



Focus areas

Topography

Land use impact

Why WHM at airports

Statutory Regulations

Aerodrome WHM – Active /Passive control

Risk Assessments

Vegetation Management Plan

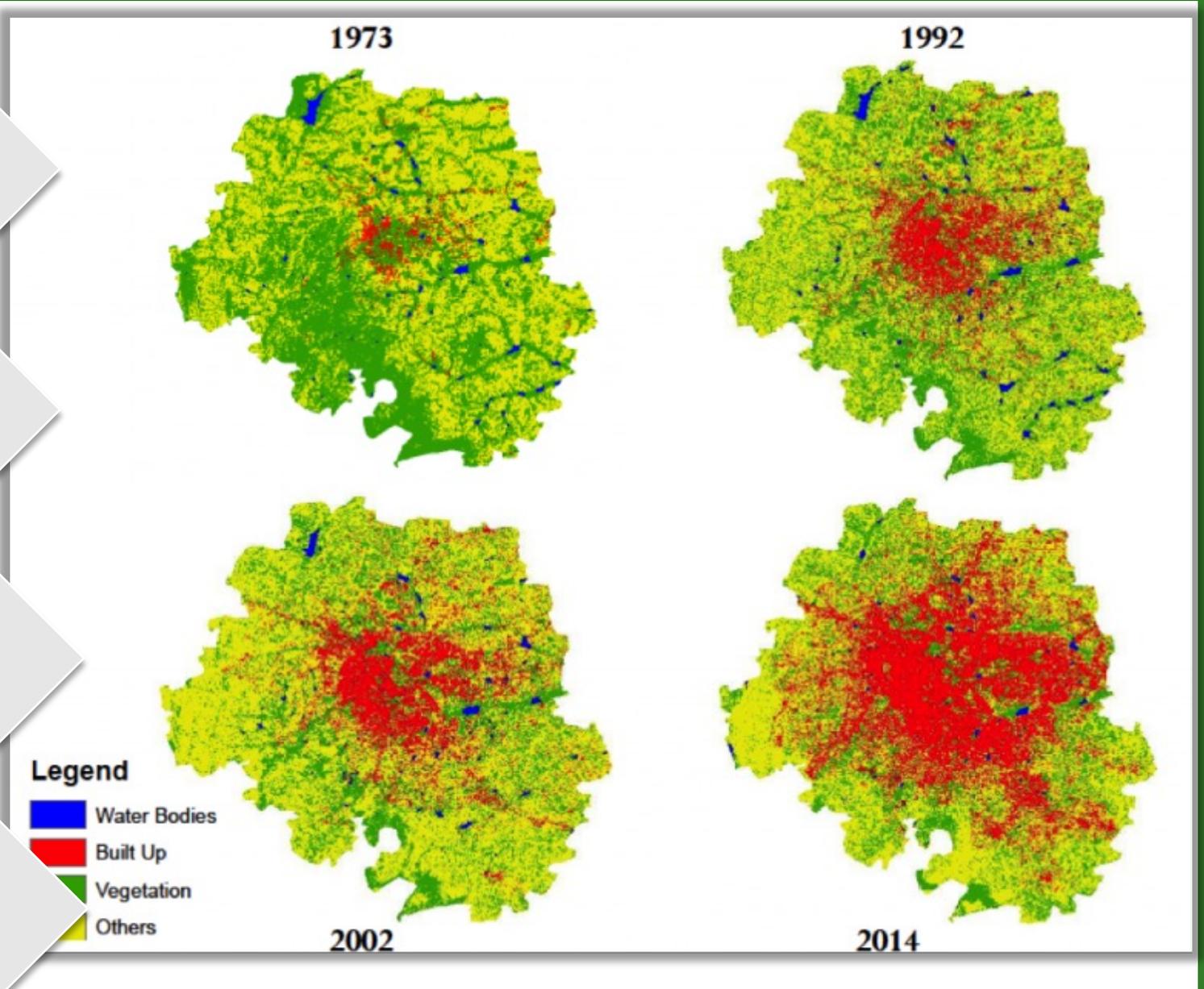
Impact of Land use pattern on ecology

Urbanization related ecosystem change

Depletion of lakes/Pollution of lakes

Rapid loss of habitat

Flushing more distress birds into airspace



The Wildlife (Protection) Act, 1972, is the umbrella legislation in the country for wildlife crime enforcement. State Forest and Police Departments are the primary enforcement agencies with regards to wildlife crimes. Wildlife crimes are also investigated by Central Bureau of Investigation (CBI) with the permission of State Governments concerned.

Wildlife crime can be defined as taking, possession, trade or movement, processing, consumption of wild animals and plants or their derivatives in contravention of any international, regional, or national legislation(s). Infliction of cruelty to and the persecution of wild animals, both free-living and captive are also at times added to this definition.

. It is clear from the constitutional mandate that wildlife is our national wealth hence any actions of airport in dealing with Wildlife hazard to in compliance with WPA 1972

Wildlife Protection Act 1972

Care to Cultural sentiments

THE MOST SACRED ANIMALS ON THE PLANET
WWW.ILOVEVETERINARY.COM 

COW Cows regarded as a holy animal in religions like Hinduism, Jainism and Zoroastrianism.

Serpent deities have an important place in Indian culture. During 'Nag Panchami', Hindus worship the serpent deities, and offer them prayers and warm milk. 

TIGER According to the Korean folklore, the tiger is regarded as guardian of the west and a divine spirit. They symbolize power and courage and are believed to ward off evil and bring about good luck.

Dogs, man's best friend, is also worshipped during the Rakshas Tika festival in few parts of Nepal. In Hindu culture, Lord Ganesha's eye is depicted with four dogs, and these dogs represent the four Vedas (Rig, Yajur, Sama, Isha, Yajur, Isha, and Atharva Vedas). 

ELEPHANT All over southern India, the majestic elephants are worshipped in the temples. The Hindu mythology even has a deity called Ganesha, the Elephant God.

The goat is one of the 12 sign in the Chinese Zodiac. The goat has been worshipped also in Greek and Egyptian mythology. 

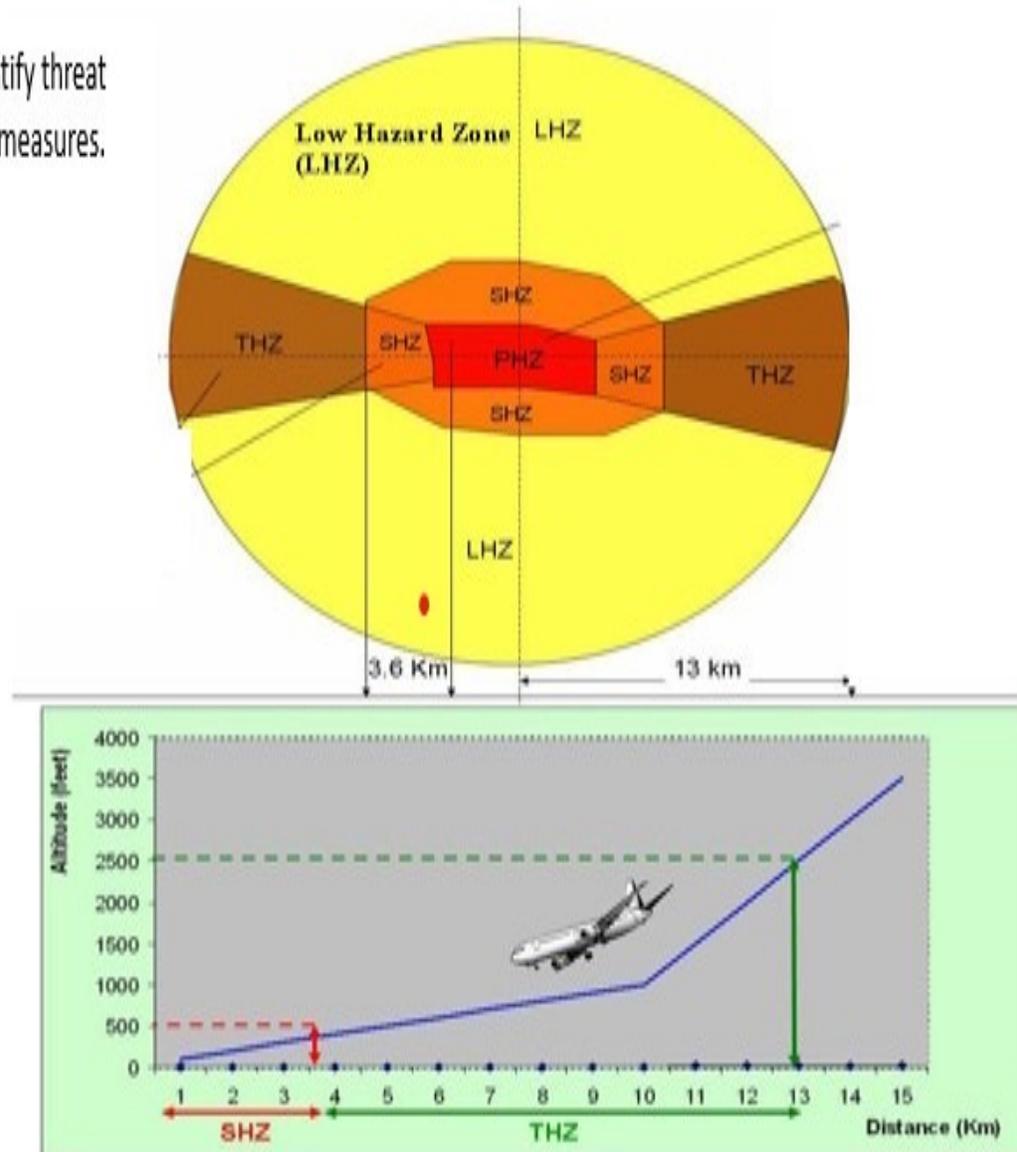
The people of ancient Egypt regarded pigs as sacred and as an important deity. Their deity appeared as a pig with erect bristles, who kept an eye on storms, rains, droughts and darkness. 

The people of Ancient Egypt were especially known for cat worshipping. The cat's ability to control snakes and vermin made them a 



Wildlife Hazard Assessment

Survey of 13 KM radius – identify threat sources – suggest preventive measures.



Primary Hazard Zone(PHZ)

- Critical area of Airport

Secondary Hazard Zone(SHZ)

- Surrounding villages within 2 Km from ARP and approach/take off funnel

Tertiary Hazard Zone(THZ)

- Areas beyond 2 Km on approach/ take off funnel

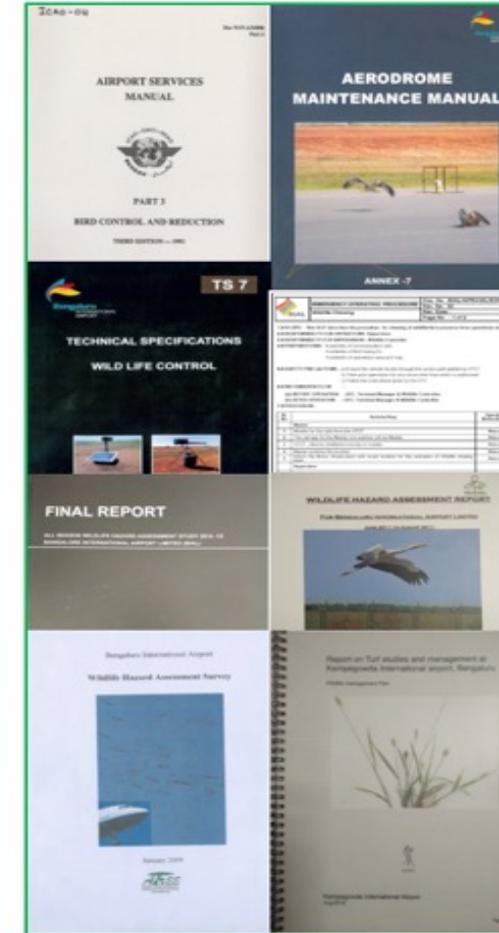
Least Hazard Zone

- Areas to be monitored for Potential Hazardous bird attraction

Primary Guidance Documents

- Wildlife Hazard Assessment Report – Airport & around 13 Km radius
- Airport WHM Manual /WHMP
- Technical specifications with maintenance Manual – WHM devices
- Emergency Operating Procedure
- Standard Operating procedures
- WHA Reports of Ornithologists/ Consultant
- Turf studies and Management report
- Bat Hazard Survey
- Honeybee Survey
- WHA survey report (2020)x

