वन विभाग

प्रधान मुख्य वनसंरक्षक (वनबल प्रमुख) महाराष्ट्र राज्य, यांचे कार्यालय

O/o Principal Chief Conservator of Forests (HoFF), Maharashtra State

Phone No.- 0712-2560953
E-mail - pccfwlngp@mahaforest.gov.in
Website – www.mahaforest.gov.in

अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) महाराष्ट्र राज्य,
Additional Principal Chief Conservator of Forest (Wildlife) Maharashtra State.
"Van Bhavan", 3rd Floor, Ramgiri Road, Civil Lines, Nagpur – 440 001.

पत्र-ई मेल क्रमांक :-कक्ष-२३(२)/वजी/सर्व्हे/प्र.क्र.१६३/२२६९ /२०२५-२६ दिनांक १६ /०९/२०२५

प्रति,

मुख्य वनसंरक्षक (प्रादेशिक),
नाशिक.

विषय :- Request for issuance of "Certificate and Certified map" mentioning that the project boundry is located outside the ESZ/WLS and no Tiger/Elephant Corridor/Critical polluted area falls in 10 kms of the proposed Bhavali Pumped Storage Project (1500 MW) Nashik and Thane Districts, Maharashtra.

संदर्भ :- १. पर्यावरण, वने व हवामान बदल मंत्रालय, भारत सरकार, (Impact Assessment Division), नवी दिल्ली यांचेकडील पत्र क्र. J-१२०११/०८/२०२२-IA.I (R) दिनांक २७/०६/२०२२ रोजीचे पत्र.

२. अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांचे कार्यालयीन पत्र क्र. कक्ष-३/जमीन/ FCA/ प्र.क्र.१२०/६२६/२०२४-२५, दिनांक १४/११/२०२४.

३. अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांचे कार्यालयीन पत्र क्र. कक्ष-३/ जमीन/ FCA/ प्र.क्र.१२०/ ६३६/२०२४-२५, दिनांक १८/११/२०२४.

४. या कार्यालयाचे पत्र क्र. कक्ष-२३(२)/वजी/सर्व्हे/प्र.क्र.१६३/४३७७, दिनांक २९/११/२०२४.

५. या कार्यालयास उद्देशुन लिहीलेले आपले कार्यालयीन पत्र क्र. कक्ष-२/जमीन/प्र.क्र.५८/२८२, दिनांक १९/०६/२०२५.

केंद्र शासनाने सदर प्रस्तावाचे अनुषंगाने संदर्भ पत्र-१ अन्वये A. Environmental Management and Biodiversity Conservation मधील अनु क्र. vi वर खालीलप्रमाणे अट घालून दिलेली होती.

vi. ***Certificate and certified map from Chief Wildlife Warden shall be submitted mentioning that project boundary is located outside the Eco-Sensitive Zone (ESZ)/ Wildlife Sanctuary and no Tiger/elephant corridor /critically polluted area falls within 10 km. of Project site.***

वरील अट क्रमांक vi नूसार प्रस्तावित प्रकल्प क्षेत्राचे हद्दीपासून २.२१ कि.मी. अंतरावर कळसूबाई हरिश्चंद्रगड वन्यजीव अभयारण्य आहे. तसेच सदर अभयारण्याच्या पर्यावरण संवेदनशील क्षेत्रापासून प्रकल्प क्षेत्राच्या हद्दीचे अंतर १२.५ मी. आहे. उपरोक्त संदर्भिय पत्र-२ अन्वये प्राप्त झालेल्या अहवालानूसार

उपवनसंरक्षक (वन्यजीव), नाशिक यांनी सदर प्रकल्प क्षेत्र व परिसर हे राष्ट्रीय व्याघ्र संवर्धन प्राधिकरण (NTCA) च्या संकेत स्थळावर असलेल्या निर्णय समर्थन प्रणाली (DSS) वर तपासणी करून, सदर क्षेत्र व्याघ्र भ्रमण मार्गाचा भाग नसल्याचे कळविले होते. तसेच सदर क्षेत्र हत्ती भ्रमण मार्ग देखील नसल्याचे या कार्यालयास कळविले होते.

प्रकरणी संदर्भिय पत्र-३ अन्वये प्राप्त झालेला नकाशा मुख्य वन्यजीव रक्षक, तथा अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव), महाराष्ट्र राज्य यांचेकडून सांक्षाकन करून यासोबत सहपत्रीत करण्यात आलेला होता. तसेच सदरचा प्रकल्प हा Hydro Project या प्रकारातला असल्यामुळे व सदरचे क्षेत्र कळसुबाई हरिश्चंद्रगड वन्यजीव अभयारण्याचे पर्यावरण संवेदनशील क्षेत्रापासून १२.५ मी. अतंरावर येत असल्यामुळे, आपलेकडून वन्यजीव संवर्धन आराखडा मागविण्यात आलेला होता.

सदर प्रकरणी रु. ३२६.५० लक्ष रक्कमेचा वन्यजीव संवर्धन आणि जैवविविधता व्यवस्थापन आराखडयास या कार्यालयाचे संदर्भ पत्र ४ अन्वये मान्यता प्रदान करण्यात आलेली होती.

आता, विषयांकित प्रकरणी आपले कार्यालयीन संदर्भ पत्र ५ अन्वये जे.एस.डब्ल्यु . एनर्जी, पीएसपी -२, लि. मुंबई यांचेकडून उपरोक्त २४३.७४ हे. वनजमीन वन (संवर्धन) अधिनियम १९८० अंतर्गत वळतीकरण व परवानगी मिळणेकामी प्राप्त झालेनंतर सदर प्रस्तावाचे अवलोकन तसेच वळतीकरण क्षेत्राचे स्थळ निरिक्षण केले असता, प्रकल्प यंत्रणेकडून सादर करण्यात आलेला वन्यजीव व्यवस्थापन आराखडा हा प्रत्यक्षात स्थळावर असलेल्या परिस्थितीनुसार (Site Specific) आढळुन न आल्यामूळे सुधारित वन्यजीव व्यवस्थापन आराखडा शिफारसीसह या कार्यालयास प्राप्त झालेला आहे. त्याचा तपशील खालील प्रमाणे आहे.

Cost of Wildlife and Biodiversity Management Plan

Sr. No.	Activities	Amount (in rs. Lakhs)
1.	Removal of invasive species eg. Lantana, glyricidia, etc.	20.00
2.	Fodder Development work in Igatpuri subdivision	25.00
3.	Raising nursery for fodder species	15.00
4.	Construction of Watch Tower in Igatpuri CR	10.00
5.	Camera traps for wildlife monitoring	15.50
6.	GPS equipment	10.00
7.	Rescue equipment for HWC in Igatpuri and Sinnar	10.00
8.	First Aid Kits to Schools	10.00
9.	Provision of Rescue Vehicle /Patrolling Vehicle (2)	30.00
10.	Training of Staff /capacity building for HWC	15.00
11.	Management of Vulture restaurant	10.00

12.	Equipment and instruments for Rapid Rescue Team	15.00
13.	Awareness signages in CR	10.00
14.	Awareness about wildlife issues in schools	5.00
15.	Monitoring of implementation by CWLW office	5.00
16.	Protection hut(s) in CR	15.00
17.	Water holes with Solar Pump in CR	10.00
18.	Rescue equipment for HWC	25.00
19.	Training of staff/capacity building for HWC	25.00
20.	Awareness about wildlife issues in schools	16.00
21.	Habitat development works	30.00
	Total cost	**326.50**

वरील बाबनिहाय सुधारित रू. ३२६.५० लक्ष रक्कम असलेला वन्यजीव संवर्धन आणि जैवविविधता व्यवस्थापन आराखडा वन्यजीव व्यवस्थापनाच्या दृष्टीने पोषक स्वरूपाचा असल्यामूळे, त्यांस मान्यता प्रदान करण्यात येत आहे.

(एम. श्रीनिवास राव)
मुख्य वन्यजीव रक्षक तथा
प्रधान मुख्य वनसंरक्षक (वन्यजीव),
महाराष्ट्र राज्य

प्रतिलिपी : मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांना माहितीस व आवश्यक कार्यवाहीस अग्रेषित.
प्रतिलिपी : उपवनसंरक्षक (वन्यजीव), नाशिक यांना माहितीस व आवश्यक पुढील कार्यवाहीस अग्रेषित.
प्रतिलिपी : JSW Energy PSP Two Limited, JSW Centre, Bandra Kurla Complex,Bandra East, Mumbai-400051 यांना माहितीस व आवश्यक पुढील कार्यवाहीस अग्रेषित.
Email- lalit.bora@jsw.in

WILDLIFE CONSERVATION AND BIODIVERSITY MANAGEMENT PLAN

BHAVALI PUMPED STORAGE PROJECT
(5 X 250 MW+2X125MW),
Nashik &Thane District,
Maharashtra.

Section 1(c)(i) River Valley Project, Category "A"

August, 2024

Project Proponent:

JSW Energy PSP Two Limited

JSW Centre, Bandra Kurla Complex,
Bandra East, Mumbai,
Maharashtra

Submitted By:

EQMS GLOBAL PVT. LTD.
(Formerly EQMS India Pvt. Ltd.)
305, 3rd Floor, Plot No. 16, Rishabh Corporate Tower,
Community Centre, Karkardooma, Delhi – 110092
Phone: 011-43062757;

Website: www.eqmsglobal.com ; E-mail – kahmad@eqmsglobal.com

NABET Certificate No: NABET/EIA/1922/RA0197

UID: EQMS/EIA/VPSP/1(c)A/PR-682/21092022

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ABBREVIATION

CA	Compensatory Afforestation

CAT	Catchment Area Treatment
cumec	cubic meter per second
EIA	Environmental Impact Assessment
ESZ	Environmental Sensitive Zone
GLC	Ground Level Concentration
GW	Giga Watt
ha	Hectare
HH	Household
IUCN	International Union for Conservation of Nature
KIADB	Karnataka Industrial Area Development Board
km	Kilo meter
m	meter
masl	meter above sea level
MoEF&CC	Ministry of Environment, Forest and Climate Change
MU	Million Unit
MW	Mega Watt
NOx	Nitrogen Oxide
NSL	Natural Surface Level
$PM_{2.5}$	Particulate Matter with a dimeter of 2.5micron or less
PM_{10}	Particulate Matter with a diameter of 10 micron or less
PSP	Pump Storage Project
RCC	Reinforced Cement Concrete
RF	Reserve Forest
RoW	Right of Way
SO_2	Sulphur Dioxide
sq.km	Square kilometre
$\mu g/m^3$	micro gram per cubic meter
WCS	Water Conductor System
WLS	Wildlife Sanctuary
WPA	Wildlife Protection Act
ZSI	Zoological Survey of India

1 INTRODUCTION

1.1 BACKGROUND

The JSW Energy has set a vision of becoming a 10 GW company by 2025 and 20 GW company by 2030, with all the incremental capacity additions coming predominantly from the Renewable Energy sources. The bold and ambitious plan of the company further reinforces its position as a leader in the energy transition, with its renewable's portfolio currently at 30%, growing to 68% of total energy portfolio by 2025, and to about 84% by 2030. With renewable capacity additions already on blueprint, JSW Energy would become Carbon neutral well before 2030.

1.2 NEED FOR THE PROJECT

As per the recent study carried out by Central Electricity Authority on Optimal Generation Capacity mix for 2029-30, the likely All India installed capacity in 2029-30 is estimated to be 8,17,254 MW which includes 2,04,911 MW Coal, 25,080 MW Gas, 71,128 MW Hydro, 18,980 MW Nuclear and 4,35,155 MW Renewable Energy Sources. Thus, the clear focus of the Central Government is to increase the share of renewable energy (like solar, wind and NCE's). Flexible Energy Generation Assets that have a capability to supply both Base Load & Peaking Power efficiently and economically are the need of the future and the necessary solution to address the dynamic evolving energy needs of India.

The Pump storage offers multiple benefits to a power system. In addition to providing energy storage, pumped storage can provide power immediately and can be rapidly adjusted to respond to changes in energy demands. The importance for Bhavali PSP, indicative installed capacity 1500 MW, in Nashik and Thane district, Maharashtra, has therefore been considered in context of the focus of State Government to increase the share of renewable energy which is available in plenty within the state in general and in the country as whole.

1.3 BRIEF DESCRIPTION OF PROJECT, LOCATION AND IMPORTANCE

1.3.1 Brief Description of Project

The project envisages creation of an upper reservoir (gross storage:12.35 MCM & live storage:11.08 MCM) by constructing 962.47 m long dam comprising of 822.47 m long Geomembrane faced rockfill dam (GRFD) with maximum height of 48.64 m from foundation, 60 m long and 61 m height ungated spillway with 4 bays of 12.5 m each; 4 blocks of 20 m length each non-overflow section of maximum height of 49.57 m from foundation, two each on either side of spillway. 80 m long saddle dam (maximum height 10 m from foundation) to reduce backwater to enter ESZ area. The lower reservoir (gross storage:13.26 MCM; live storage: 11.71 MCM) shall be created by constructing concrete gravity dam 365.5 m long at top with maximum height of 48.15 m from foundation and 104 m long, 74 m high (from foundation) ungated spillway with 8 bays of 10.5 m each. Diffuser type Intake structure with 3 intakes (25.5 m x 10.5 m) of

42.44 m length shall be provided. The water conductor system shall comprise of 67.96 m long three intake tunnels of 7 m diameter each with design discharge of 131.74 cumec each. 5.1 m diameter, followed Steel lined pressure shaft 3 nos. of independent, 5.1 m diameter with length varying from 1568.09 m to 1594.89 m, six 3.8 m diameter branch pressure shaft after first bifurcation of design discharge 65.96 cumec each; two 2.9 m diameter 46.83 m long steel lined branch pressure shaft after second bifurcation of design discharge 32.98 cumec each. Underground powerhouse (167 m x 22 m x 52.9 m) housed with 7 No's. Francis vertical shaft reversible pump-turbine (5 X 250 MW & 2 X 125 MW) discharging into circular draft tube 5.20 m and 4.0 m diameter for large and small unit; two four meter diameter concrete lined branch tail race tunnel for 32.98 cumec discharge after 3rd bifurcation; six 5.2 meter diameter concrete lined branch tail race tunnel for 65.78 cumec discharge after 4th bifurcation; followed by three 7 m diameter main tail race tunnel with length varying from 621.17 m to 646.57 m, each discharging 131.74 cumec, 105 m long trapezoidal tail race pool followed by 560 m long trapezoidal tail race channel.

