARK	*Calandrella brachydactyla*	W	UC		
CRESTED LARK	*Galerida cristata*	R	UC		
ORIENTAL SKYLARK	*Alauda gulgula*	R	UC	W	
PURPLE SUNBIRD	*Nectarinia asiatica*	R	C	R	R
HOUSE SPARROW	*Passer domesticus*	R	C	R	R
CHESTNUT-SHOULDERED PETRONIA	*Petronia xanthocollis*	?	O		
OLIVE-BACKED PIPIT	*Anthus hodgsoni*	W	O	W	
RED AVADAVAT	*Amandava amandava*	R	O	S	S
INDIAN SILVERBILL	*Lonchura malabarica*	R	C	R	S
SCALY-BREASTED MUNIA	*Lonchura punctulata*	R(?)	O		
COMMON ROSEFINCH	*Carpodacus erythrinus*	W	O	W	
WHITE-CAPPED BUNTING	*Emberiza stewarti*	PM	R		
		101 species		64 species	

The effort in sampling particularly in summer was less and so abundance stutus has not been given.
KEYS: W = Wintering; R = Resident; M = Migrant (summer or monsoon migrant); PM = Passage Migrant; ? = unknown seasonal status; C = Common (seen in large numbers on the majority of visits); UC = Uncommon (seen in small numbers on the majority of visits); O = Occasional (seen in small numbers on a few occasions);
R= Observed both in Summer and winter; W= Observed only in winter; S= Observed only in rapid summer survey; PM= Observed in passage