- Reference to
- ICAO ASM 9137
- Review process as per DGCA - CAR/AD AC reference



BASHM Jurisdiction

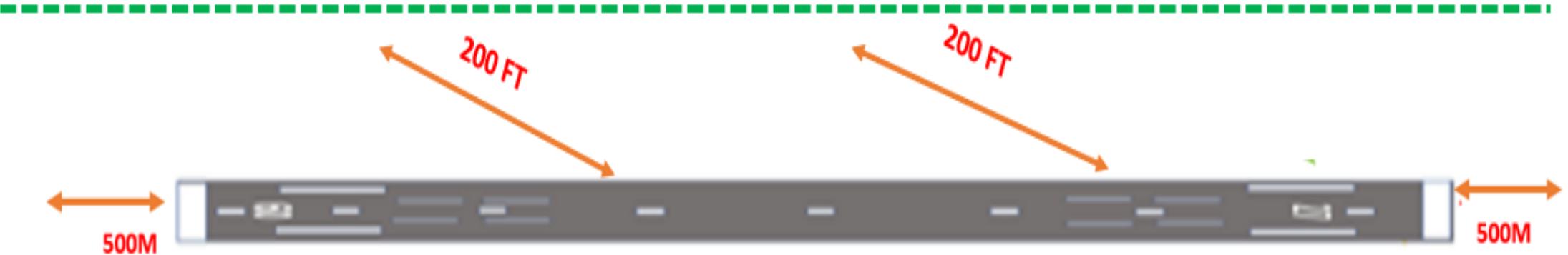


BASHM

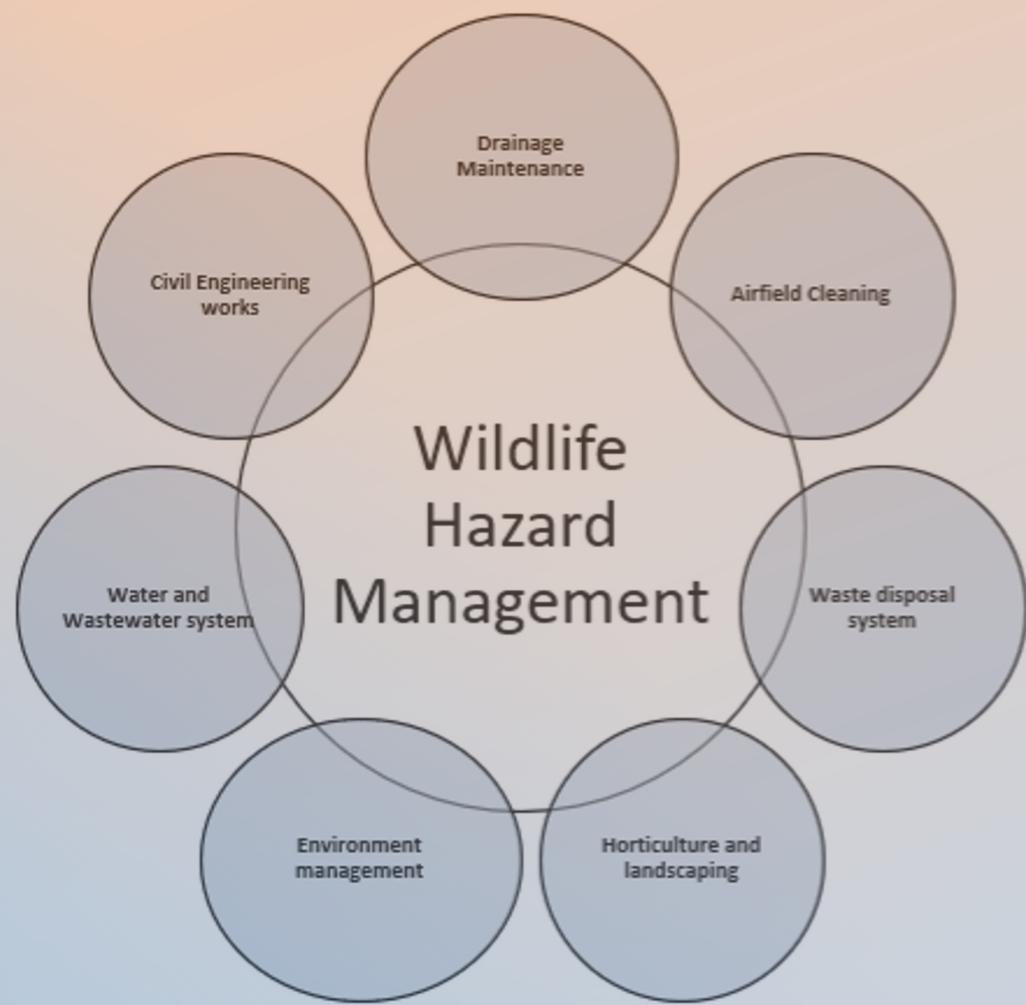
Total airside area – 2467 acres

Habitat Management

1794 Acres
(N Rwy 1014+ S Rwy 780)



Integrated Wildlife hazard management system



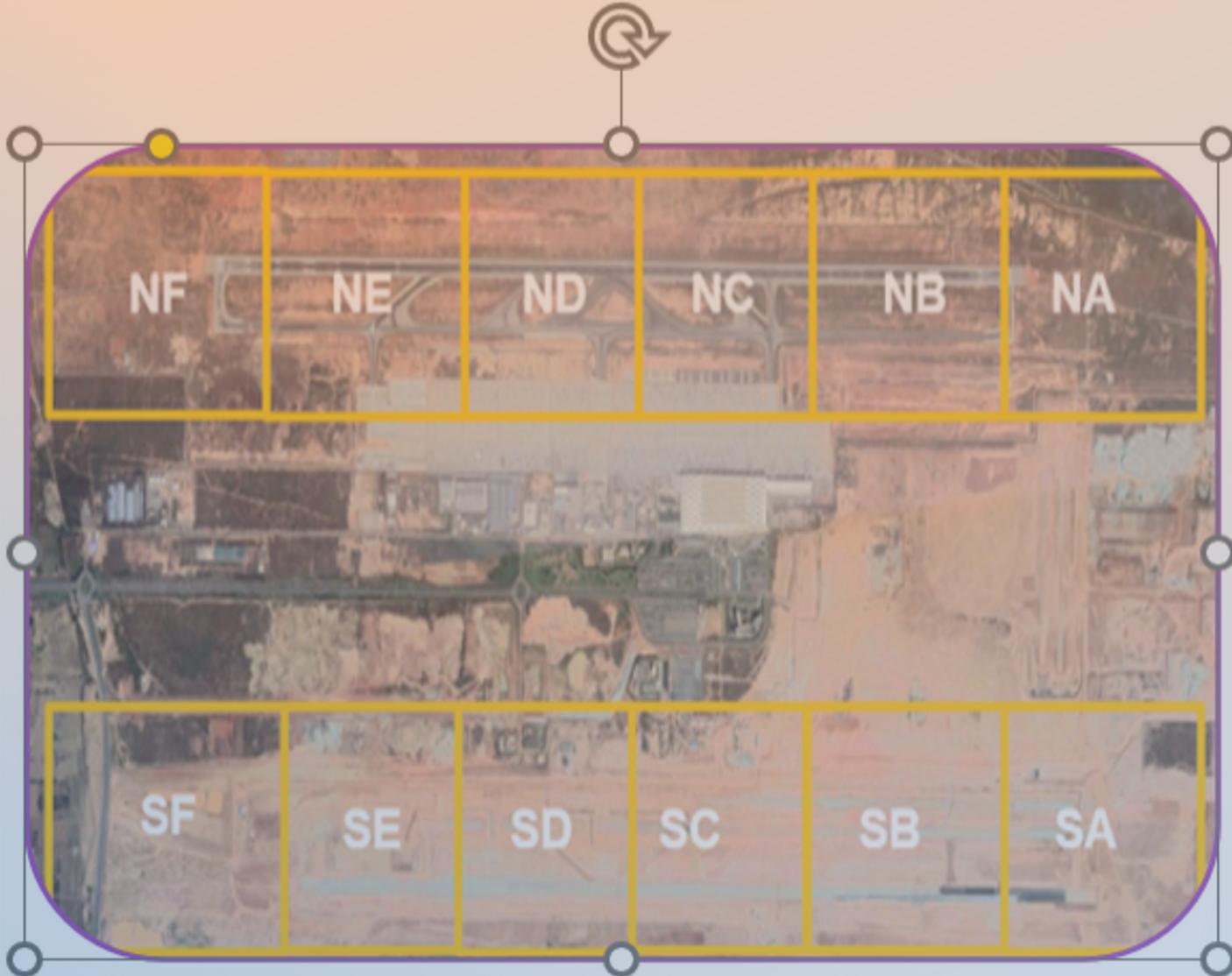
- Wildlife attracts to favorable ecosystem
- Airport ecosystem is impacted due to:
 - **Soil excavation**
Exposing insects to birds
Disturbs the habitat of rodents/reptiles
Migrates to favorable areas
 - **Drainage**
Leads to rodent burrows
Growth of wild vegetation
 - **Waste Management**
Dry/food waste management
Organic waste management
 - **Water & Wastewater management**
 - **Environment Management**
 - **Horticulture and Landscape department**

Primary Hazard Zone - Active control measures



- Wildlife/Bird watching
- Wildlife/Bird data recording
- Manning critical hot spots for Bird chasing
- Deployment of bird scarer with bird hazing kit
- Usage of pyrotechnics
- Cracker bombs
- Special crackers
- Six shot launchers
- Blasting devices
- Remote operated thunder cannons
- Acoustic deterrents
- Lazer sticks