The project will generate 1500 MW by utilizing a design discharge of 394.84 cumecs that includes, 65.78 cumec with rated head of 425.23 m (for larger unit of 250 MW) and 32.98 cumec with rated head of 424.03 m (for smaller unit of 125 MW) for 7.78 hr. The PSP will utilize 1680 MW to pump 0.391 TMC of water to the upper reservoir in 8.79 hours. Annual energy generation by Bhavali PSP in turbine mode is 4044.06 MU whereas annual energy consumed in pump mode is 5120.53 MU.

1.3.2 Project Location

The upper reservoir of the project shall be in village Jamunde, Tehsil Igatpuri, District Nashik while the lower reservoir in Village Kalbhonde, Tehsil Shahpur, District Thane, Maharashtra. The project site is located at 50 kms from the District Headquarters Nashik and is approachable from Mumbai via Shahapur by NH-160. Nearest railway head is in Igatpuri. The project layout map marked on toposheet is shown in **Figure 1.1** and Google image in **Figure1.2.**

1.3.3 PROTECTED AREA

Kalsubai Harichandragad Wildlife Sanctuary exists within 10 km of project boundary. However, no part of the project lies within Eco-sensitive zone of the Sanctuary. The nearest project boundary is about 12.5 m from ESZ boundary. **(Annexure-1)**.

1.3.4 Land Requirement of Project

The total land requirement under the project for upper and lower rock fill dam, reservoir & other works, has been assessed as 278.92 ha of which Private land is 35.18 ha, and Forest land is 243.74 ha. The acquisition of the land shall be in consonance with "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013", (RFCTLARRA 2013). The component wise land requirement is shown in **Table 1.1.**

Table 1.1: Land use & Land cover of Study Area

S.N.	Component	Land Requirement (ha)		
		Forest	Non-forest	Total
1	Upper Dam & Reservoir	58.42	30.08	88.5
2	Approach Road to Upper Dam	0.77	5.10	5.87
3	Lower Dam & Reservoir	81.10	0.00	81.10
4	Approach Road to Lower Dam	37.83	0.00	37.83
5	HRT (Underground)	4.77	0.00	4.77
6	Powerhouse (Underground)	1.853	0.00	1.853
7	TRT (Underground)	4.2	0.00	4.2
8	Tail Race Channel	1.64	0.00	1.64
9	Adit/ MAT (Underground)	0.99	0.00	0.99
10	Cable & Ventilation	0.084	0.00	0.084
11	Dumping Area and Job Facilities - 1	22.3	0.00	22.3
12	Dumping Area and Job Facilities - 2	22.6	0.00	22.6
13	Working Space	4.80	0.00	4.80
14	Service Corridor	2.27	0.00	2.27
15	Saddle Dam	0.11	0.00	0.11
Total		**243.737**	**35.18**	**278.917**
Say		**243.74**	**35.18**	**278.92**

About 243.74 ha forest land shall be required for construction of project as shown in **Annexure-2**.

1.3.5 Cost of Project

The basic cost of project is Rs. 8964.02 Crores.

1.3.6 Conditions Imposed in First Stage Forest Clearance or EC

The forest land diversion case was submitted by the Company vide PROPOSAL NO. FP/MH/HYD/153240/2022, dated 06.03.2022. The first stage clearance is not yet accorded for the diversion of 243.74 ha forest land. The prior Environmental Clearance is yet to be granted.

1.3.7 Need for Preparation of Biodiversity and Wild Life Conservation & Management Plan

MOEF&CC, New Delhi, Vide ToR Letter NO. J-12011/08/2022-IA. I(R), Dated 27th June 2022, has prescribed that Biodiversity and Wildlife Conservation & Management Plan for conservation and preservation of endemic, rare and endangered species of flora and fauna to be prepared in consultation with State Forest Department.

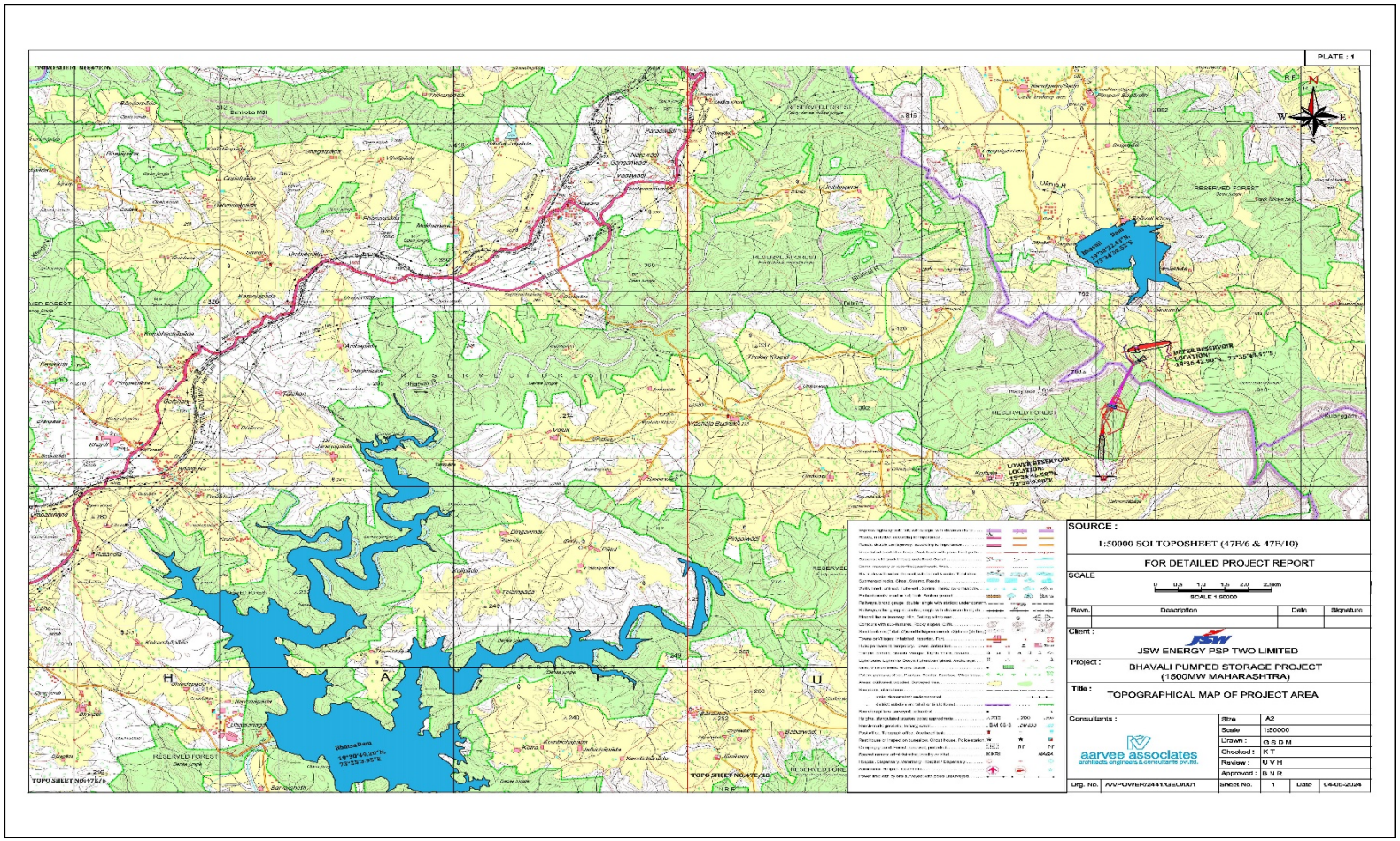

Figure 1.1 : Project Layout MAP

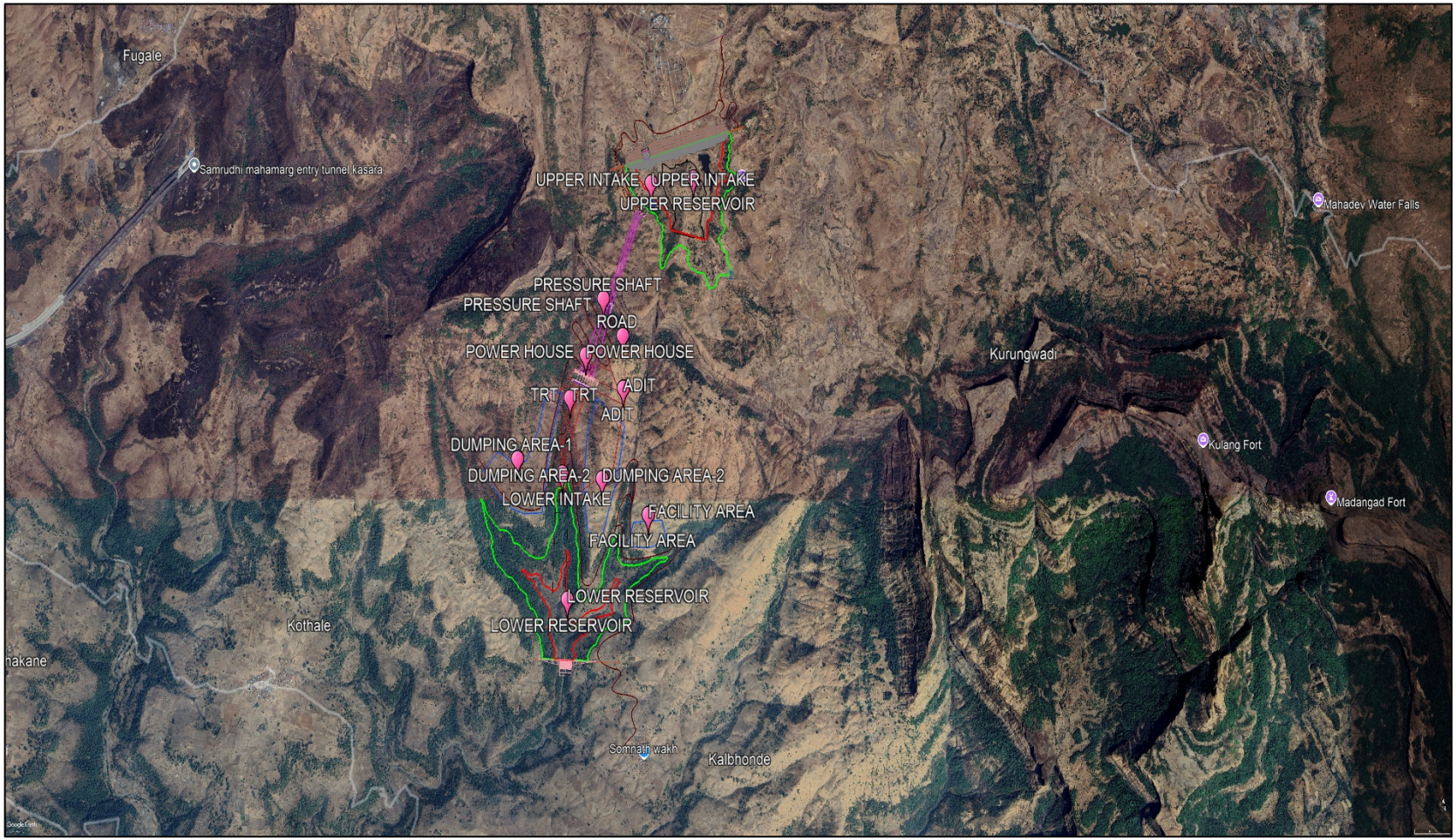

Figure 1.2 : Google Image of Project Area showing Project Layout

2 PROJECT AND IMPACT AREA

2.1 DESCRIPTION OF PROJECT AREA

The project area lies in Northern Western Ghats (Sahyadri Mountain) and comprises of varied topography. The distinct physiographic units are the main system of Sahyadri hill ranges with plains of Darna River valley and Bhatsa river, Tributary of the western flowing Ulhas river, separated by the hill ridge forming boundary between Nashik and Thane Districts. The elevation of the study area varies between 250 metres and 1470 metres. The general slope of this plateau is towards the east. The study area, covered in Survey of India topo-sheet 47E/10 in 1:50,000 scale, is not entirely rocky or hilly but has smooth plains and smooth undulating lands as well. Geographically, the landscape of the study area consists of two natural regions, separated by the Sahayadri hill ranges which has Godavari basin in its North and Western flowing Ulhas Basin in South. The photographic view of proposed upper and lower reservoirs is depicted in **Figure2.1** and **Figure 2.2**.