Primary Hazard Zone – Allocation of zones

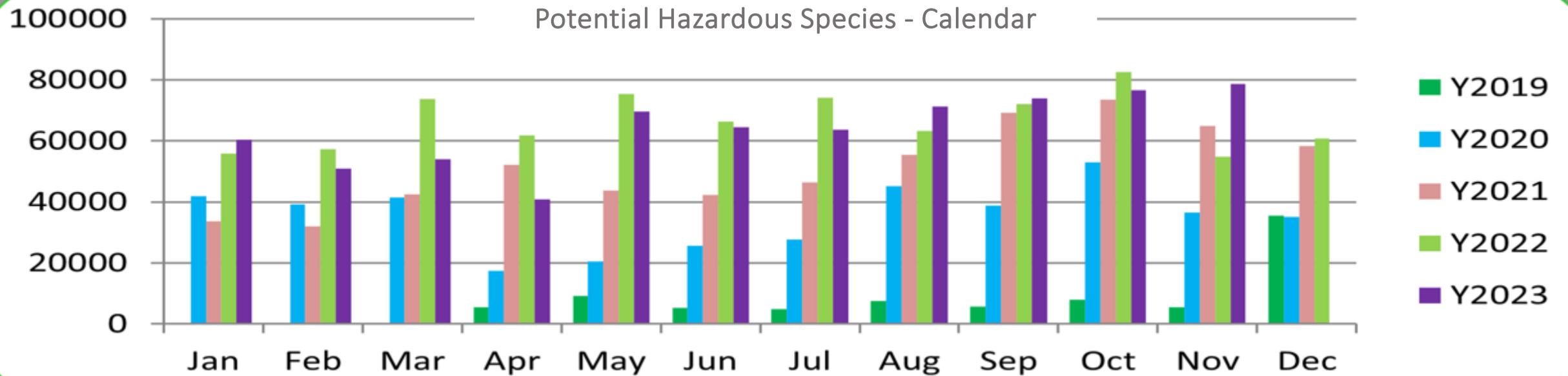
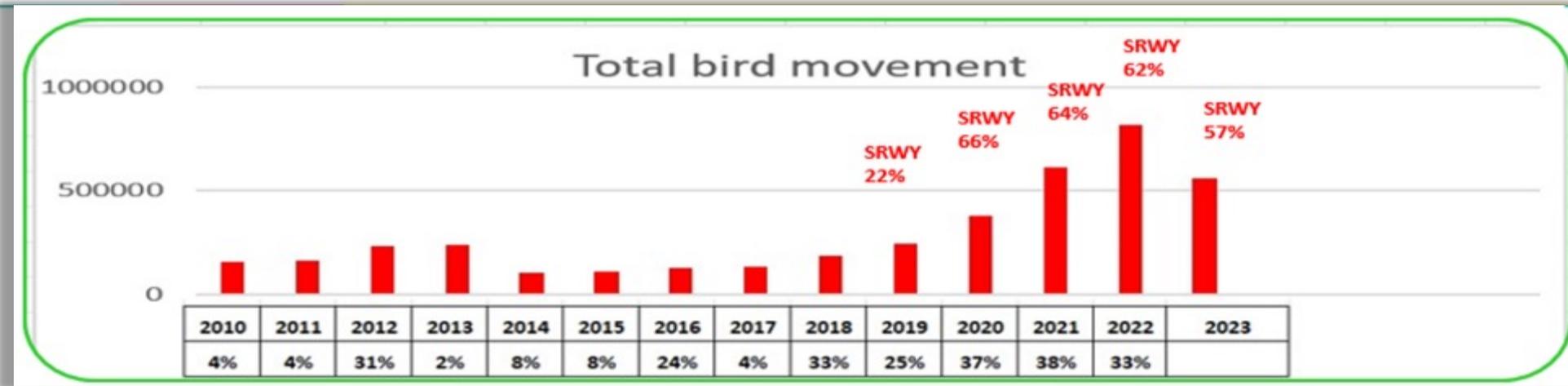


Critical area is divided into 6 zones

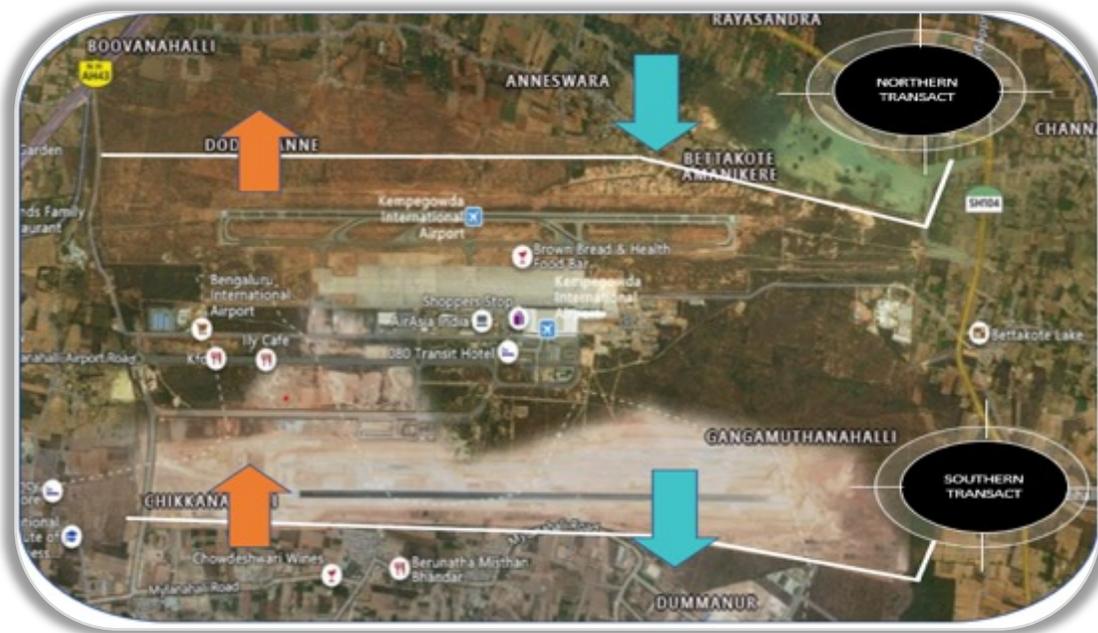
Each zone is divided taking into

- 300 meters from runway strip
- 300 meters from Taxiway strip
- To facilitate quick recording of near accurate bird movement data
- To alert Bird chasers to localize and action
- To facilitate quick response for follow me to reach the incident site for bird scaring/FOD/carcass retravel

BASHM - Wildlife Data Management



Sampling - Potential bird hazard log



Total Bird count – 43 million

ATM – 23 + million

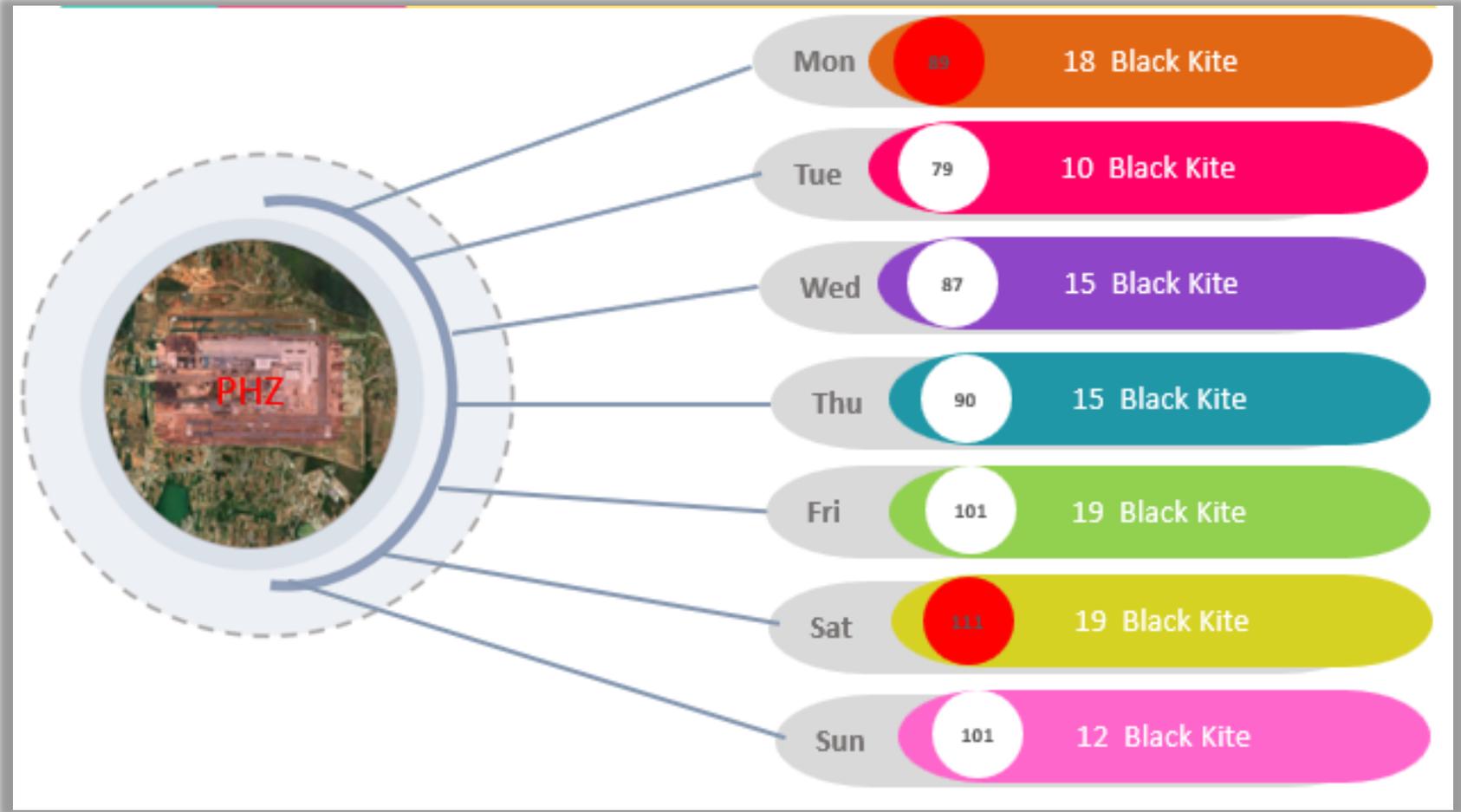
AM – 30 million

PM – 13 million

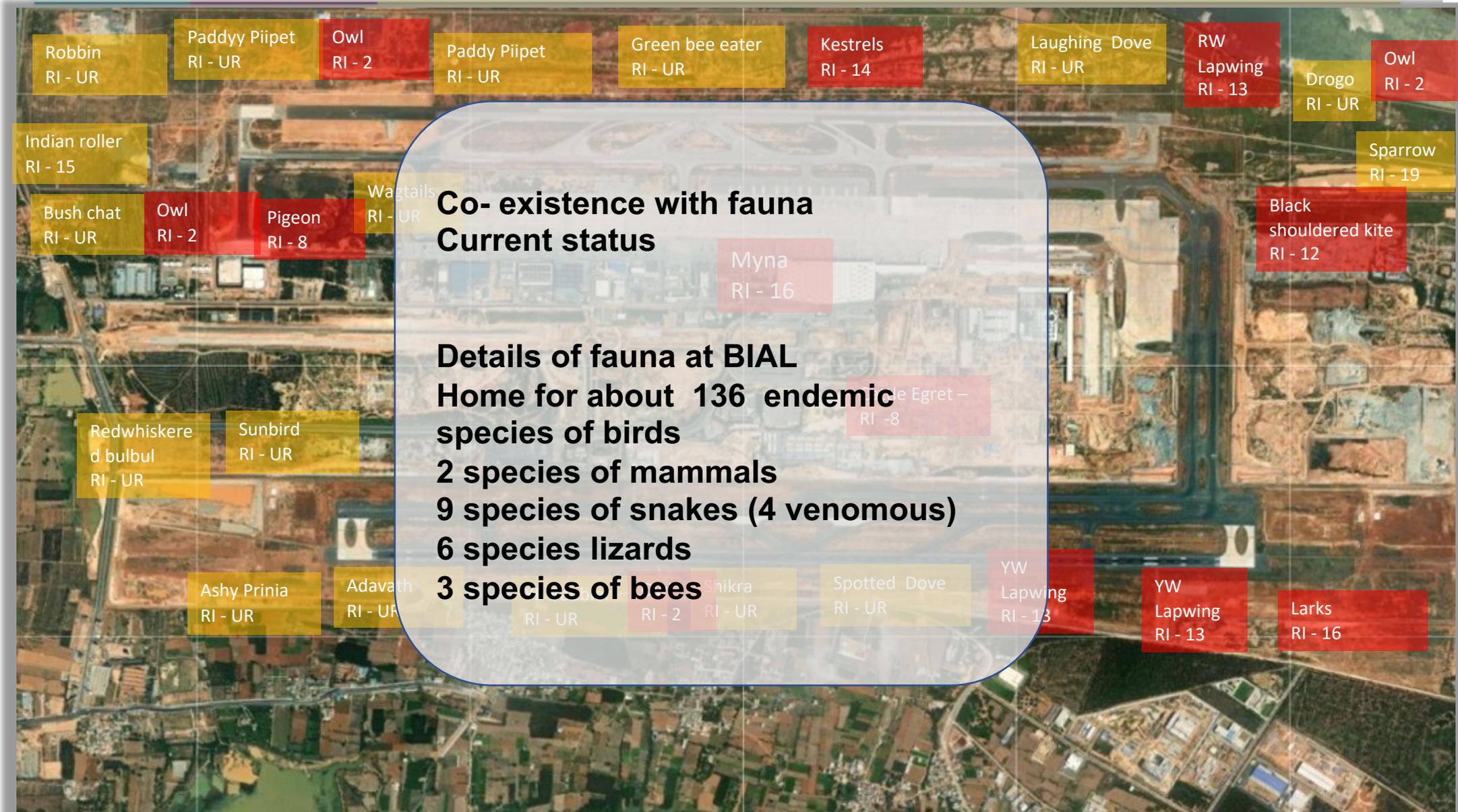
POTENTIAL HAZARDOUS BIRD TRANSACT - VOBL AIRSPACE

Species	BK	HC	CE	Pigeon	Parakeet	Swallows	Others
AM	998047	258785	101227	456041	313989	108768	81463
Avg	201	104	20	92	63	22	16
PM	427734	258785	43383	195446	313989	27192	20366
Avg	86	104	9	39	63	5	4

Bird movement Impact on weekdays



Tour – Tropical Habitat (ALARP model)



Co-existence with fauna Current status

Details of fauna at BIAL

Home for about 136 endemic species of birds

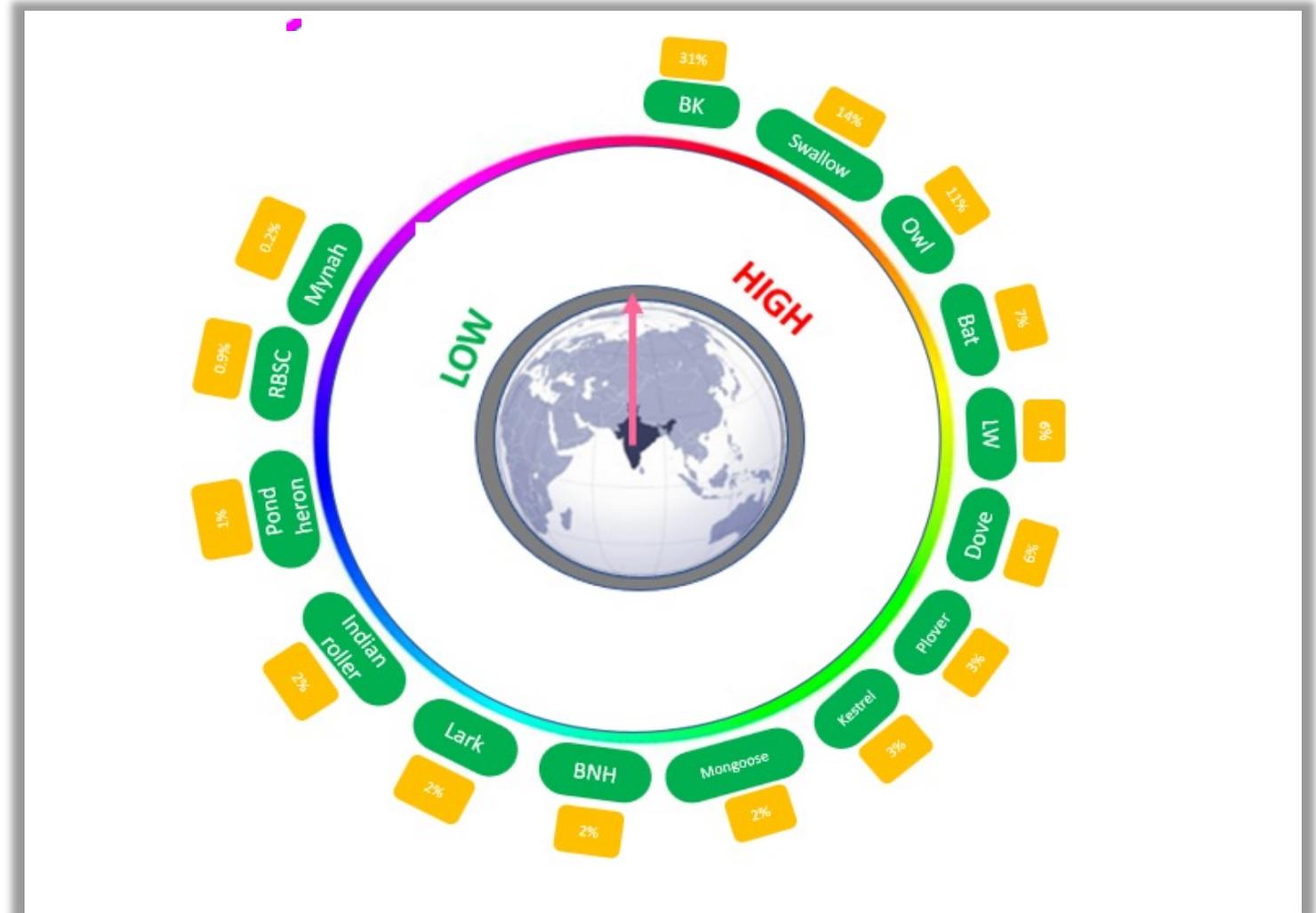
2 species of mammals

9 species of snakes (4 venomous)

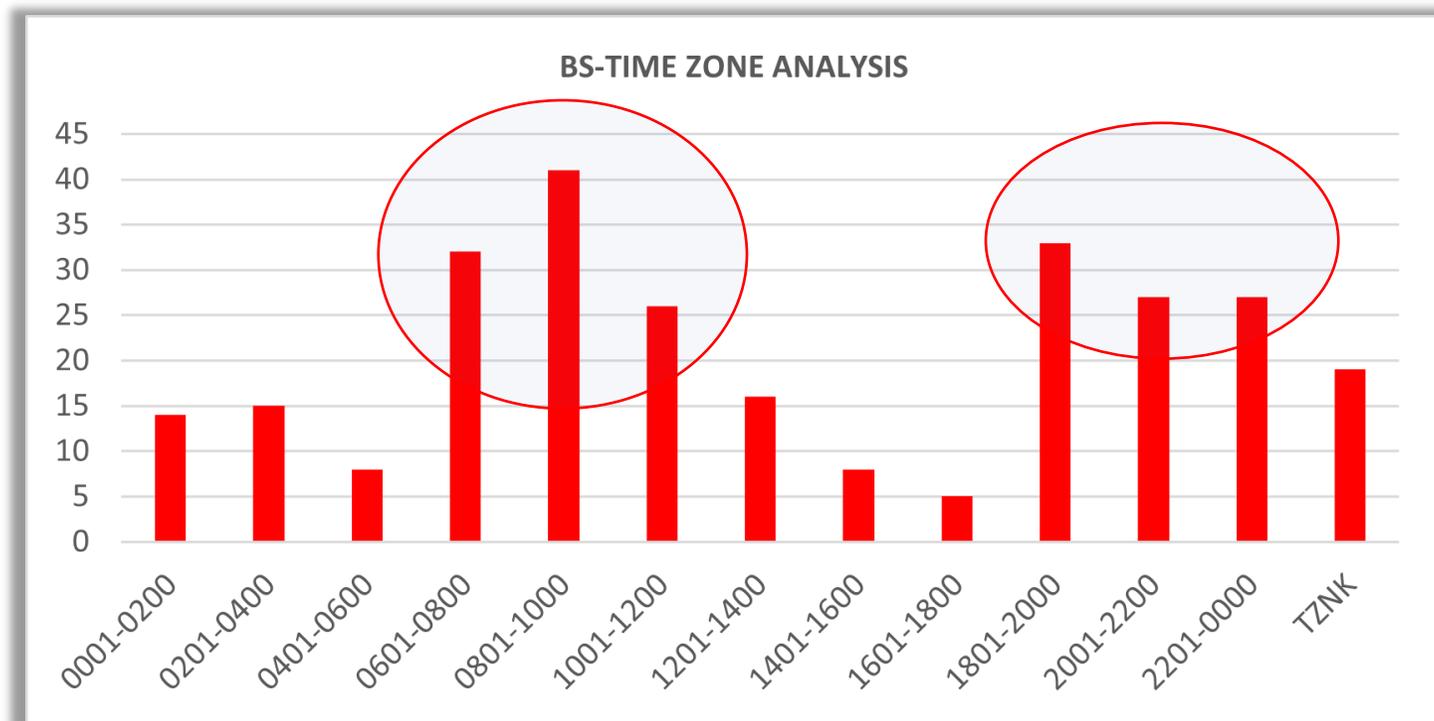
6 species lizards

3 species of bees

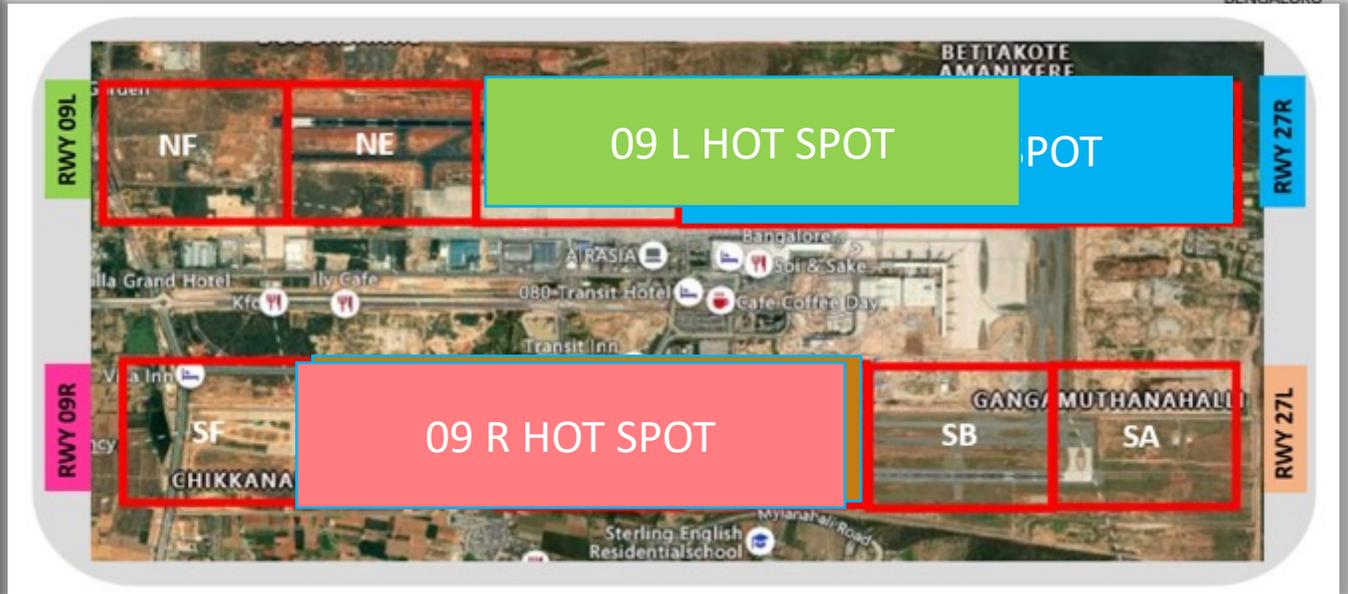
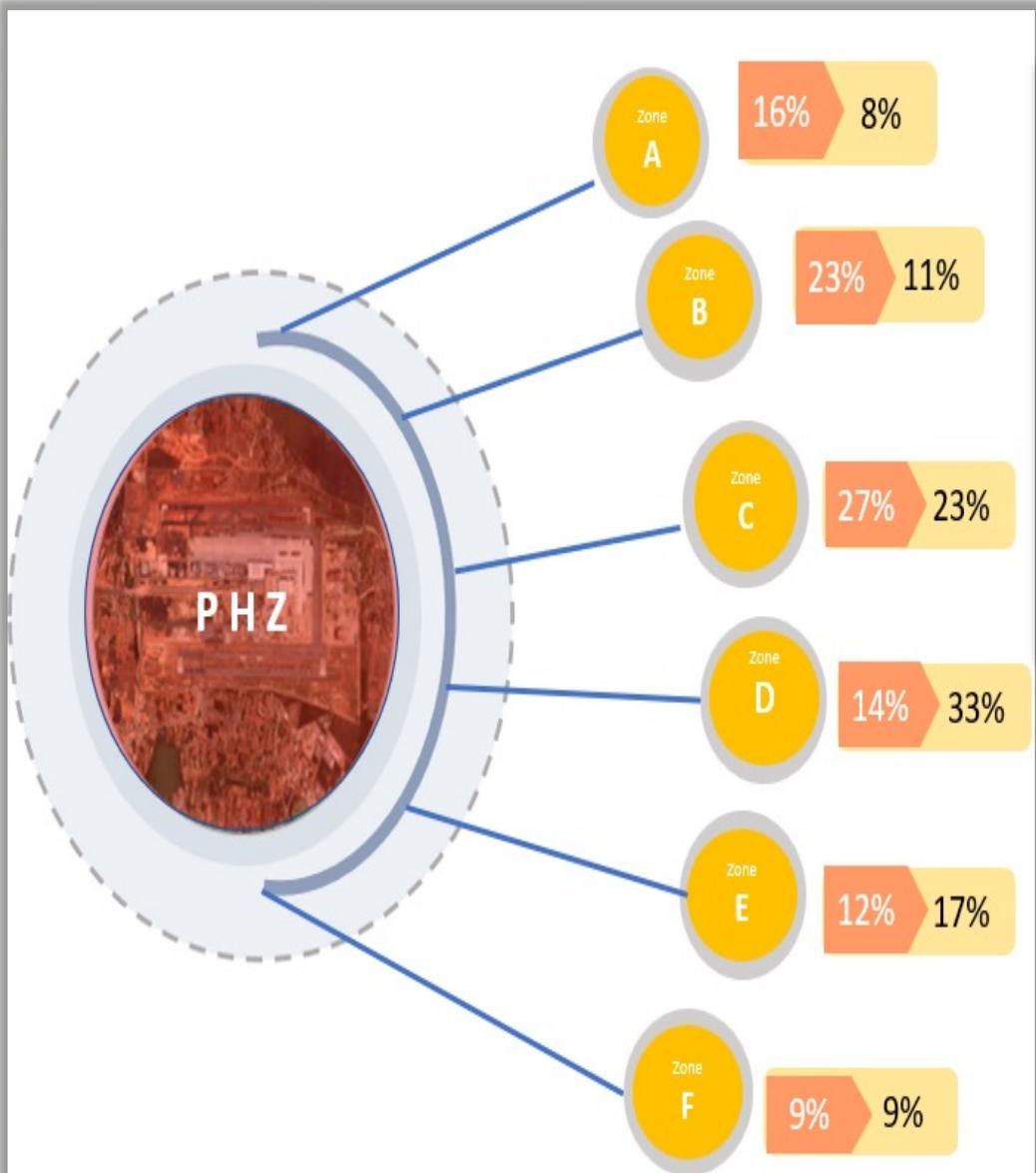
Potential species Probability