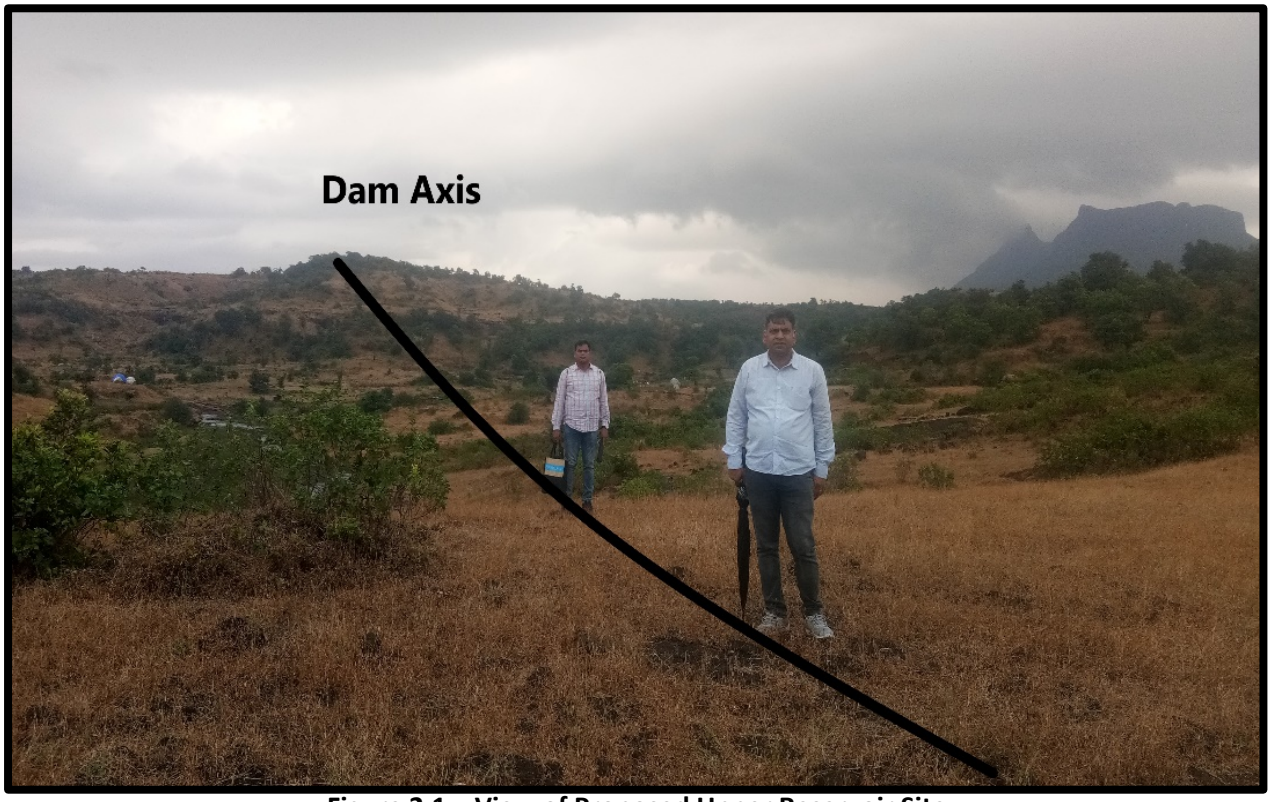

Figure 2.1 : View of Proposed Upper Reservoir Site

Figure 2.2 : View of Existing Lower Reservoir Site

2.2 PROJECT IMPACT AREA

In context of River Valley Hydro Electric Projects with or without Pump Storage Project and Stand-alone Pump Storage Project, the study area is construed as impact area and shall comprise of the following:

- Catchment area up to the upper and lower reservoir site.
- Submergence Area.
- Area falling within 10 km radius from the periphery of the upper reservoir and downstream up to 10 km from the lower reservoir.

2.3 GEOLOGY OF STUDY AREA

The geological formations underlying the area are the basaltic lava flows of upper Cretaceous to lower Eocene age. Igatpuri tehsil of Nashik district is mainly part of the Great Deccan Trap and formed by volcanic eruption. It shows prominent basaltic features. Most of the basalts in the study area are fine or coarse textured and nodular form. Along the banks of the rivers in the flowing area, shallow alluvial formation occurs in narrow belt.

2.4 SEISMICITY OF STUDY AREA

As per the seismic zoning map of India, as incorporated in Indian Standard Criteria for Earthquake Resistant Design of Structures IS:1893-(Part I) 2002, the proposed site lies in seismic Zone-III, which is referred to as moderate risk zone.

2.5 LAND USE OF STUDY AREA

The dominating classes are dense forest (47.75%), agriculture land (29.87%), open forest (20.61%), settlement (0.95%) and water body (0.82%). The land use pattern of study area is exhibited in **Figure 2.3** and enumerated in **Table 2.1.**

Table 2.1: Land use & Land cover of Study Area

S.N.	Land use category	Area in sq. km	Area in %
1	Agriculture Land	121.75	29.87
2	Dense Forest	194.63	47.75
3	Open Forest land	83.99	20.61
4	Waterbody	3.36	0.82
5	Settlement	3.85	0.95
Total		**407.58**	**100.00**

2.6 SLOPE OF STUDY AREA

The study area has hilly and plain topography. The general slope of the study area is from north to south and follows the general trend of drainage. The slope map of the study area is shown in **Figure 2.4** and the area under different slope classes is enumerated in **Table 2.2**. About 31.92% of the area is covered under very gentle; 21.07% and 19.23% under gentle slope and moderate slope respectively. About 27.78% is covered under moderately steep slope to steep slope.

Table 2.2: Area Under Different Slope Classes of Study Area

S. No	Slope Range (Degrees)	Slope Description	Area under different class (Sq. km)	Area (%)
1	0-5	Very Gentle Slope	130.11	31.92
2	5-10	Gentle Slope	85.89	21.07
3	10-15	Moderate Slope	78.37	19.23
4	15-20	Moderately Steep Slope	62.89	15.43
5	>20	Steep Slope	50.32	12.35
Total			**407.58**	**100.00**

2.7 HUMAN HABITATION OF STUDY AREA

The study area comprises of 40 villages of which 20 ,18 and 2 are in Nashik, Thane and Ahmednagar districts respectively. Out of these villages Jamunde and Kalbhonde shall be project affected villages as these shall be impacted due to acquisition of private land, falling within the boundary of these villages for project works. As per the Census of India 2011, the total households under study area villages are 9190. The total population of villages is 52201 composed of 26398 males and 25803 females with sex ratio of 977. **(Table2.3**).

The cast wise composition of the total population made up the Scheduled Cast population is 2234 (4.28%) and Scheduled Tribe population is 32079 (61.45%), which shows that the Scheduled Tribe is the dominant cast in most of the villages in study area. The total literate population is 28605, of which male and female population is 16974 and 11631 respectively. Total literate population is 64.83%, of which male and female literates are 76.40 % are 53.09 % respectively. The total working population is 24293 (46.53%) which comprises of main workers 18849 (36.10%) and marginal workers 5444 (10.43%) while non-workers are 27908 (53.47%). Among main workers, cultivators constitute the highest category (54.3%), followed by cultivators (29.7%) and other workers (15.90%). Among marginal workers agricultural labour constitutes the highest category (50.7%) followed by cultivators (31.9%) and other workers (15.4%).

Table 2.3: Population Composition of Study Area

S. No.	Villages	H.H.	Population						
			Total	Male	Female	Below 6 yr.	Male <6 yr.	Female < 6 yr.	Sex Ratio
1	Bhavli Bk	176	1023	527	496	146	81	65	941
2	Titoli	203	1076	548	528	148	73	75	964
3	Bortembhe	289	1673	858	815	231	121	110	950
4	Kanchangaon	316	1906	975	931	275	147	128	955
5	Talogha	411	2501	1303	1198	398	235	163	919
6	Taloshi	303	1796	891	905	239	111	128	1016
7	Nandgaonsado	718	4203	2102	2101	567	292	275	1000
8	Pimpri Sadroddin	394	2316	1174	1142	361	185	176	973
9	Fangul Gavhan	256	1531	790	741	215	120	95	938
10	Borli	111	616	298	318	107	51	56	1067
11	Bhavli Kh	397	2307	1112	1195	396	206	190	1075
12	Kaluste	660	3885	1987	1898	502	263	239	955
13	Bharwaj	159	819	412	407	95	49	46	988
14	Manjargaon	177	889	453	436	98	43	55	962
15	Nirpan	146	828	415	413	173	87	86	995
16	Gavhande	104	701	351	350	147	77	70	997

S. No.	Villages	H.H.	Population						
			Total	Male	Female	Below 6 yr.	Male <6 yr.	Female < 6 yr.	Sex Ratio
17	Jamunde	107	589	287	302	120	62	58	1052
18	Kurungwadi	186	1055	514	541	288	145	143	1053
19	Ambewadi	380	2183	1111	1072	317	150	167	965
20	Taked Kh	220	1120	582	538	150	82	68	924
21	Kasara Kh.	460	2588	1293	1295	443	236	207	1002
22	Dand	35	165	80	85	29	16	13	1063
23	Umbravane	42	249	126	123	36	16	20	976
24	Fugale	168	1018	507	511	202	103	99	1008
25	Vashala Bk	282	1439	711	728	246	114	132	1024
26	Vashala Kh	69	325	153	172	56	24	32	1124
27	Susarwadi	156	1044	563	481	122	70	52	854
28	Pingalwadi	37	162	87	75	28	16	12	862
29	Dhakane	296	1882	1036	846	268	146	122	817
30	Kothale	261	1233	589	644	258	137	121	1093
31	Kalbhonde	176	997	510	487	205	128	77	955
32	Julawani	294	1382	699	683	184	82	102	977
33	Jambhulwad	129	665	342	323	104	48	56	944
34	Roadvahal	92	476	233	243	96	45	51	1043
35	Hinglud	77	404	203	201	42	18	24	990
36	Chondhe Kh.	81	384	185	199	62	31	31	1076
37	Chilhar	98	588	290	298	92	42	50	1028
38	Ranvihir	286	1468	763	705	194	102	92	924
39	Ghatghar	197	1176	588	588	186	95	91	1000
40	Udadawane	241	1539	750	789	249	131	118	1052
	Total	**9190**	**52201**	**26398**	**25803**	**8075**	**4180**	**3895**	**977**