BIRD WARNING PERIOD @ VOBL

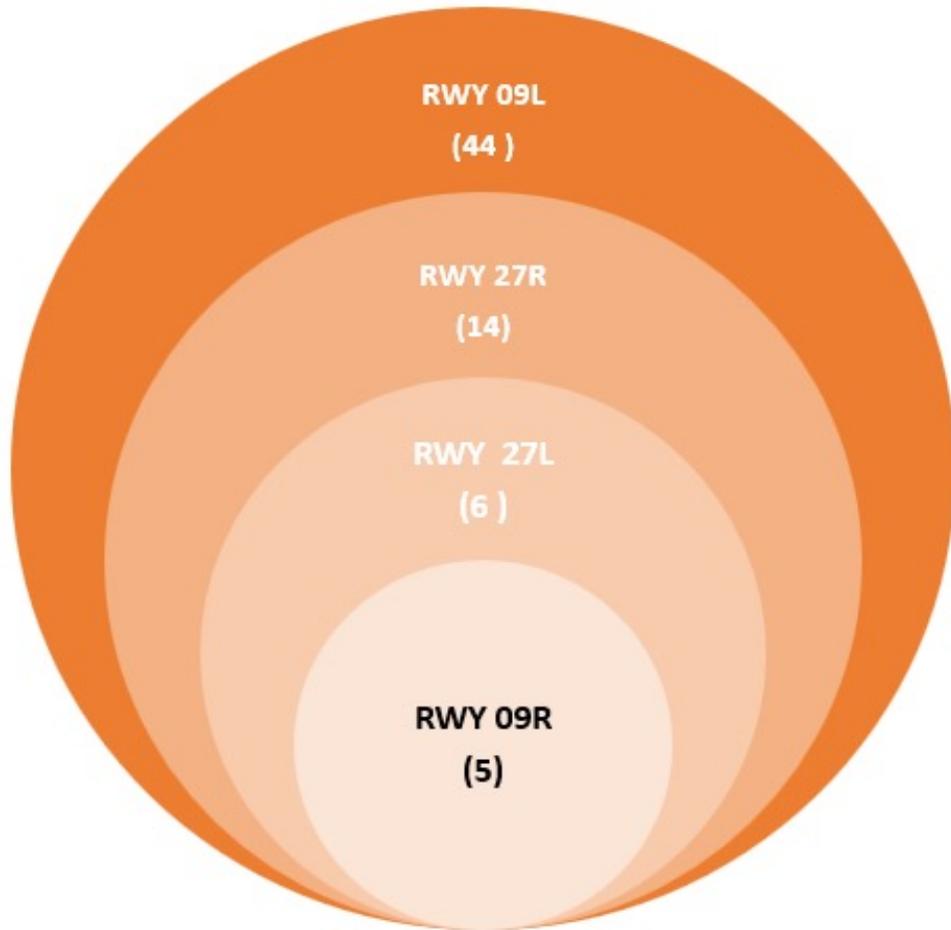


PHZ – Hot spots



Rwy	PHZ - Critical Zones		
27R	A	B	C
09L	C	D	E
27L	C	D	E
09R	E	D	C

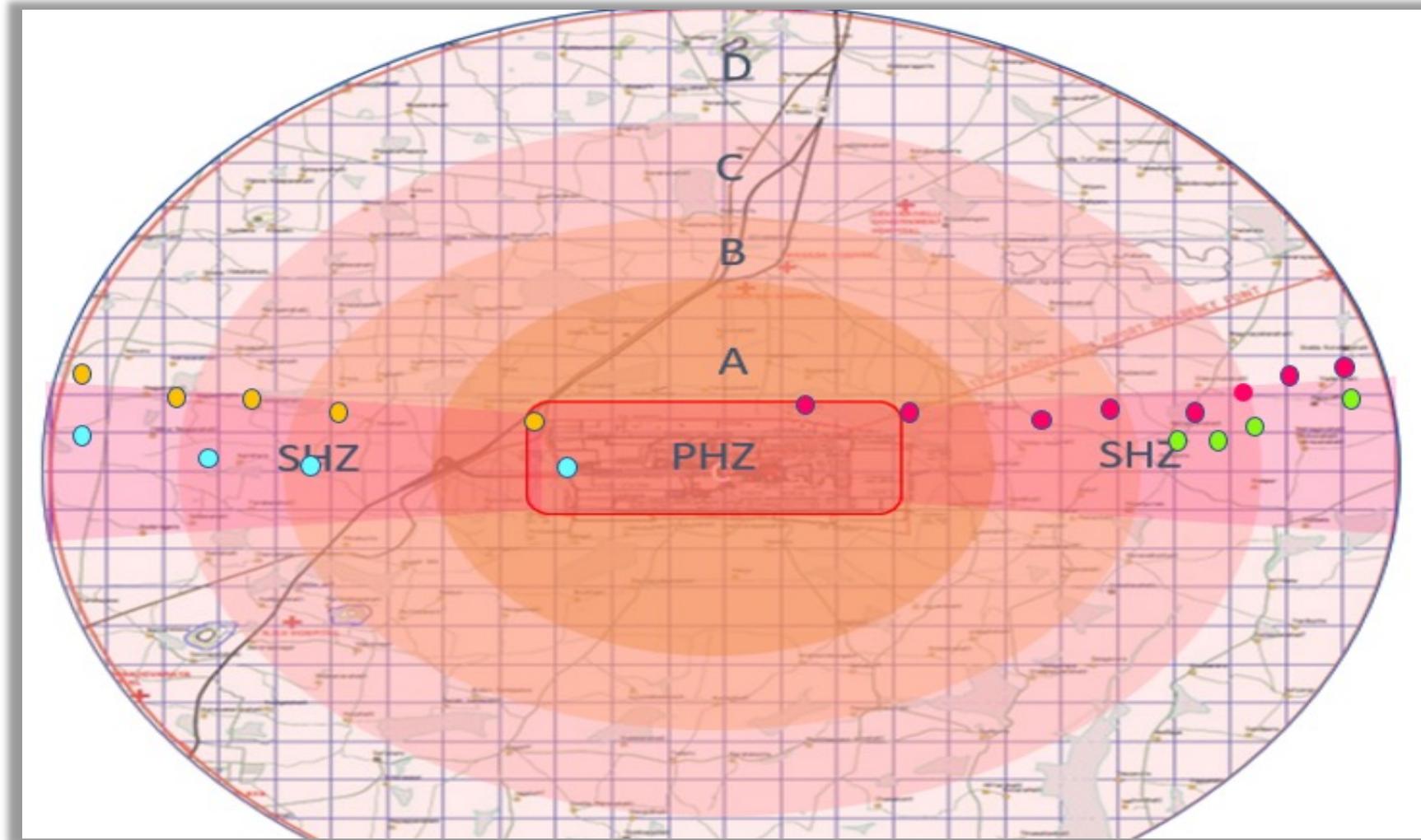
Potential track



Altitude		Runway				
In feet		09L	09R	27L	27R	
D A Y	100	6	0	1	5	
	500	9	0	0	3	D A R K
	1000	8	0	2	3	
	2000	3	0	2	2	
	3000	5	0	0	0	P H A S E
	5000	2	1	1	1	
	6000	4	1	0	0	
	7000	3	2	0	0	
	8000	2	9	0	0	
	9000	2	9	0	0	
10000	0	1	0	0		

Data extracted from 2020 after ops of second runway

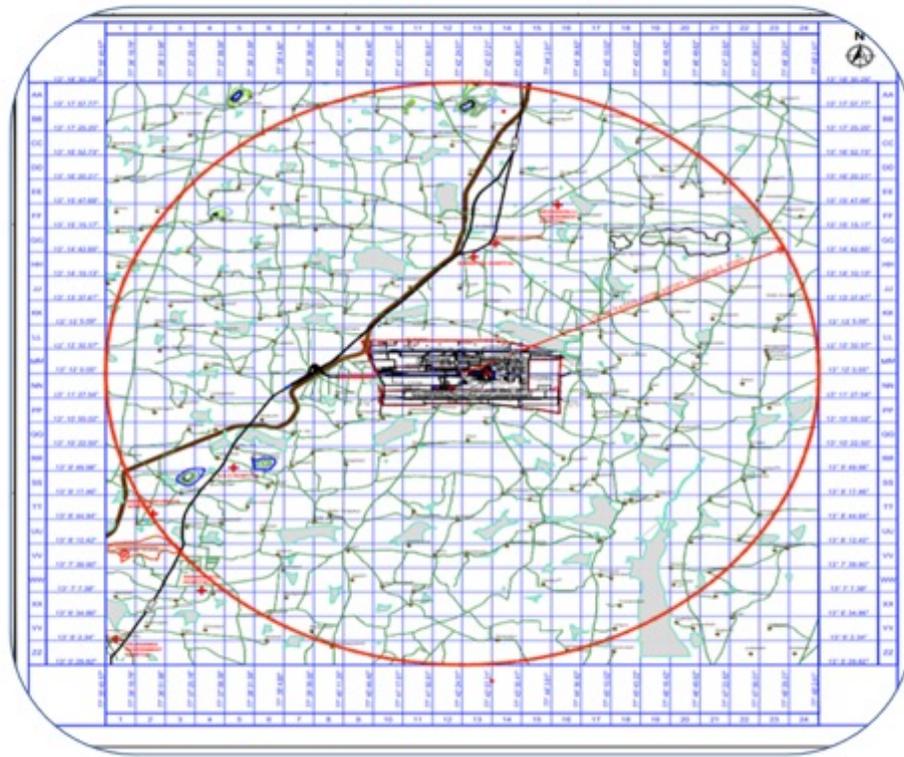
VOBL - Critical path



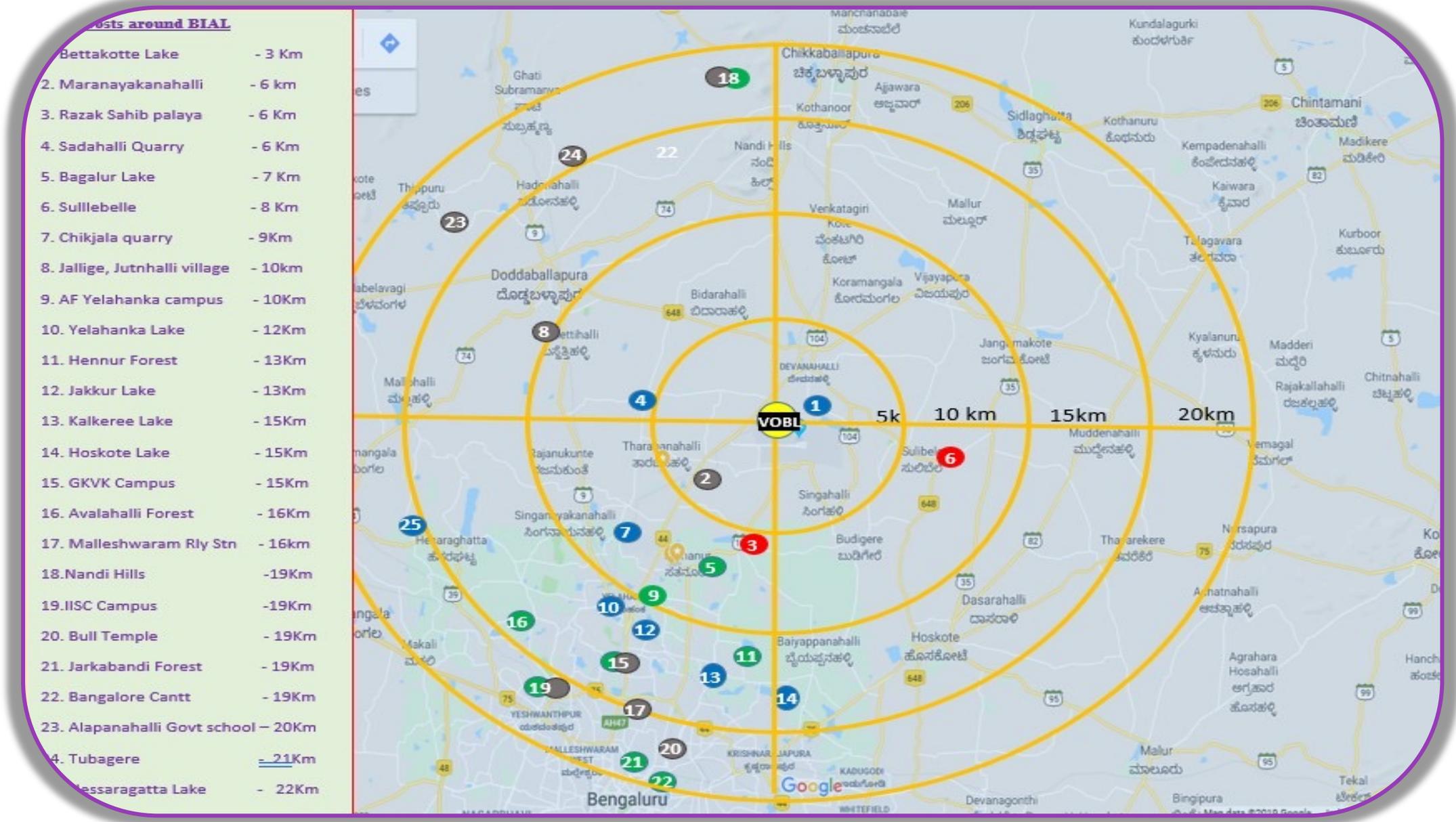
RUNWAY

- 09 L
- 09 R
- 27R
- 27L

WHMP grid for airport



Potential Hazardous site around VOBL



Risk Assessment Matrix for Wildlife

			Severity of Strikes				
			Catastrophic	Critical	Moderate	Minor	Negligible
Probability of Strikes			A/C Crash & Severe	A/C Crash & Light Casualty	A/C Severe Damage & No Crash	A/C light Damage	near miss
Definition	Meaning	Value	A	B	C	D	E
Frequent	5/10,000 movements	5	5A(Unacceptable)	5B(Unacceptable)	5C(Unacceptable)	5D(High)	5E(Moderate)
likely	4/10,000 movements	4	4A(Unacceptable)	4B(Unacceptable)	4C(Unacceptable)	4D(Moderate)	4E(Moderate)
Occasional	3/10,000 movements	3	3A(Unacceptable)	3B(High)	3C(High)	3D(Moderate)	3E(low)
Seldom	2/10,000 movements	2	2A(Unacceptable)	2B(High)	2C(Moderate)	2D(Low)	2E(Very Low)
Improbable	1/10,000 movements	1	1A(Unacceptable)	1B(High)	1C(Low)	1D(Very Low)	1E(Very Low)

Bird Hazard Management – A ceaseless Endeavor

RISK INDEX LEGEND

SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Black Kite	13	11	9	7	7	7	7	3	2	1	1	0	2	4	8	3
RI	5D	5D	5D	5D	5D	4D	4E	4E	3E	3E	3E	2E	3E	4E	4E	4E
Owl		1	0	3	0	5	4	1	4	1	0	0	0	1	2	2
RI		3E		4E	2E	5D	5D	4D	4D	3D				3D	3D	3D
Lapwing		0	0	0	0	0	0	0	0	3	0	1	2	2	1	3
RI										3E		3E	3E	3E	3E	3E
Swallows							4	1	4	1	0	0	0	1	2	2
RI							4E	3E	4E	3E	2E	2E	2E	3E	3E	3E

Bird/wildlife Strike data & Impacts

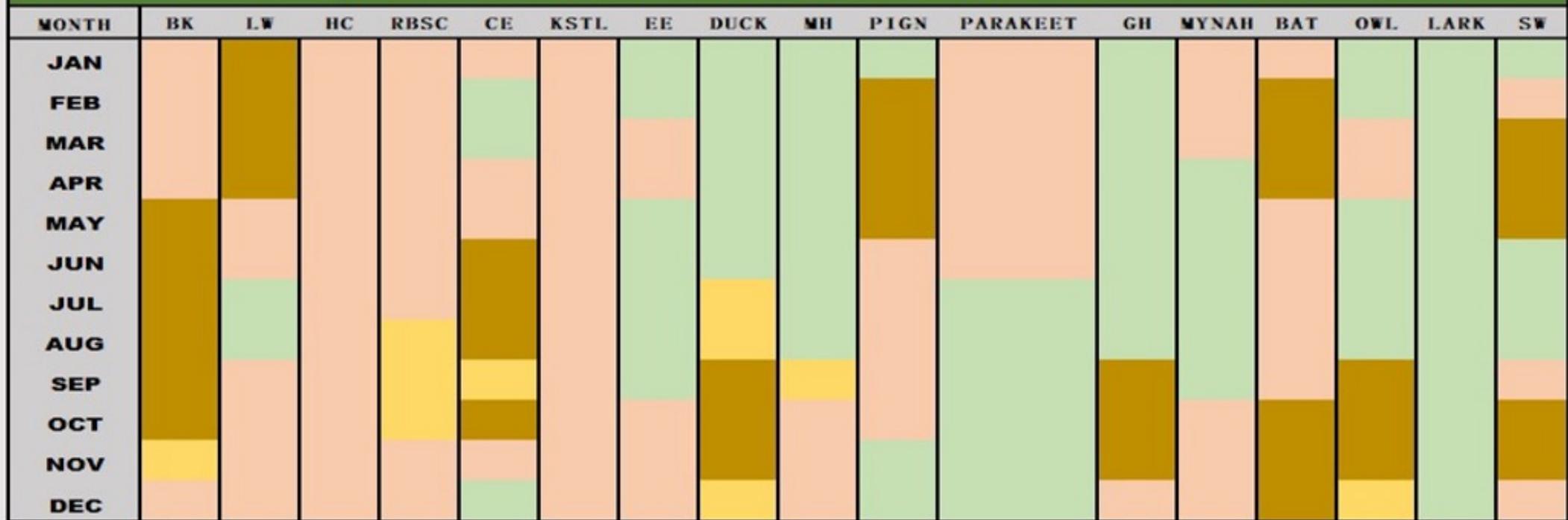
YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
BSI	15	16	10	10	10	32	21	19	43	30	34	22	34	24	41	41
BSR	2.1	1.6	0.9	0.8	0.9	2.8	1.6	1.3	2.4	1.6	1.2	1.9	2.7	1.6	2.0	1.8
ATM	72136	102958	112516	125969	106711	114998	130802	147450	177287	184364	278832	114469	124988	153101	200704	222869

Impact on operations

YEAR	GO AROUND	ABORT TAKE OFF	AC LANDED BACK	AOG	TOTAL
2017	12		2		15
2018	23	2			25
2019	18				18
2020	10				10
2021	16				16
2022	17				17
2023	13				13

Wildlife Hazard Calendar

WILDLIFE HAZARD CALENDAR - CRITICAL SPECIES



LEGEND

HIGH
MEDIUM



LOW
NORMAL

Hazardous species management – Scavenger/Raptor (Endemic)



PARIAH KITE	
Category	Scavenger /Raptor
Airspace use	Soaring on thermals
Hazard Ranking	1
Airport attraction	Thermals
Activity	Gaming, Training and Grooming
Behaviour	Flocking to paved area post rain
Critical Season	Jul-Aug & Oct - Nov
Deterrence	Physical deterrence
Impact on BIAL	83% share in Bird movement 35% part in total bird strikes incidents

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TBM	38932	49616	114666	111776	138152	59022	76466	68026	60702	60841	73983	213459	150105	161654	31014	91400
TBS	15	16	10	10	10	32	21	19	43	30	34	22	34	23	41	21
BK	13	11	9	7	7	7	3	2	1	1	1	0	2	4	8	3
% BK	87%	69%	90%	70%	70%	22%	14%	11%	2%	3%	3%	0%	6%	17%	20%	14%
RI	5D	5D	5D	5D	5D	4D	4E	4E	3E	3E	3E	2E	3E	4E	4E	4E

Hazardous species – Black Shouldered Kite(Local)



BLACK SHOULDERD KITE

Category	Raptor
Airspace use	Hovering over ground mammals
Hazard Ranking	15 (others)
Airport attraction	Reptiles in plain land
Activity	Fights with invaders/gaming
Behaviour	Moving around the territory
Critical Season	All season
Deterrance	Physical deterrance
Impact on BIAL	Kites monitor & attack them once possession of prey

Black shouldered Kite

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bird log	821	3254	2344	3443	1420	1193	1693	2384	2455	1440	1749	3125	1322	1079
BSI	1											1		1

Co-existence measures - Lapwing (YW) (Endemic)



Red wattled Lapwing	
Category	Ground nesting
Airspace occupancy	Gliding/Power Flight
Hazard Ranking	1(N)/13 (D)
Sources of attraction	Breeding grounds
Activity	Slow & irregular wingbeats flight
Behaviour	Always alert to its territory
Responds	Physical deterrence
Impact on BIAL	Often moves into AMP

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TBM	1975	620	400	348	393	787	1446	5177	2494	5363	4550	5380	6995	3059	5809
TBS	15	16	10	10	10	32	21	19	43	30	34	22	34	23	41
LW	0	0	0	0	0	0	0	0	3	0	1	2	2	1	3
% LW	0%	0%	0%	0%	0%	0%	0%	0%	7%	0%	3%	9%	6%	4%	7%
RI									3E		3E	3E	3E	3E	3E