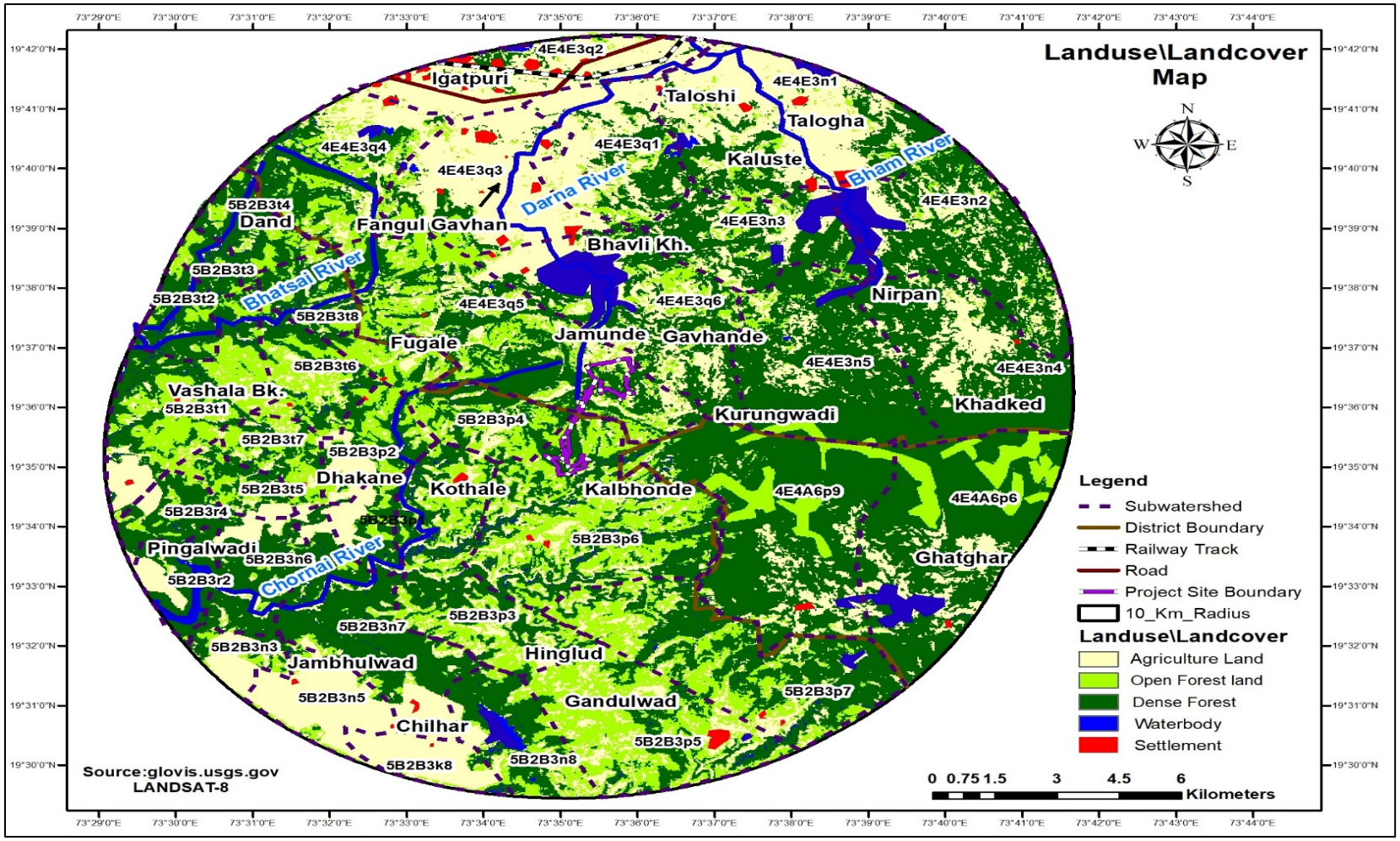

Figure 2.3 : Land Use Land Cover Map

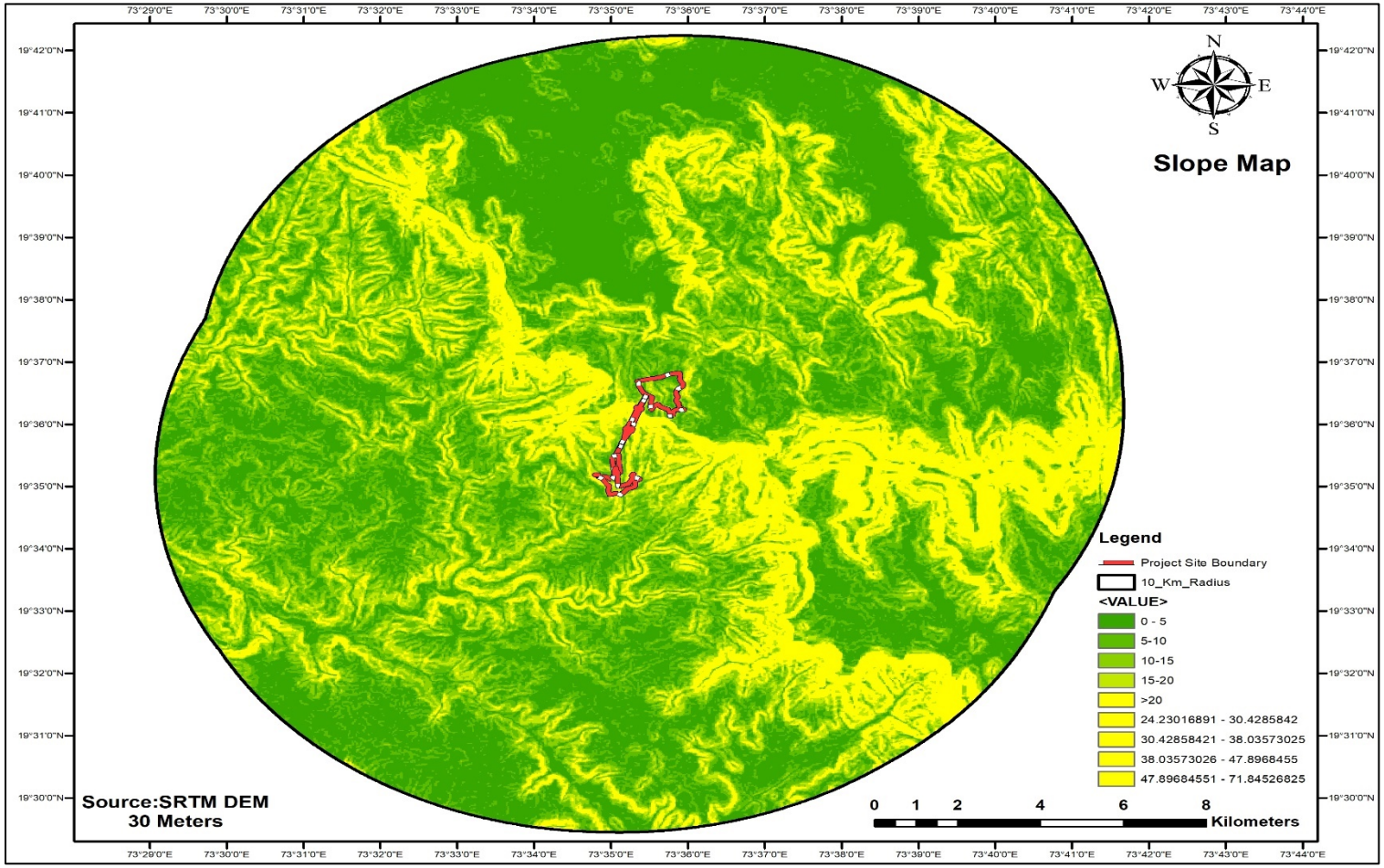

Figure 2.4 : Slope Map of Study Area

2.8 BASELINE STATUS OF ENVIRONMENT ATTRIBUTES

2.8.1 CLIMATE OF STUDY AREA

The average annual temperature of the study area is 24.2 °C. January is the coldest month of the year with average minimum temperature 15.5 °C. April is the hottest month of the year with average maximum temperature 35.8 °C. Average precipitation is about 2084 mm. There is average 96 rainy days in a year of which 80 days are in monsoon season. Skies are generally clear from November to April. During monsoon the clouds cover varies from 4.7 to 6.3 oktas of sky. For about 146 days skies are clear and for 76 days about 3 to 5 oktas of sky are covered.

2.8.2 Ambient Air Quality in Study Area

The maximum concentration of PM10, PM2.5, NOX and SO2 monitored at was 66.3µg/m^3, 25.5µg/m^3, 12.8µg/m^3 and 9.6µg/m^3 respectively which shows that concentration of pollutants was within the limits of NAAQS, prescribed by CPCB ,2009.

2.8.3 Noise Levels in Study Area

The highest noise levels recorded during daytime at Bhavali Khurd is 62.6 dB (A) and during nighttime it is 50.3dB (A) and both are within the CPCB limits of 65 dB (A) and 55 dB (A) for commercial zone. The noise levels for all other locations are within the limits set forth under Noise Pollution (Regulation and Control) Rules, 2000. Standards for daytime and night time i.e., 55 dB (A) and 45 dB (A) respectively.

2.8.4 Soil Quality in Study Area

The soil is neutral having pH varying from 6.6 to 7.34. The texture of the soil is loam, and sandy clay loam. Available nitrogen content in the surface soils ranges between 153 to 849 kg/ha thereby is indicating that soils are low to high in available nitrogen content. Available phosphorus content ranges between 6.6 to 46.9 kg/ha thereby indicating that soils are low to high in available phosphorus. Available potassium content in these soils' ranges between 81.8 to 826 kg/ha, thereby indicating low to high in potassium content. The organic carbon varies from 0.76 % to 3.0% thereby implying high in organic content.

2.8.5 Surface Water Quality in Study Area

The pH values of all analyzed samples ranged between 6.97 – 7.6 and are within the acceptable limit (6.5-8.5). The TDS levels ranged from 74 to 107 mg/l and were less than the desirable limit of 500 mg/l. Total hardness levels ranged from 56 to 77 mg/l and were well below the acceptable limit of 200 mg/l. The dissolved oxygen values ranged between 6.9-8.4 mg/l and were more than 4 mg/l, i.e., the limit under CPCB Water Quality Criteria for designated best use (C). The chlorides level in surface water samples ranged from 30.3 - 41.1 mg/l and were below the acceptable limit of 250 mg/l. The sulphate levels ranged from 7.4 to 14.1 mg/l and were below the acceptable limit of 200 mg/l. The nitrate ranged between 2.4 to 6.7 mg/l and were below the acceptable limit of 45 mg/l. The BOD values ranged between 1.1 to 2.8mg/l

and exceeded the CPCB criteria of 2mg/l or less for Class A water. The Total Coliform level ranged between 52-116 MPN/100ml and were less than 500 MPN/100ml, the limits specified for Class B water under CPCB Water Quality Criteria is designated as best use. The water is suitable for meeting drinking water requirements after conventional treatment and disinfection.

2.8.6 Ground Water Quality in Study Area

The pH values ranged between 6.58 – 7.86 and are within the acceptable limit (6.5-8.5). The TDS levels ranged from 216 to 310 mg/l and were less than the desirable limit of 500 mg/l. Total hardness levels ranged from 140 to 190 mg/l and were well below the acceptable limit of 200 mg/l. Chloride levels at all the locations were within the desirable limits (250 mg/l) as it ranged between 57.1 – 83 mg/l. Sulphate levels at all the locations were within the desirable limits (200 mg/l) as it ranged between 21.3 – 36 mg/l. Nitrate levels at all the locations were within the desirable limits (45 mg/l) as it ranged between 2.8 – 5.1 mg/l. Iron at all the locations was observed well within the desirable limits (1.0 mg/l) as it ranged between 0.03 – 0.10 mg/l. Bacteriological studies revealed that no coliform bacterial are present in the samples. The heavy metal contents were observed to be in below detectable limits. All physical and general parameters were observed within the desirable limit as per IS10500:2012 (Second Revision). The WQI for ground water at all sampling locations is below 50 and therefore, water quality is excellent.

2.8.7 Hydrogeological Aspects of Study Area

Hydrogeologically, the study area is underlain by the basaltic lava flows. The groundwater in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 20-25 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined to confined conditions. The yield of dug wells tapping upper phreatic aquifer down to the depth of 12 to 15 m bgl ranges between 45 to 90 m3/day depending upon the local hydrogeological conditions. Borewells drilled down to 70 m depth, tapping weathered and vesicular basalt are found to yield 18 to 68 m3/day. The dug wells constructed in Alluvium has been ranging in depth from 8-12 m with diameters of 2-3 m, whereas the borewells range in depth from 15 to 20 m and the yield of both the dug wells and borewells ranges from 13 to 22 m3/day.

During pre-monsoon, depth to ground water in dug wells occur in most part of the watershed within 5-7.5 mbgl. During monsoon in some of dug wells extremely shallow water levels within 1.0- 1.5 mbgl have been observed in study area. In the Decadal Water Level Trend of all Ground Water Monitoring Wells (2010-2019) at Igatpuri Piezometer during pre-monsoon season, the fall of 1.33m/year has been observed, whereas, during post monsoon season, a rise of 1.293m/year has been found. The piezometer level observed a rise of 0.0593m/year during the decade period. There is no problem of availability of ground water at present as in both Taluka the stage of ground water development is categorized safe.

2.9 FLORA OF STUDY AREA

2.9.1 Forest Types in Study Area

As per the revised classification of Indian forest types by Champion & Seth, the forests of the study area can be broadly classified under two sub-groups with their associated types (**Table 2.4**).

Table 2.4: Type of Forests in Study Area

S. N.	Forest Group/Type	Distribution/Dominant species
1	Southern Tropical Moist Deciduous Forests. Type-3B/C1b: Moist Teak Forest	This type can be seen near plains of Igatpuri range. The crop is deteriorated due to encroachment on forest areas. The over wood consists of Teak (*Tectona grandis*) with its associates like Sadada (*Terminalia tomentosa*), Hed (*Adina cordifolia*), Kalamb (*Mitragyna parvifolia*), Shisham (*Dalbergia latifolia*), Khair (*Acacia catechu*), and Dhawada (*Anogeissus latifolia*). The underwood consists of Apta (*Bauhinia racemosa*), Asan (*Bridelia retusa*), Awala (*Emblica officinalis*), Bahava (*Cassia fistula*), Bhokar (*Cordia myxa*), Dhaman (*Grewia tiliifolia*), Humb (*Miliusa tomentosa*), Jambhul (*Syzygium cumini*), Kahandol (*Sterculia urens*), Karwal (*Dillenia pentagyna*), Kuda (*Holarrhena pubescens*), Kudi (*Wrightia tinctoria*), Kumbhi (*Carea arborea*), Moha (*Madhuca longifolia*), Palas (*Butea monosperma*), Payar (*Ficus rumphii*), Petari (*Dalbergia paniculata*), Shendri (*Mallotus philippensis*), Tembru (*Diospyros melanoxylon*), Tetu (*Oroxylum indicum*), Umber (*Ficus glomerata*), Waras (*Heterophragma quadriloculare*), Bamboo (*Dendrocalamus strictus*), etc. The undergrowth consists of Burando (*Blumea lacera*), Dhaiti (*Woodfordia fruticosa*), Gal (*Randia dumetorum*), Galgugar (*Flacourtia indica*), Ghatbor (*Ziziphus xylopyrus*), Guthura (*Lantana camara*), Karvi (*Strobilanthes callosa*), Karwand (*Carissa carandas*), Khuri (*Ixora pavetta*), Kirmira (*Casearia esculenta*), Murud Sheng (*Helicteres isora*), Ranbhendi *(Thosposia lampas*), Tarota (*Senna tora*), etc
	Southern Tropical Moist Deciduous Forests. Type-3B/C2: Southern Moist Mixed Deciduous Forest	The over wood consists predominantly of miscellaneous species like Kakad (*Garuga pinnata*), Modhal *(Lannea coromandelica),* Sadada (*Terminalia tomentosa*), and Dhawada (*Anogeissus latifolia*). In addition to this, the species which occurs in the overwood are Bibla (*Pterocarpus marsupium*), Bondara (*Lagerstroemia parviflora),* Khair (*Acacia catechu*), Kinhai (*Albizia procera*), Pangara (*Erythrina variegata*), Sawar (*Bombax ceiba*), Shisham (*Dalbergia latifolia*), Shiras (*Albizia lebbeck*), Shiwan (*Gmelina arborea*), Teak (*Tectona grandis*) and Tiwas (*Ougeinia oojeinensis*). The underwood consists of Amba (*Mangifera indica*), Apta (*Bauhinia racemosa*), Asan (*Bridelia retusa*), Awala (*Emblica officinalis*), Bahava (*Cassia fistula*), Dhaman (*Grewia tiliifolia),* Kahandol (*Sterculia urens*), Kudi (*Wrightia tinctoria*), Kumbhi (*Careya arborea),* Moha (*Madhuca longifolia*), Palas (*Butea monosperma*), Payar (*Ficus rumphii*), Tembru (*Diospyros melanoxylon*), Waras (*Heterophragma quadriloculare*)

		The undergrowth consists of Bor (*Ziziphus mauritiana*), Burando (*Blumea lacera*), Dhaiti (*Woodfordia fruticosa*), Gal (*Randia dumetorum*), Ghatbor (*Ziziphus xylopyrus*), Gulthur (*Lantana camara*), Karvi (*Strobilanthes callosus*), Karwand (*Carissa carandas*), Kharata (*Streblus asper*), Tarota (*Senna tora*), etc.
2	Western Sub-Tropical Hill Forest Type 8A/C2: Southern thorn scrub	This sub type is generally found near Kurungwadi and Ambewadi area of Igatpuri range. The percentage of ever green species particularly Amba (*Mangifera indica*) and Karap (*Memecylon edule*) is significantly high. These types of forests are found in narrow strips. Top Canopy and Second Storey: This type of forest is dominated by Amba (*Mangifera indica*), Asasssn (*Bridelia retusa*), Bhuri (*Ixora pavetta*), Jambhul (*Syzygium cumini*), Kakad (*Garuga pinnata*), Karap (*Memecylon edule*), Koshimb (*Schleichera oleosa*), Modhal (*Lannea coromandelica*), Palas (*Butea monosperma*), Pangara (*Erythrina variegata*), Sadada (*Terminalia tomentosa*), Waras (*Heterophragma quadriloculare*), etc. Among herbs and shrubs Bhoma (*Glochidion hohenackeri*), Karwand (*Carissa congesta*), Karvi (*Strobilanthes caliosus*), Tarota (*Senna tora*). etc. are the dominant speciess.