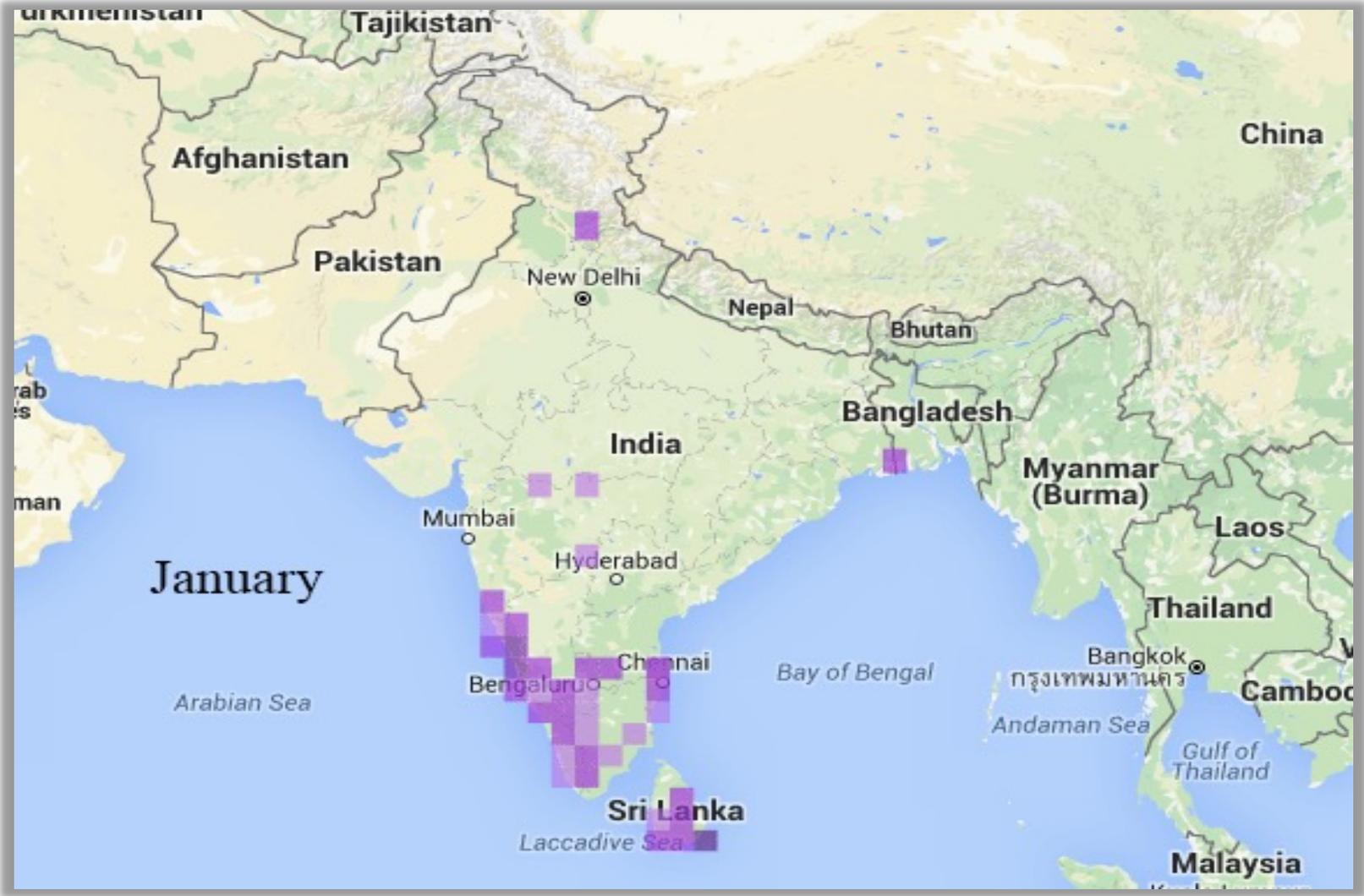
Ecological management – Nocturnal birds



Barn Owl	
Category	Silent Predator
Airspace occupancy	Gliding/Power Flight
Hazard Ranking	Nocturnal 2
Sources of attraction	Ground mammals
Activity	Slow & irregular wingbeats flight
Behaviour	Slow moving
Responds	Physical deterrence
Impact on BIAL	Often moves into AMP

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TBM	85	98	123	223	295	321	287	340	393	376	345	398	285	293	320
TBS	15	16	10	10	10	32	21	19	43	30	34	22	34	23	41
Owl	1	0	3	0	5	4	1	4	1	0	0	0	1	2	2
% Owl	7%	0%	30%	0%	50%	13%	5%	21%	2%	0%	0%	0%	3%	9%	5%
RI	3E	4E	2E	5D	5D	4D	4D	3D					3D	3D	3D

Migration map endemic species - Swallows



Migratory bird management (Transit route)



Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TBM	722	495	8976	5535	23686	32643	23691	6726	13901	19165
TBS	32	21	19	43	30	34	22	34	23	41
Swallow	4	1	4	1	0	0	0	1	2	2
% on BS	13%	5%	21%	2%	0%	0%	0%	3%	9%	5%
RI	4E	3E	4E	3E	2E	2E	2E	3E	3E	3E



Wildlife hazard management – Predator based Ecological management

1



2



3



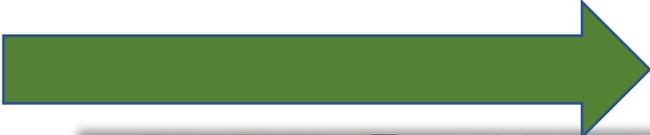
Jackrabbits/Hare	
Category	Mammals
Hazard Ranking	12(D) / 3 (N)
Aircraft path	by predator
Life	habitat
ments	
nce	



Ecological management



Sanitization treatment 400 acres West to East

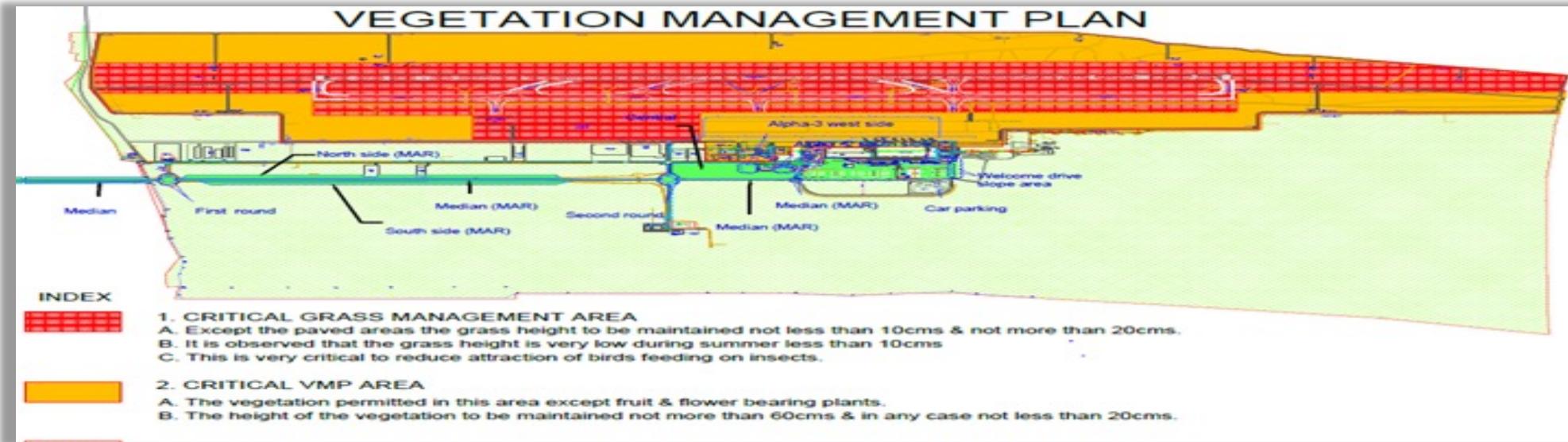


Safe area away from Critical Area



Relocated close to 341+ snakes **Demarked as snake habitat**

Habitat Management Measures



Test done for soil, water
 25 species of grass
 20 soil samples
 3 water samples
 Bird movement upto 100 meters
 from runway



Habitat Management



Kikuyu 60: Bermuda 40 (Period – 2009 – 2013)



Spear grass (Period – 2016 - 2018)



Stylosanthes (Period – 2017 - 2019)



Stylosanthes

Blister Beetles (Acid flies) They do not form primary food source of birds and birds avoid them due to their acid secretion - Cantharidin