2.9.2 Flora

There are many patches of forests in the study area. The forest of the study area is mainly dominated with Aam *(Mangifera indica),* Sadada *(Terminalia tomentosa),* and Dhawada *(Anogeissus latifolia).*

Vegetation in Lower Reservoir Area

In upper reservoir, scattered forest vegetation and stunted growth of tree species were observed. The upper reservoir area is mainly dominated with shrubby species along with few trees of Amba and Sadada. The upper story is mainly dominated by tree species like Aam (*Mangifera indica*), Sadada (*Terminalia tomentosa*), Umar (*Ficus racemose)* and Dhawada (*Anogeissus latifolia*). The shrub and herb species consists of Karwand (*Carissa congesta*), Bhoma (*Glochidion hohenackeri*) and Karvi (*Strobilanthes caliosus*), etc.

Vegetation in Lower Reservoir Area

The lower reservoir area has slightly dense vegetation with respect to upper reservoir area. The vegetation is also diverse. The vegetation is mixed type by Sadada (*Terminalia tomentosa*), Teak (*Tectona grandis*), Hed (*Adina cordifolia*), Kalamb (*Mitragyna parvifolia*), Shisham (*Dalbergia latifolia*), Khair (*Acacia catechu*), and Dhawada (*Anogeissus latifolia*). The undergrowth consists of Dhaiti (*Woodfordia fruticosa*), Gal (*Randia dumetorum*), Galgugar (*Flacourtia indica*), Ghatbor (*Ziziphus xylopyrus*), Guthura (*Lantana camara*), Karwand (*Carissa carandas*), Khuri (*Ixora pavetta*), and Murud Sheng (*Helicteres isora*).

Vegetation Near Tail Race Channel:

The Vegetation type in tail race channel area is similar to the lower reservoir area. The vegetation is dominated by teak species along with the associated species.

Vegetation in Rest of Study area

In rest of the study area, the main jungle type is mixed deciduous forest and main composition is Teak along with Sadada-Dhavda- and Wali-Dhaiti local type of vegetation. In dense forest area, the teak is the dominant species. In some areas of the study area on steep slopes and depleted soil areas the Kakkad Modhal-waras sub type of forest is observed.

Figure 2.5 : Photographs of Flora of Study Area

2.9.3 Florsistic Composition

During primary and secondary study carried out under present project, 88 tree species (37 families), 41 shrub species (23 families), 40 herbs species (26 families) and 14 species of climbers (10 families) and 18 species of grasses (1 family) were recorded from the study area. The comprehensive list of the plant species observed in the study area is given **Table 2.5**.

Table 2.5: Plant Species Recorded/Reported in Study Area

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
Trees				
1.	Amba	*Mangifera indica*	Anacardiaceae	DD
2.	Ambada	*Spondias pinnata*	Anacardiaceae	LC
3.	Biba	*Semecarpus anacardium*	Anacardiaceae	LC
4.	Modhal, Moi	*Lannea coromandelica*	Anacardiaceae	LC
5.	Humb	*Miliusa tomentosa*	Annonaceae	-
6.	Kuda (Safed)	*Holarrhena antidysentrica*	Apocyanaceae	LC
7.	Kuda	*Wrightia tinctoria*	Apocyanaceae	LC
8.	Buralicode	*Wrightia arborea*	Apocynaceae	LC
9.	Medsing	*Dolichandron falcata*	Bignoniaceae	-
10.	Tetu	*Oroxylon indicum*	Bignoniaceae	-
11.	Waras/Varas	*Heterophrasma quadriculata*	Bignoniaceae	-
12.	Semal	*Bombax ceiba*	Bombacaceae	LC
13.	Aliv	*Lepidium sativum*	Brassicaceae	
14.	Kakad	*Garuga pinnata*	Burseraceae	-
15.	Salai	*Boswellia serrata*	Burseraceae	-
16.	Bahawa	*Cassia fistula*	Caesalpiniaceae	LC
17.	Chamol	*Bauhinia lawii*	Caesalpiniaceae	-
18.	Chinch	*Tamarindus indica*	Caesalpiniaceae	LC
19.	Wagat	*Capparis zeylanica*	Capparaceae	-
20.	Petari	*Mallotus polycarpus*	*Euphorbiaceae*	-
21.	Ain (sadada)	*Terminalia alata*	Combretaceae	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
22.	Arjun sadada	*Terminalia arjuna*	Combretaceae	-
23.	Beheda	*Terminalia bellirica*	Combretaceae	LC
24.	Dhawda, Dhamoda	*Anogeissus latifolia*	Combretaceae	-
25.	Hirda	*Terminalia chebula*	Combretaceae	LC
26.	Ain	*Terminalia elliptica*	*Combretaceae*	-
27.	Tendu	*Diospyros melanoxylon*	Ebenaceae	-
28.	Kamala, Kumkum	*Mallotus philipensis*	Euphorbiaceae	-
29.	Anjan	*Hardwickia binata*	Fabaceae	LC
30.	Apta	*Bauhinia racemosa*	Fabaceae	-
31.	Bija/Bibla	*Pterocarpus marsupium*	Fabaceae	NT
32.	Karanj	*Pongamia pinnata*	Fabaceae	LC
33.	Palas	*Butea monosperma*	Fabaceae	LC
34.	Pangara	*Erythrina stricta*	Fabaceae	-
35.	Shisham	*Dalbergia latifolia*	Fabaceae	VU
36.	Sissoo	*Dalbergia sissoo*	Fabaceae	LC
37.	Tiwas/Tinsa	*Ougenia oojeinensis*	Fabaceae	-
38.	Kumbhi	*Careya arborea*	Lecythidiaceae	-
39.	Bondara	*Lagerstroemia parviflora*	Lythraceae	LC
40.	Baranga	*Kydia calycina*	Malvaceae	LC
41.	Bakan-Nimb	*Melia azadirachta*	Meliaceae	LC
42.	Neem/Nimb	*Azadirachta indica*	Meliaceae	LC
43.	Babul	*Acacia nilotica*	Mimosaceae	LC
44.	Ghubata	*Acacia polycantha*	Mimosaceae	-
45.	Hiwar	*Acacia leucophloea*	Mimosaceae	LC
46.	Ichan (Pandra Khair)	*Acacia ferruginea*	Mimosaceae	VU
47.	Kansar	*Albizia amara*	Mimosaceae	LC
48.	Khair	*Acacia catechu*	Mimosaceae	LC
49.	Safed Siras	*Albizzia procera*	Mimosaceae	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
50.	Siras (Kala)	*Albizzia lebbek*	Mimosaceae	-
51.	Sonchafa	*Michelia champaca*	Mognoliaceae	LC
52.	Amba-payer	*Ficus virens*	Moraceae	LC
53.	Payer, Pipri	*Ficus amplissima*	Moraceae	-
54.	Phanas	*Artocarpus heterophyllus*	Moraceae	-
55.	Umbar	*Ficus racemosa*	Moraceae	LC
56.	Wad	*Ficus bengalensis*	Moraceae	-
57.	Shevga	*Moringa oliefera*	Moringaceae	-
58.	Jambul, Jamun	*Syzygium cumini*	Myrtaceae	LC
59.	Nilgiri	*Eucalyptus camaldulensis*	Myrtaceae	-
60.	Mokha	*Schrebera swietenioides*	Oleaceae	-
61.	Shindi	*Phoenix sylvestris*	Palmaceae	-
62.	Darara	*Erythrina suberosa*	Papilionaceae	-
63.	Asand	*Bridelia retusa*	Phyllanthaceae	LC
64.	Awalkanti, Aonla	*Phyllanthus emblica*	Phyllanthaceae	LC
65.	Bhoma	*Glochidion hohenackeri*	Phyllanthaceae	-
66.	Bor	*Ziziphus mauritiana*	Rhamnaceae	LC
67.	Ghatbor	*Zizyphus xylopyra*	Rhamnaceae	-
68.	Ali	*Morinda tinctoria*	Rubiaceae	-
69.	Aliv	*Meyna laxiflora*	Rubiaceae	-
70.	Haldu/ Hed	*Haldina cordifolia*	Rubiaceae	-
71.	Kalamb	*Mitragyna parviflora*	Rubiaceae	-
72.	Bel	*Aegle marmelos*	Rutaceae	NT
73.	Kawat	*Limonia acidissima*	Rutaceae	-
74.	Kusum	*Schleichera oleosa*	Sapindaceae	LC
75.	Ritha	*Sapindus laurifolius*	Sapindaceae	-
76.	Bakula	*Mimusops elengi*	Sapotaceae	LC
77.	Kad, Kadhai, Kandol	*Sterculia urens*	Sterculiaceae	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
78.	Bothi, Varying	*Eriolaena quinquelocularis*	Sterculiceae	-
79.	Dhaman	*Grewia tilifolia*	Tiliaceae	-
80.	Gangudi	*Grewia tenax*	Tiliaceae	LC
81.	Gol, Karamatigol	*Trema orientalis*	Ulmaceae	LC
82.	Papada	*Holoptelea integrifolia*	Ulmaceae	-
83.	Sag/Sagwan	*Tectona grandis*	Verbenaceae	-
84.	Shivan	*Gmelina arborea*	Verbenaceae	LC
85.	Ela	*Eletteria cardamomum*	Zingiberaceae	-
86.	Kharmati	*Memecylon umbellatum*	Melastomataceae	-
87.	Kirmira	*Glycosmis pentaphylla*	Rutaceae	-
88.	Kuda	*Holarrhena pubescens*	Apocynaceae	-
Shrubs				
1.	Achra	*Dyschoriste dalzellii*	*Acanthaceae*	-
2.	Karvi	*Carvia callosa*	*Acanthaceae*	-
3.	Kati Koranti	*Barleria prionitis*	*Acanthaceae*	LC
4.	Amoni	*Rhus mysorensis*	*Anacardiaceae*	-
5.	Pandrakuda	*Holarrhena antidysenterica*	*Apocyanaceae*	LC
6.	Karvand	*Carissa congesta*	*Apocynaceae*	LC
7.	Anantvel	*Hemidesmus indicus*	*Asclepiadaceae*	-
8.	Rui	*Calotropis gigantea*	*Asclepiadaceae*	-
9.	Kadu Jire	*Vernonia anthelmintica*	*Asteraceae*	-
10.	Dhordavana	*Artemisia nilagirica*	*Asteraceae*	-
11.	Phadya Niwadung	*Opuntia dilleniid*	*Cactaceae*	LC
12.	Awal, Tarvad	*Senna auriculata*	*Caesalpiniaceae*	-
13.	Chilhar	*Caesalpinia decapetala*	*Caesalpiniaceae*	-
14.	Dewawali	*Cassia suffruticosa*	*Caesalpiniaceae*	-
15.	Tarwad	*Cassia auriculata*	*Caesalpiniaceae*	-
16.	Yenkal/Bharati	*Maytenus emarginata*	*Celastraceae*	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
17.	Henkal	*Gymnosporia spinosa*	*Celestraceae*	-
18.	Chandrajyoti	*Jatropha curcas*	*Euphorbiaceae*	LC
19.	Pachurna	*Securinega virosa*	*Euphorbiaceae*	-
20.	Shembarti	*Acacia pennata*	*Fabaceae*	LC
21.	Umbrella Thorn	*Vachellia tortilis*	*Fabaceae*	LC
22.	Hirna	*Indigofera trita*	*Fabaceae*	LC
23.	Dhaiti	*Woodfordia fruticose*	*Lythraceae*	LC
24.	Ambadi	*Hibiscus aculeatus*	*Malvaceae*	-
25.	Ranbhendi	*Thespesia lampas*	*Malvaceae*	-
26.	Zingaroot	*Urena lobata*	*Malvaceae*	LC
27.	Velatur	*Dichrostachys cinerea*	*Mimosaceae*	LC
28.	Pandharphali	*Securinega leucopyrus*	*Phyllanthaceae*	LC
29.	Vowding	*Embelia tsjeriam cottam*	*Primulaceae*	-
30.	Bor	*Ziziphus mauritiana*	*Rhamnaceae*	LC
31.	Chanyabor	*Ziziphus nummularia*	*Rhamnaceae*	-
32.	Toran	*Ziziphus rugosa*	*Rhamnaceae*	-
33.	Gal/Gel	*Catunaregam spinosa*	*Rubiaceae*	LC
34.	Papat	*Pavetta indica*	*Rubiaceae*	-
35.	Bhokoda	*Casearia graveolens*	*Salicaceae*	-
36.	Bhui ringni	*Solannum xanthocarpum*	*Solanaceae*	-
37.	Ati, Murudsheng	*Helicteres isora*	*Sterculiaceae*	-
38.	Jaol	*Tamarix dioica*	*Tamaricacease*	-
39.	Barkudi	*Grewia damine*	*Tiliaceae*	-
40.	Bharangi	*Clerodendrum serratum*	*Verbenaceae*	-
41.	Gultura/Ganeri	*Lantana camara*	*Verbenaceae*	-
Herbs				
1.	Buikarvi	*Hygrophila serpyllum*	*Acanthaceae*	-
2.	Corata	*Barleria lawii*	*Acanthaceae*	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
3.	Aghada	*Achyranthes aspera vari*	*Amaranthaceae*	-
4.	Babli	*Heracleum grandis*	*Apiaceae*	-
5.	Dongarjeera	*Pimpinella heyneana*	*Apiaceae*	-
6.	Badadha	*Arisaema murrayi*	*Araceae*	-
7.	Khorpad	*Aloe vera*	*Asphodelaceae*	-
8.	Burandu	*Ageratum conyzoides*	*Asteraceae*	-
9.	Dagadipala	*Tridax procumbens*	*Asteraceae*	-
10.	Khurasini	*Guizotia abyssinica*	*Asteraceae*	-
11.	Ranjenda	*Zinnia peruviana*	*Asteraceae*	-
12.	Tarota	*Senna tora*	*Caesalpiniaceae*	-
13.	Pivli tilwan	*Cleome viscosa*	*Cleomaceae*	-
14.	Gomett	*Solena amplexicaulis*	*Cucurbitaceae*	-
15.	Kartoli	*Momordica dioca*	*Cucurbitaceae*	-
16.	Medwan	*Dioscorea oppositifolia*	*Dioscoreaceae*	-
17.	Buishirid	*Euphorbia fusiformis*	*Euphorbiaceae*	-
18.	Barbada	*Indigofera cordifolia*	*Fabaceae*	-
19.	Borupdi	*Indigofera glandulosa*	*Fabaceae*	-
20.	Dador	*Sesbania bispinosa*	*Fabaceae*	LC
21.	Kachquiri/Kawitch	*Mucuna pruriens*	*Fabaceae*	LC
22.	Phat-phati	*Crotalaria filipes*	*Fabaceae*	-
23.	Rangas	*Crotalaria medicaginea*	*Fabaceae*	-
24.	Alsi	*Dalbergia volubilis*	*Fabaceaea*	LC
25.	Chidsi/ Chimandara	*Eragrostis unioloides*	*Gramineae*	LC
26.	Kal-lavi	*Gloriosa superba*	*Lilliaceae*	LC
27.	Jalmukhi	*Rotala densiflora*	*Lythraceae*	LC
28.	Rankel/Kawder	*Ensete superbum*	*Musaceae*	-
29.	Gatrack	*Boerhavia diffusa*	*Nyctaginaceae*	-
30.	Chichur-kanda	*Habenaria grandifloriformis*	*Orchidaceae*	NT

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
31.	Haryakand	*Geodorum demiflorum*	*Orchidaceae*	-
32.	Ambushi	*Oxalis corniculate*	*Oxalidaceae*	-
33.	Pivla dhotra	*Argemona mexicana*	*Papaveraceae*	-
34.	Ranborat	*Echinochloa colona*	*Poaceae*	LC
35.	Burad/shedya	*Paspalidium flavidum*	*Poaceae*	LC
36.	Bohra/Kaligunj	*Cardiospermum halicacalum*	*Sapindaceae*	-
37.	Kangani	*Solanum nigrum*	*Solaraceae*	-
38.	Agya	*Girardinia diversifolia*	*Urticaceae*	-
39.	Anderphod	*Leea macrophylla*	*Vitaceae*	-
40.	Gokhru	*Tribulus terrestris*	*Zygophyllaceae*	LC
Climbers				
1.	Kawalvel/Nivali	*Tylophora dalzelli*	Asclepiadaceae	-
2.	Sathawari	*Asparagus racemosus*	Asparagaceae	-
3.	Mahulvel	*Bauhinia vahlii*	Ceasalpiniaceae	-
4.	Randhodka	*Luffa acutangular*	Curcurbitaceae	-
5.	Amarvel	*Cuscuta reflexa*	Cuscutaceae	LC
6.	Kadukand	*Dioscorea bulbifera*	Dioscoreaceae	-
7.	Mukani/Ranudid	*Vigna radiate*	Fabaceae	-
8.	Palasvel	*Butea superba*	Fabaceae	-
9.	Ramdatan	*Smilax macrophylla*	Liliaceae	-
10.	Bandgul	*Dendrophthoe falcata*	Loranthaceae	-
11.	Bokadvel/Ghatmol	*Aspidoptrys cordata*	Malipighiaceae	-
12.	Butgandivel	*Clematis hedy sarifollia*	Ranunculaceae	-
13.	Aradhashish	*Ventilago denticulate*	Rhamnaceae	-
14.	Toran	*Zizyphus rugosa*	Rhamnaceae	-
Grasses				
1	Balgadhan	*Cyperus rotundus*	Poaceae	LC
2	Belakuda	*Eragrostis tenella*	Poaceae	-

Sl. No.	Local Name	Botanical Name	Family	IUCN Status
3	Fulora	*Themeda quadrivalvis*	Poaceae	-
4	Gavati Chaha	*Cymbopogon citratus*	Poaceae	-
5	Goundwel	*Andropogon pumilus*	Poaceae	-
6	Haryali	*Cynodon dactylon*	Poaceae	LC
7	Kahandol	*Chrysopogon fulvus*	Poaceae	-
8	Kalikusali/Kusal	*Heteropogon contortus*	Poaceae	-
9	Kasti	*Bambusa arundinacia*	Poaceae	NE
10	Kathara	*Bothriochloea pertusa*	Poaceae	-
11	Kunda	*Ischaemum pilosum*	Poaceae	NE
12	Manvel	*Dendrocalamus strictus*	Poaceae	NE
13	Marvel	*Dichanthium annulatum*	Poaceae	-
14	Mesi	*Chloris barbata*	Poaceae	-
15	Paonya	*Sehima sulcatum*	Poaceae	NE
16	Rosha	*Cymbopogon martini*	Poaceae	-
17	Shedya	*Sehima nervosum*	Poaceae	NE
18	Thuda	*Ischaemum rugorum*	Poaceae	LC

2.9.4 RET Plant Species in Study Area

There are 3 Near Threatened (NT) and two Vulnerable (VU) species and only one endemic specie in study area. Based on IUCN Version3.1, the conservation status of these species is given in **Table 2.6.**

Table 2.6: List of Near Threatened & Vulnerable species in Study Area

S.N.	Species	Conservation Status IUCN, (Ver 3.1)
1	*Aegle marmelos*	NT
2	*Pterocarpus marsupium*	NT
3	*Habenaria grandifloriformis*	NT
4	*Acacia ferruginea*	VU
5	*Dalbergia latifolia*	VU

NT: Near Threatened; VU: Vulnerable

2.9.5 Plant of Ethno botanical/medicinal Importance in Study Area

During the survey, ethno-botanical information on 36 plant species was documented (**Table 2.7**). It was found that these plant species are used for medicinal, timber, fuel wood, fodder, ornamental, agricultural tools, thatching, fencing, etc.

Table 2.7: List of ethno-botanically important plant species in Study Area

Sl. No.	Local Name	Botanical Name	Family	Part used	Status
1	Amba	*Mangifera indica*	Anacardiaceae	Bark, leaves, fruits, wood	EN
2	Semal	*Bombax ceiba*	Bombacaceae	Root, gum	VU
3	Salai	*Boswellia serrata*	Burseraceae	Bark, gum	VU
4	Bahawa	*Cassia fistula*	Caesalpiniaceae	All parts	EN
5	Chinch	*Tamarindus indica*	Caesalpiniaceae	Fruit, pulp	-
6	Ain (sadada)	*Terminalia alata*	Combretaceae	Heart wood	-
7	Arjun sadada	*Terminalia arjuna*	Combretaceae	Bark	VU
8	Beheda	*Terminalia bellirica*	Combretaceae	Bark. Fruits	VU
9	Hirda	*Terminalia chebula*	Combretaceae	Fruits	EN
10	Tendu	*Diospyros melanoxylon*	Ebenaceae	Leaves	-
11	Bija/Bibla	*Pterocarpus marsupium*	Fabaceae	Bark and leaves	-
12	Karanj	*Pongamia pinnata*	Fabaceae	Root, bark, leaves, flower	R
13	Shisham	*Dalbergia latifolia*	Fabaceae	Heart wood, Bark, leaf	-
14	Sissoo	*Dalbergia sissoo*	Fabaceae	Heart wood	-
15	Bakan-Nimb	*Melia azadirachta*	Meliaceae	Seed	-
16	Neem/Nimb	*Azadirachta indica*	Meliaceae	Bark and leaves	VU
17	Bate, Kalasiras	*Albizia lebbeck*	Mimosaceae	Heart wood, bark	-
18	Kalasiras	*Albizia Lebbeck*	Mimosaceae	Heart wood, seeds	-
19	Khair	*Acacia catechu*	Mimosaceae	Bark, heart wood	VU
20	Phanas	*Artocarpus heterophyllus*	Moraceae	Fruit, leaves	-
21	Umbar	*Ficus racemosa*	Moraceae	Fruit, leaves, bark	-
22	Shevga	*Moringa oliefera*	Moringaceae	Leaves, bark, roots	-
23	Jambul, Jamun	*Syzygium cumini*	Myrtaceae	Bark, leaves, fruits	VU
24	Haldu/ Hed	*Haldina cordifolia*	Rubiaceae	Heart wood, Bark, leaf	-
25	Bel	*Aegle marmelos*	Rutaceae	Fruit, leaf, root, and bark	VU
26	Kusum	*Schleichera oleosa*	Sapindaceae	Bark, wood, seeds	-
27	Ritha	*Sapindus laurifolius*	Sapindaceae	Seeds	-
28	Sag/Sagwan	*Tectona grandis*	Verbenaceae	Whole plant	EN
29	Karvand	*Carissa congesta*	*Apocynaceae*	Root, fruit	-

Sl. No.	Local Name	Botanical Name	Family	Part used	Status
30	Rui	*Calotropis gigantea*	*Asclepiadaceae*	Bark, root	-
31	Chandrajyoti	*Jatropha curcas*	*Euphorbiaceae*	Fruit, seeds	-
32	Bor	*Ziziphus mauritiana*	*Rhamnaceae*	Fruit, leaves, flower	VU
33	Khorpad	*Aloe vera*	*Asphodelaceae*	Leaves	-
34	Kachquiri/Kawitch	*Mucuna pruriens*	*Fabaceae*	Seeds	-
35	Pivla dhotra	*Argemona mexicana*	*Papaveraceae*	Seed	-
36	Kangani	*Solanum nigrum*	*Solaraceae*	Fruit	-

2.10 FAUNA OF STUDY AREA

The forests, water bodies, mountains and hills present in the study area are having different habitats for different kind of wild fauna. Faunal elements studied comprise mammals, avifauna, herpetofauna and butterflies. Baseline data has been collected during EIA study of the project, and secondary literature. Secondary literature is primarily included in Forest Working Plan of the published literature and EIA report of other projects in the same area, viz., Wildlife Management Plan for Bhadra Iron Ore Mine of JSW Steel Ltd., prepared by ZSI, September, 2018.

2.10.1 Mammals

Sixteen species of mammals were found/reported from secondary sources as well as from the primary survey and consultations **(Table 2.8).** Out of reported species, nine species are Schedule-I species, three species and four species belong to Schedule -II and IV respectively. As per IUCN criteria (2010), study area harbors three vulnerable species and one species is categorized under threatened category.

Table 2.8: Mammalian Species Recorded/Reported in Study Area

S. N.	Common Name	Scientific Name	Family	WPA	CS (IUCN)
1	Panther	*Panthera paradus*	Felidae	I	VU
2	Striped Hyaena	*Hyaena hyaena*	Hyaeninae	I	NT
3	Jackal	*Canis aureus*	Canidae	I	LC
4	Khokad	*Vulpes bengalensis*	Canidae	I	LC
5	Jungle cat	*Felis chaus*	Felidae	I	LC
6	Wolf	*Canis lupus*	Canidae	I	LC
7	Mongoose	*Herpestes edwardsi*	Herpestidae	IV	LC
8	Common Langur	Semnopithecus entellus	Cercopithecidae	II	LC
9	Chowsingha	*Tetracerus quadricornis*	Bovidae	I	VU
10	Barking deer	*Muntiacus muntjak*	Cervidae	I	LC
11	Sasa	*Lepus nigricollis*	Laporidae	II	LC
12	Salu	*Hystrix indica*	Hystricidae	I	LC

S. N.	Common Name	Scientific Name	Family	WPA	CS (IUCN)
13	Khar	*Funambulus palmarum*	Sciuridae	IV	LC
14	Sambar	*Cervus unicolor*	Cervidae	IV	VU
15	Monkey	*Macaca mulatta*	Cercopithecidae	IV	LC
16	Wild Boar	*Sus scrofa*	Suidae	II	LC

CS (IUCN)-Conservation Status (IUCN), LC-Least Concerned, VU-Vulnerable, NT-Near Threatened, WPA (S)-Schedule as amended in 2022.