Passive control initiatives



Cover all bases



Mass migration management – Grass insects



Wildlife survey of outside airport areas

BAT CLUSTERS

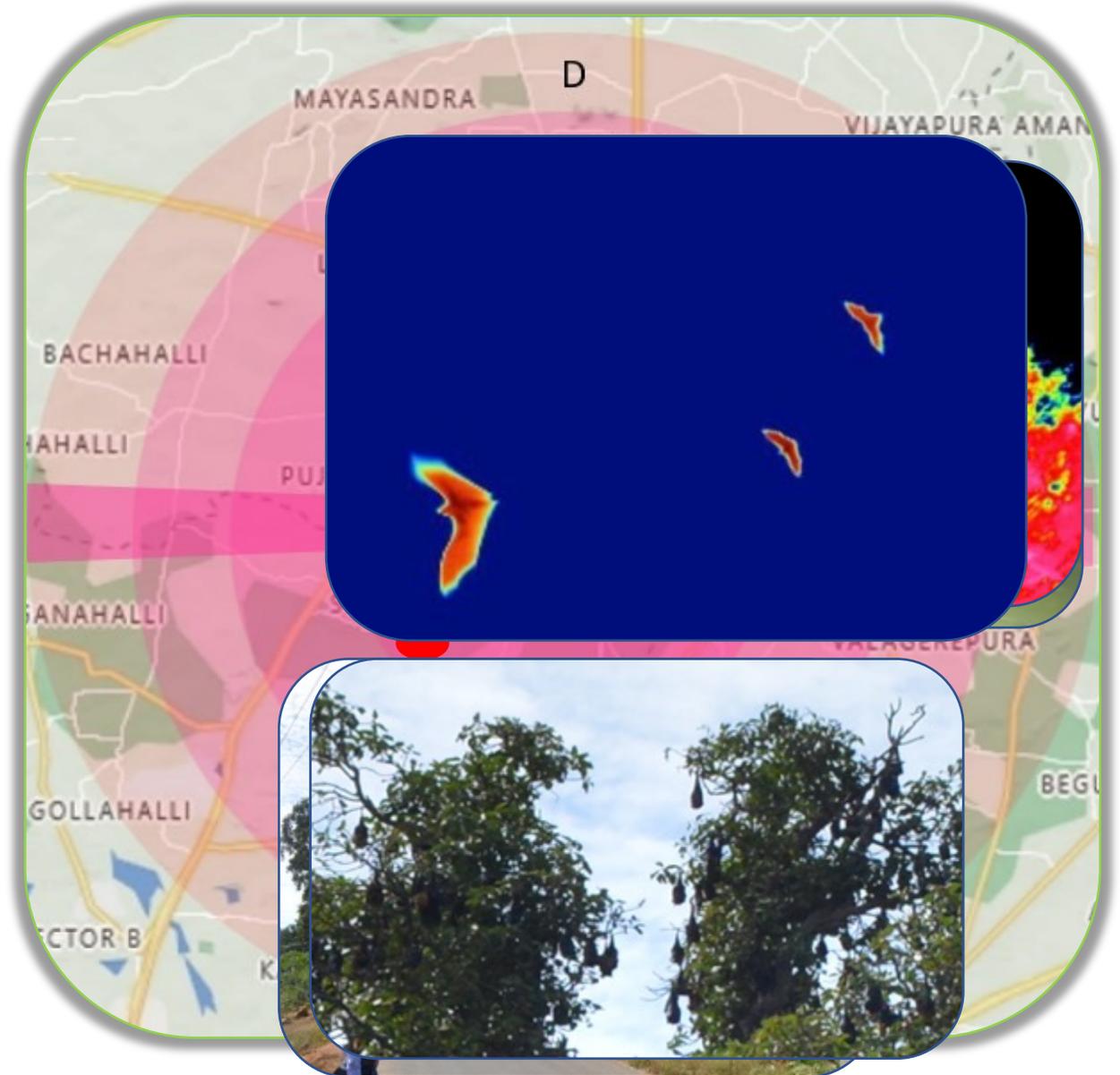
A	B	C	D
2	-	3	2

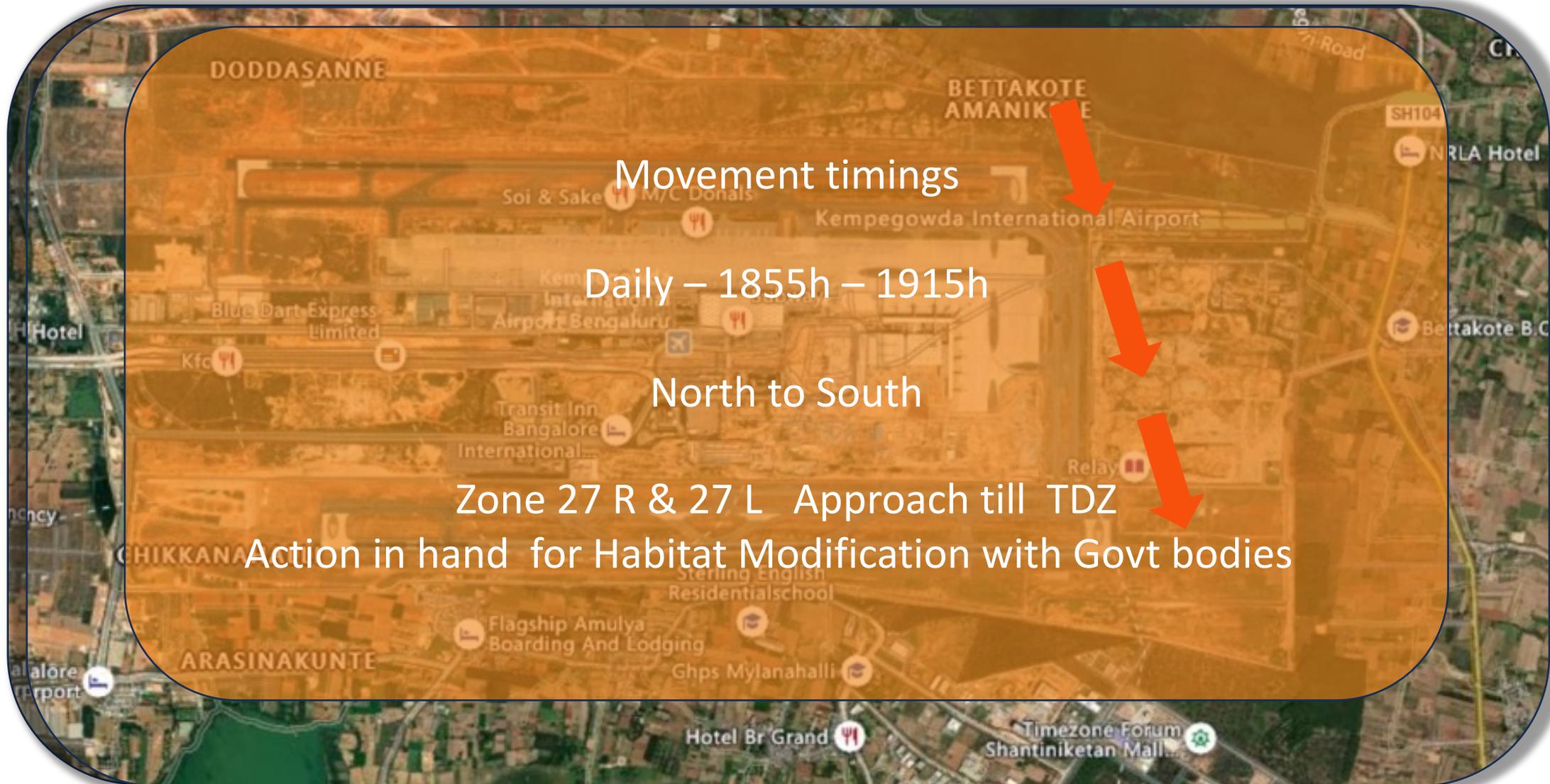
LAKES – WADERS

A	B	C	D
12	13	12	14

BIRD COLONIES

A	B	C	D
4	6	5	6

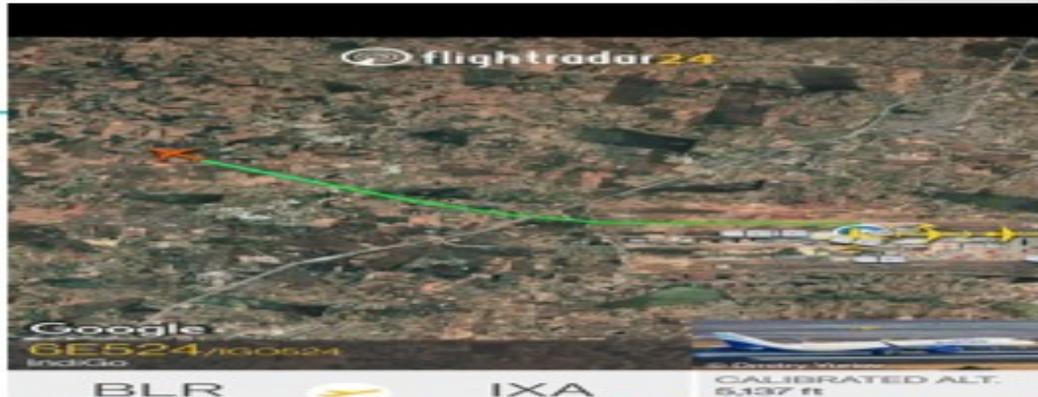




Off Airport Management – WHMP



gowda
INTERNATIONAL
PORT
BANGALURU



Off Airport Management – WHMP



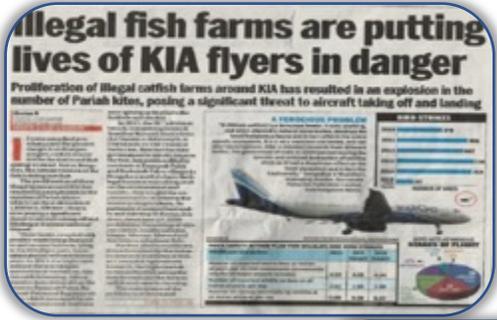
December 22, 2023

- Survey around airport
- Divided the 13 km radius to 4 quadrants
- Monthly safety recce with stake holder
- Awareness campaign among villages and eating joints
- Fortnightly wildlife hazard survey
- Mapped the potential hazardous sites around airport
- Refuse dumps
- Illegal fish breeding sites
- Landfills
- Bat colonies
- Kite settlements
- Potential bird sourcing water bodies
- Deskinning plants
- Abattoirs
- Bone processing plants
- Polo tracks
- Gold clubs

Achieved results

99 illegal fish breeding sites permanently closed
Posters placed at prominent places around the airport
Anneswera village adjacent airport awarded with the best waste management village

Off Airport Management – WHMP



Airport WHMP issues are handed by AEMC Sub Committee

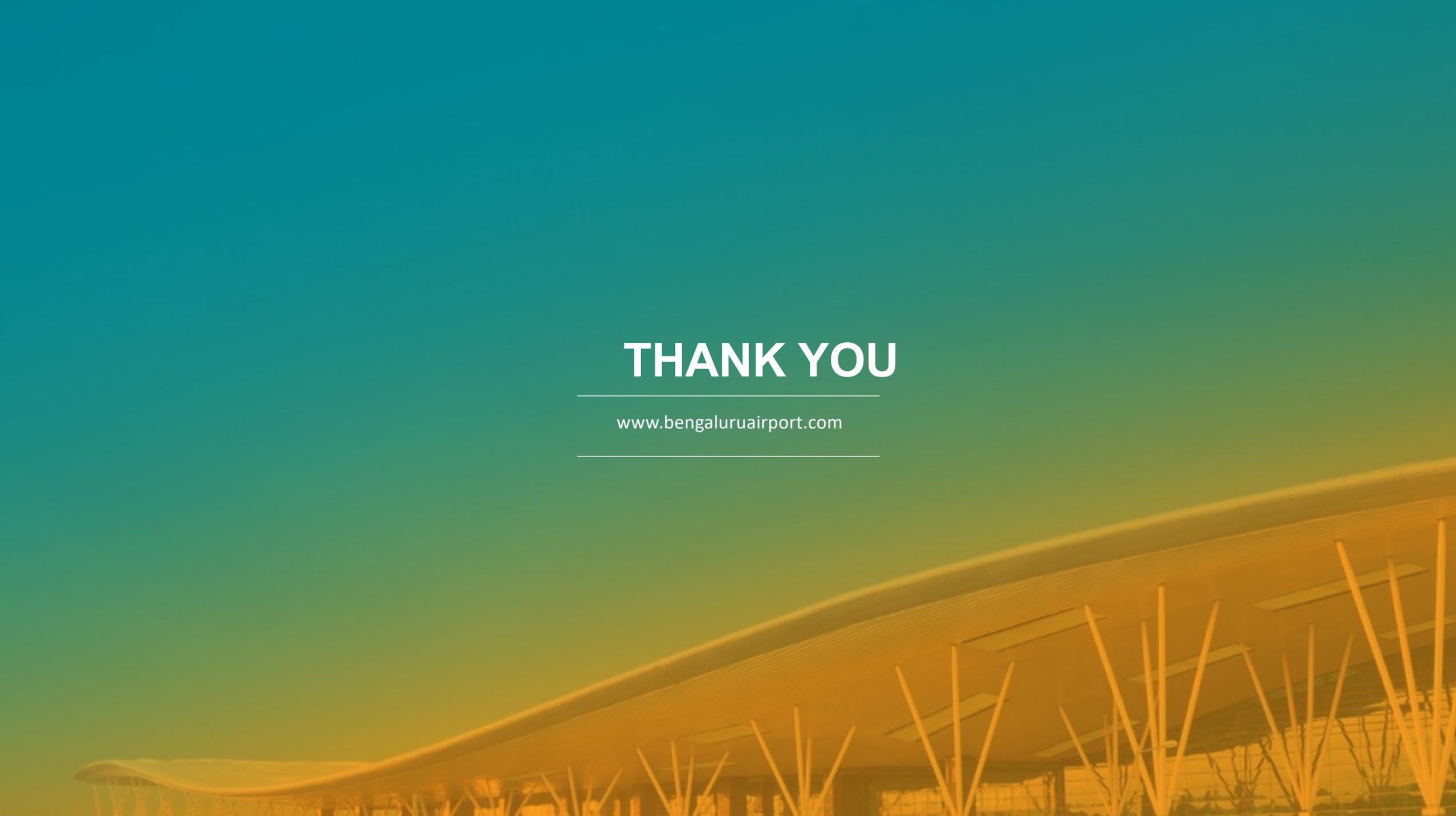
- Meets quarterly yearly
- All stake holders including villages heads part of this committee
- All issues related to WHMP attended
- Unresolved issues such as fish breeding permits are closed with the support
- Well cooperated support extended from Govt to airport

Airport Environment Management Committee

- Meets once in a year
- Chaired by BDA Chairman
- All unresolved issues from AEMC sub committees are resolved with the support of AEMC

Aviation Wildlife Hazard – A Constant pursuit

- **Constant monitoring of ecosystem**
- **Continuous engagement of physical deterrence**
- **Frequent liaisoning with Stake holders for integrated management support**
- **Additional resources based on the behavior of nature**
- **Management support on need basis fund allotment**



THANK YOU

www.bengaluruairport.com