2.10.2 Avifauna

An on-spot identification of birds has been carried out with the help of pictorial guides/literature published by **Grimmett *et al.* (2011)**. The study area of the proposed HEP is poor in avifaunal richness. A total of 49 species belonging to 25 orders were recorded during this survey (**Table 2.9**). Among bird species, ten species viz., White backed Vulture, Slender billed vulture, Sparrow hawk. Brahminy kite, Booted eagle, Crested serpent eagle, Grey junglefowl, Indian peafowl, Barn owl and Brown wood owl belong to Schedule-I. Rest of the species belong to either Schedule-II or IV. As per the IUCN Red list, two species of Vultures are categorized as "Critically Endangered" and all other species are listed as "Least Concern"

Table 2.9: Avifauna Recorded /Reported in Study Area

S. No.	Scientific Name	Common Name	Order	CS IUCN	WPA Status	Status
1	*Gyps bengalensis*	White backed Vulture	Accipitridae	CR	I	R
2	*Gyps tenuirostris*	Slender billed vulture	Accipitridae	CR	I	R
3	*Accipiter nisus*	Sparrow hawk	Accipitridae	LC	I	R
4	*Milvus migrans*	Pariah Kite	Accipitridae	LC	II	R
5	*Haliastur indus*	Brahminy kite	Accipitridae	LC	I	R
6	*Hieraaetus pennatus*	Booted eagle	Accipitridae	LC	I	R
7	*Aquila pomarina*	Lesser spotted eagle	Accipitridae	LC	IV	R
8	*Spilornis cheela*	Crested serpent eagle	Accipitridae	LC	I	R
9	*Alcedo atthis*	Common kingfisher	Alcedinidae	LC	II	R
10	*Dendrocygna javanica*	Lesser whistling duck	Anatidae	LC	II	R
11	*Anus acuta*	Pintail	Anatidae	LC	II	R
12	*Tachymarptis melba*	Alpine swift	Apodidae	LC	II	R
13	*Ardea cinerea*	Grey heron	Ardeidae	LC	II	R
14	*Ardeola grayii*	Indian pond heron	Ardeidae	LC	II	R
15	*Bubulcus Ibis*	Cattle egret	Ardeidae	LC	II	R
16	*Ardea alba*	Great egret	Ardeidae	LC	II	R
17	*Egretta garzetta*	Little egret	Ardeidae	LC	II	R

S. No.	Scientific Name	Common Name	Order	CS IUCN	WPA Status	Status
18	*Caprimulgus mathrnttensis*	Sykes nightjar	Caprimulgidae	LC	IV	R
19	*Vanellus malabaricus*	Yellow wattled lapwing	Charadriidae	LC	IV	R
20	*Cionia episcopus*	White naked stork	Ciconiidae	VU	IV	R
21	*Streptopelia chinensis*	Spotted dove	Columbidae	LC	II	R
22	*Columba livia*	Brown rock pigeon	Columbidae	LC	IV	R
23	*Streptopelia trangcubarica*	Red collared dove	Columbidae	LC	II	R
24	*Coracias benhgalensis*	Indian roller	Coraciidae	LC	II	R
25	*Centropus sinensis*	Crow pheasant	Cuculidae	LC	II	R
26	*Eudynamys scolopaceus*	Asian Koel	Cuculidae	LC	II	R
27	*Dicrurus macrocercus*	Black Drongo	Dicruridae	LC	II	R
28	*Lanius schach*	Rufous-backed shrike	Laniidae	LC	II	R
29	*Sterna aurantia*	River tern	Laridae	LC	I	R
30	*Argya striata*	Jungle Babbler	Leiothrichidae	LC	II	R
31	*Merops orientalis*	Green bee eater	Meropidae	LC	II	R
32	*Phalacrocorax carbo*	Great cormorant	Phalacrocoracidae	LC	II	R
33	*Francolinus pictus*	Painted partridge	Phasianidae	LC	II	R
34	*Francolinus pondicerianus*	Grey francolin	Phasianidae	LC	II	R
35	*Perdicula asiatica*	Jungle bush quail	Phasianidae	LC	II	R
36	*Gallus sonneratii*	Grey junglefowl	Phasianidae	LC	I	R
37	*Pavo cristatus*	Indian peafowl	Phasianidae	LC	I	R
38	*Dinopium benghalense*	Blackrumped Woodpecker	Picidae	LC	II	R
39	*Ploceus philippinus*	Baya weaver bird	Ploceidae	LC	II	R
40	*Psittacula krameri*	Rose ringed parakeet	Psittacidae	LC	II	R
41	*Pycnonotus jocosus*	Red whiskered bulbul	Pycnonotidae	LC	II	R
42	*Pycnonotus cafer*	Red vented bulbul	Pycnonotidae	LC	II	R
43	*Amaurornis phoenicurus*	Waterhen	Rallidae	LC	II	R
44	*Himantopus himantopus*	Black winged stilt	Recurvirostridae	LC	II	WM
45	*Tyto alba*	Barn owl	Strigidae	LC	I	R
46	*Strix leptogrammica*	Brown wood owl	Strigidae	LC	I	R

S. No.	Scientific Name	Common Name	Order	CS IUCN	WPA Status	Status
47	*Athene brama*	Spotted owletta	Strigidae	LC	II	R
48	*Acridotheres tristis*	Common myna	Sturnidae	LC	II	R
49	*Pseudibis papilosa*	Black ibis	Threskiornithidae	LC	IV	R

CS (IUCN)-Conservation Status (IUCN), LC-Least Concerned, LR-Low Risk, NL-Not Listed, VU-Vulnerable, NT-Near Threatened, WPA (S)-Schedule as amended in 2022.

2.10.3 Herpetofauna

The amphibian and reptiles were sampled with the same transect marked for mammals/birds. The sampling was also carried out along the banks of river & submergence area and downstream of proposed dam. There were 2 species of frogs, 4 species of snakes and 4 species of lizards recorded/confirmed in the study area of which three (Indian cobra, Russell's Viper and Rat snake) belong to Schedule-I of WPA,1972 further amended in Dec., 2022 (**Table 2.10**).

Table 2.10: Herpetofauna Recorded /Reported in Study Area

S.N.	Common Name	Scientific Name	Vernacular Name	Family	Schedule	IUCN
1	Frog	*Rana tigrina*	-	Ranidae	IV	LC
2	Indian bull frog	*Hoplobatrachus tigerinus*	-	Dicroglossidae	II	LC
3	Indian cobra	*Naja naja*	Nag	Elapidae	I	LC
4	Indian Krait	*Bungarus caeruleus*	-	Elapidae	II	LC
5	Russell's Viper	*Vipera russellis*	-	Crotalidae	I	LC
6	Rat snake	*Ptyas mucosus*	Dhaman	Colubridae	I	LC
7	Forest Lizard	*Calotes versicolor*	-	Agamidae	IV	LC
8	House geeko	*Hemidactylis brukaii*	-	Gekkonidae	II	LC
9	Monitor lizard	*Varanus monitor*	Ghorpad	Varanidae	II	LC
10	Chamaeleon	*Chaemeleon vulgatis*	-	Chamaeleonidae	IV	LC

LC= Least Concerned

2.10.4 Butterflies

Eight species of butterfly belonging to 4 families were reported from the study area (**Table 2.11**).

Table 2.11: Butterfly Recorded /Reported in Study Area

S. N.	Insect Group	Species	Family	IUCN Status	WPA Status
1	Butterfly (Lepidoptera)	*Castalius rosimon*	Lycaenidae	NE	-
2		*Pareronia hippie*	Pieridae	NE	-
3		*Neptis hylas*	Nymphalidae	NE	-

S. N.	Insect Group	Species	Family	IUCN Status	WPA Status
4		*Sarangasa dasahara*	Hesperiidae	NE	-
5		*Junonia aflites*	Nymphalidae	NE	-
6		*Talicada nyseus*	Lycaenidae	NE	-
7		*Euthalia aconthea*	Nymphalidae	NE	II
8		*Junonia lemonias*	Nymphalidae	NE	-

2.11 DESCRIPTION OF SCHEDULE-I FAUNAL SPECIES

The details regarding description, distribution, behavior, habitat, food habits, reproduction, life span, threats and conservation status of Schedule -I faunal species found in study area are given in following sub sections:

2.11.1 Panther

Figure 2.6 : Photograph of Panther

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family: Felidae

Genus: Panthera, Binomial Name: *Panthera pardus fusca*

Description: The body size and color patterns of leopards varies geographically and probably reflects adaptations to particular habitats. The Indian Panther has strong legs and a long, well-formed tail, broad muzzle, short ears, small, yellowish-grey eyes, and light-grey ocular bulbs. Male Indian leopards grows in between 127 cm to 142 cm in body size and weigh between 50 and 77 kg. Females are smaller, growing to between 104 cm to 117 cm (3 ft 10 in) in body size and weigh between 29 and 34 kg.

Distribution: In India, the leopard is found in all forest types, from tropical rainforests to temperate deciduous and alpine coniferous forests. It is also found in dry scrubs and grasslands, the only exception being desert and the mangroves of Sundarbans.

Behaviour: They are solitary, nocturnal carnivores. Although they sometimes hunt during overcast days, they are less diurnal in areas close to humans in comparison to uninhabited areas. They mark their territory with urine, feces, and claw marks and communicate with conspecifics by growling, roaring, and spitting when aggravated and purring when content. They can run at bursts of up to 60 km/hour, jump more than 6 m horizontally and 3 m vertically. Range of their territory varies from 13 to 35 sq km.

Habitat: They inhabit a variety of terrain. They are most populous in mesic woodlands, grassland savannas, and forests. They also occupy mountainous, scrub, and desert habitats. They favor trees throughout their entire geographic distribution and have been recorded at 5638 meters on Mt. Kilimanjaro. ("African Wildlife Foundation", 2009).

Food Habits: Their foods are primarily ungulates (Harihar et al. 2011; Mondal et al. 2011; Selvan et al. 2013), Sambar; Chital; Wild pig (*Sus scrofa*); cattle; Barking deer; Gaur (*Bos garus*); porcupine; Rodents; Birds; Civet (Harihar et al).

Reproduction: These are promiscuous, as both males and females have multiple mates. Females initiate mating by walking back and forth in front of a male and brushing up against him or swatting him with her tail. A single breeding pair may copulate up to 100 times per day for several days, The reproductive season is year-round but peaks during the rainy season in May. Gestation last 96 days and females usually give birth once every 15 to 24 months. Typically, females stop reproducing around 8.5 years old. (Friedman and Case, 2002; Macaskill, 2009)

Life Span: They can live to be 21 to 23 years while in captivity. Wild leopards may live to be 10 to 12 years. Survival rates for cubs range from 41% to 50%. (Guggisberg, 1975; Hunter and Hinde, 2005)

Threats: Hunting of Indian leopards for the illegal wildlife trade is the biggest threat to their survival. They are also threatened by loss of habitat and fragmentation of formerly connected populations, and various levels of human–leopard conflict in human–dominated landscapes

Conservation Status: The leopards are listed as "Vulnerable" on the IUCN Red List of Threatened Species. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in **Schedule-I**

2.11.2 Wolf

Figure 2.7 : Photograph of Wolf

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family: Canidae

Genus: Canis, Binomial Name: *Canis lupus*

Description: A large canid, the Grey Wolf superficially looks like a slim Alsatian (Iljin, N.A, 1941) with a big head, long limbs, large feet, a slightly curved tail and shorter ears. It has a long muzzle. Its pelage varies greatly with tones of red and grey fur intermingled with black, especially on the dorsal crest, forehead and tip of the tail. The undersides are buff or creamish in colour**.** Adult males generally weigh 80kg to 145kg, and adult females 55kg to 95kg.

Behaviour: Wolves are highly social, pack-living animals. Each pack comprises two to thirty-six individuals, depending upon habitat and abundance of prey. Most packs are made up of 5 to 9 individuals. Packs are typically composed of an alpha pair and their offspring, including young of previous years. Unrelated immigrants may also become members of packs.

Distribution: It is distributed from the eastern parts of the Kashmir Valley to the Changthang in Ladakh. Jammu & Kashmir; a small population is known from Spiti in Himachal Pradesh. It is distributed in a patchy fashion through peninsular India in appropriate habitat. It is mainly found in the states of Haryana, Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh and West Bengal.

Habitat: It inhabits cold deserts of the trans-Himalayas while it frequents dry open country, scrubland and semi-arid grasslands in the Peninsula (Jhala and Giles, 1991). It has a wide tolerance level of habitat with different precipitation as is evidenced by its presence in habitats with 300 mm precipitation in the Rann and in parts of Rajasthan, to those with 1,500 mm precipitation in Odisha. (Shahi, 1982)

Food Habits: Their diet is dominated by wild medium-sized hoofed mammals and domestic species.

Reproduction: Wolves are monogamous, mated pairs usually remaining together for life. Should one of the pair dies, another mate is found quickly [Heptner and Naumov, 1998]. Wolves become mature at the age of two years and sexually mature from the age of three years. Females can produce pups every year, one litter annually being the average. The gestation period lasts 62–75 days with pups usually being born in the spring months or early summer in very cold places such as on the tundra. Young females give birth to four to five young.

Life Span: They can live up to 13 years in the wild.

Threats: Continued threats include competition with humans for livestock, especially in developing countries, exaggerated concern by the public concerning the threat and danger of wolves, and fragmentation of habitat, with resulting areas becoming too small for populations with long-term viability.

Conservation Status: The Wolf is listed as Least Concerned species in the Red List of International Union for Conservation of Nature (IUCN) and Appendix-I and II in CITES. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

2.11.3 Striped Hyaena

Figure 2.8 : Photograph of Striped Hyaena

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family Hyaenidae:

Genus: Canis, Binomial Name: ***Hyaena hyaena linnaeus***

Description: The striped hyena has a massive, but short torso set on long legs. The hind legs are significantly shorter than the forelimbs, thus causing the back to slope downwards. The legs are relatively thin and weak, with the forelegs being bent at the carpal region. The neck is thick, long and largely immobile, while the head is heavy and massive with a shortened facial region. The eyes are small, while the sharply pointed ears are very large, broad and set high on the head. Like all hyenas, the striped hyena has bulky pads on its paws, which are blunt but powerful.

Behavior: Striped hyenas typically live alone or in pairs and occur at relatively low population densities throughout their distribution range. The Striped hyena is a primarily nocturnal animal, which typically only leaves its den at the onset of total darkness, returning before sunrise.

Distribution: The distribution area of the striped hyenas around the globe extends from tropical and sub-tropical regions of Africa to middle and south Asia (Hofer & Mills, 1998; Leakey et al., 1999; Qarqaz et al., 2004; Wagner, 2006).

Habit: These prefer riverbed than that of mixed forest, Acacia Forest, Shorea forest and grassland. This animal mostly prefers open areas or lands covered with short shrubs in their natural distribution areas (Akay et al., 2011). In the Indian subcontinent, they occur in arid and semi-arid ecosystems, as well as in the extremely wet regions of southwestern coast (Prater, 1971; Karanth, 1986).

Food Habits: They seek their food by scent and usually feed on prey killed by other animals. Some hyena species are considered as proficient hunters (Prater 1971, Kruuk 1976).

Reproduction: The striped hyena is monogamous, with the male establishing the den with the female, helping her raise and feed when cubs are born. The mating season varies according to location. In captivity, breeding is non-seasonal. Mating can occur at any time of the day, during which the male grips the skin of the female's neck.

Threats: Striped hyena is under threats due to habitat degradation, poaching, loss of prey species and livestock grazing. The high dependency of the local people on the natural forests especially government managed forests is also a major problem to the survival of the striped hyena and its prey species

Conservation Status: Protected under Schedule I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the striped hyena has been classified on the IUCN Red List as “Near Threatened”.

2.11.4 Jackal

Figure 2.9 : Photograph of Jackal

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family Canidae:

Genus: Canis, Binomial Name: *Canis aureus*

Description: The Golden Jackal resembles Gray Wolf, but is smaller in size, weight and has more elongated torso, less-prominent forehead, shorter legs and tail, and a muzzle that is narrower and more pointed. Males measure 71–85 cm in body length and females measures 69–73 cm. Males weigh 6–14 kg and females weigh 7–11 kg. The shoulder height is 45–50 cm for both.

Behaviour: The basic social unit of the Golden Jackal is a mated pair and it is young. Golden jackal pairs forage and rest together. Their behaviour is highly synchronized. Cooperative hunting is important to the Jackals. Members of the same family also cooperate in sharing larger food items and transport food in their stomachs for later regurgitation to pups or to a lactating mother.

Distribution: Jackal (*Canis aureus*) are found in semi-arid zone, tropical dry and moist deciduous forests of the country and their diet ranges from wild ungulates to domestic livestock and rodents.

Habitat: The Golden Jackal is the most northerly of jackal species, and the most widely distributed. Golden jackals prefer dry open country, arid short grasslands and steppe landscapes.

Food Habits: Golden jackals consume 54% animal food and 46% plant food. They are opportunistic foragers with a very varied diet, which consists of young gazelles, rodents, (especially during winter), hares, ground birds and their eggs, reptiles, frogs, fish, insects and fruit. They take carrion on occasion.

Reproduction: Golden jackals live in mated pairs and are strictly monogamous. They have been observed to produce pups for at least eight years. The gestation period is 63 days. Young Jackals are born in a den within the parents' marked territory.

Life Span: Golden jackals live eight to nine years in the wild and up to sixteen years in captivity.

Threats: They are sometimes hunted for their fur.

Conservation Status: Protected under Schedule-I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the striped hyena has been classified on the IUCN Red List as "Least Concerned".

2.11.5 Indian Fox

Figure 2.10 : Photograph of Indian Fox

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family Canidae:

Genus: Vupes, Binomial Name: *V. bengalensis*

Description: Indian fox is a relatively small fox with an elongated muzzle, long, pointed ears, and a long, bushy tail. The pelage ranges in color from buff to silver-grey with an overall grizzled effect; the dorsal pelage is mostly greyish and paler ventrally. The legs tend to be brownish or rufous, and the underparts light, a pale sand or ginger shade.

Behaviour: Bengal foxes are predominantly crepuscular and nocturnal. The basic social unit of the Bengal Fox is the breeding pair, formed by a pair of bonds that can last for many years. Bengal foxes are not especially suspicious of humans, but, can be found near human habitation.

Distribution: It is endemic to the Indian subcontinent, ranging from the Himalayan foothills and Terai of Nepal through the South portion of the Indian Peninsula (but the western and east Ghats are not included).

Habitat: In the Indian peninsula, the species is confined to plains and open scrub forests. It was considered to be a habitat generalist, but it shows a strong preference for semiarid, short grassland habitats at multiple scales.

Food Habits: Bengal foxes are omnivorous and opportunistic feeders, feeding primarily on insects, small mammals, reptiles, small birds, and fruits.

Reproduction: Bengal foxes are thought to form long-term monogamous pairs. During the breeding season, males vocalize intensely during the night and at dusk and dawn. The mating season occurs in December to January and after a gestation period of 50–53 days, two to four pups are born.

Threats: Lack of habitat protection is perhaps the greatest threat to the Bengal fox.

Conservation Status: Protected under Schedule-I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the Indian fox has been classified on the IUCN Red List as "Least Concerned".

2.11.6 Indian Jungle Cat

Figure 2.11 : Photograph of Indian Jungle Cat

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Carnivora, Family Felidae:

Genus: Felis, Binomial Name: *Felis chaus*

Description: Jungle cats are medium-sized wild cats. They have a coat colour that varies from sandy, greyish brown to tawny red with a slender body with underparts of cream and pale fur.

Their legs are slender & long and occasionally retain faint horizontal strips from their younger age. Their head is narrow with a high domed forehead along with tall and rounded ears.

Behaviour: Vocalizations made by the Jungle cat are meowing, chirping, purring, growling, gurgling, hissing, and barking.

Distribution: These wild cats are native to the Middle East, South and southeast Asia

Habitat: Jungle cats love densely vegetated land cover which are surrounded by wetlands

Food Habits: Rodents make up for the jungle cat's primary feast. However, they are also known to take hares, reptiles, birds, young chital, wild pigs, etc as a part of their diet.

Reproduction: These are polygynandries and have multiple mates throughout their lives. The mating season is from January to March, differing somewhat with geographic location. After a gestation of 63 to 66 days, a litter usually numbering two or three kittens are born.

Life Span: 15 years.

Threats: The destruction of wetlands, and the anthropogenic activities has reduced the vegetative cover which has turned out to be the greatest threat faced by this cat.

Conservation Status: Protected under Schedule-I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the Jungle cat has been classified on the IUCN Red List as "Least Concerned".

2.11.7 Porcupine

Figure 2.12 : Photograph of Indian Porcupine

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Rodentia, Family Historicide:

Genus: Hystrix, Binomial Name: *Hystrix indica*

Description: The Indian porcupine's head and body measure 70-90 cm in length, with the tail adding an additional 8-10 cm (Prater 1965). Its hair is highly modified to form multiple layers of spines. Beneath the longer, thinner spines lies a layer of shorter and thicker ones. Each quill is brown or black.

Behaviour: Indian porcupines are nocturnal, with the species seeking shelter in caves, between rocks, or in its burrow during the day (Prater 1965). When irritated or alarmed, the Indian porcupine raises its quills and rattles the hollow spines on its tail.

Distribution: The Indian porcupine is found throughout Southeast and Central Asia and in parts of the Middle East.

Habitat: The Indian porcupine usually favours rocky hill sides, the species can also be found in tropical and temperate scrublands, grasslands, and forests. They are also found throughout the Himalayan mountains.

Food Habits: The main food source for the Indian porcupine is vegetable material of all kinds, including fruits, grains, and roots (Prater 1965).

Reproduction: The Indian porcupine is usually monogamous, with both parents being found in the burrow with their offspring throughout the year. Gestation for the species, on average, lasts 240 days (Gurung and Singh 1996).

Threats: The Indian porcupine is hunted as a food source (Gurung and Singh 1996).

Conservation Status: Protected under Schedule-I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the Indian porcupine has been classified on the IUCN Red List as “Least Concerned”.

2.11.8 Chow Singha

Figure 2.13 : Photograph of Chow Singha

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Artiodactyla, Family Bovidae:

Genus: Tetracerus, Binomial Name: *Tetracerus quadricornis*

Description: Four-horned Antelopes are unique, being the only bovids with four horns. These weigh between 15 and 25 kg. The body length is 80-110 cm, with a shoulder height of 55-65 cm, and a tail length of 10-15cm. The hair is short, coarse and thin. The insides of the legs are white along with the middle of the belly. Males are dull-red brown above, with white below, and have a dark stripe that runs down the front of each leg.

Behaviour: *T. quadricornis* is not gregarious, and more than two individuals found together rarely. These animals are sedentary and inhabit the same region throughout their lives. In the rut, males have been found to be extremely aggressive to other males. They can be easily tamed when young but have been found to be extremely delicate in captivity.

Distribution: *Tetracerus quadricornis* is found only in India and Nepal (Nowak, 1999; Walker, 1995)..

Habitat: The species is still widely distributed throughout its range and uses the hilly country and tall grassy areas for shelter. It prefers open forests and is rarely seen, dashing into thick cover at the first sign of danger (MacDonald, 1984).

Food Habits: These are primarily a grazer. The primary foods of these antelope are grasses, shoots, and fruit. They are rarely found far from water (Nowak, 1995).

Reproduction: Mating takes place during the rainy season from July to September. The gestation period is 7.5 to 8 months (Grizmek, 1990). Usually, one or two young per litter are born with an average weight of about 1 kg each (Nowak, 1999).

Threats: Fragmentation of habitat (Nowak, 1999).

Conservation Status: Protected under Schedule-I of the Indian Wildlife Protection Act, 1972 as amended in December 2022, the Chow Singha has been classified on the IUCN Red List as “Vulnerable”.

2.11.9 Indian muntjac

Figure 2.14 : Photograph of Indian muntjac

Kingdom: Animalia, Phylum: Chordata, Class: Mammalia, Order: Artiodactyla;, Family: Cervidae Genus: Muntiacus, Binomial Name: Muntiacus muntjac

Description: The Indian muntjac is a small, brown deer with branched antlers and a longer nose than other types of deer. Male grow to between 50 cm to 90 cm in body size weighing between 20 and 50 kg. Females are smaller. The upper canine teeth of the males are elongated making tusks that extend outward from the lips. They are also referred to as "barking deer" due to the bark-like sounds they make when on alert.

Distribution: it is found generally in India, Sri Lanka, Tibet, Southwest China, Burma, Thailand, Vietnam, Malaya, Sumatra, Java, and Borneo.

Behaviour: This solitary and nocturnal mammal prefers cover of darkness to forage for food and avoid potential predators and are often found near the edges of forests or in open areas.

Habitat: The Indian muntjac is found in tropical and subtropical deciduous forests, grasslands, savannas, and scrub forests, as well as in the hilly country on the slopes of the Himalayas. They never wander far from water.

Food Habits: Barking Deer are herbivorous and feed on a hosts of plant material like leaves, grasses, fruits, and buds.

Reproduction: These are polygamous animals. Females become sexually mature during their first to second year of life. The gestation period is 6–7 months and they usually bear one offspring at a time, but sometimes produce twins. They can live up to 10 years

Threats: They are hunted for sport, their meat and skin

Conservation Status: As per Wildlife Protection Act, 1972 further amended in Dec., 2022, these species are placed in Schedule-I and are listed as "Least Concern" on the IUCN Red List of Threatened Species

2.11.10 Pea Fowl

Figure 2.15 : Photograph of Indian Common Peafowl

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Galliformes, Family: Phasianidae

Genus: Pavo, Binomial Name: *Pavo cristatus*

Description: Male peacock has a spectacular glossy green long tail feathers which are arched into a magnificent fan shaped from across the back of the bird and almost touching the found on both sides. Female do not have these graceful tail feathers. Their primaries are dark brown.

Habit and Behaviour: The scrub jungles and forest edges are the natural habitat of this bird. It has affinity towards moist & dry deciduous and semi-arid biomess. It is also found along streams with good vegetation and in agricultural fields and in proximity with the human settlements. Habitat mosaic of scrub and open areas with ample sites for “dust bathing” and “lekking”. Dust bathing is critical as this bird must condition its feathers and remove feather-degrading bacteria and other external parasites. The life expectancy is about 10-15 years.

Distribution: The Indian sub-continent is the natural habitat of the Indian Peafowl. The arid deserts of Rajasthan, the riverbanks of Gujarat and Madhya Pradesh, the foothills of the Himalayas in Uttar Pradesh and the forests of Haryana are considered as the major and commonly known habitats.

Food and Habits: Peafowls are omnivores, eating plant parts, flower petals, seed heads, insects and other arthropods, reptiles and amphibians.

Conservation Status: Peafowl is listed as Least Concerned species as per IUCN, Version 3.1. As per Indian WPA, 1972 further amended in Dec., 2022, the species is placed in Schedule-I.

Threats: They are killed in huge numbers for their alluring and elegant feathers.

2.11.11 Grey Jungle Fowl

Figure 2.16 : Photograph of Grey Jungle Fowl

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Galliformes, Family: Phasianidae

Genus: Gallus, Binomial Name: *Gallus sonneratii*

Description: Male has a black cape with ochre spots and the body plumage on a grey ground colour is finely patterned. The elongated neck feathers are dark and end in a small, hard, yellowish plate; this peculiar structure making them popular for making high-grade artificial flies. Legs of males are red and have spurs while the yellow legs of females usually lack spurs. The central tail feathers are long and sickle shaped. Males have an eclipse plumage in which they mount their colorful neck feathers in summer during or after the breeding season.

Behaviour: Their loud calls are loud and distinctive. The male does not flap its wings before uttering the call. They breed from February to May and lay 4 to 7 eggs which are pale creamy

Distribution and Habitat: The species is endemic to India and is found mainly in Peninsular India and towards the Northern boundary. They are found in thickets, on the forest floor and open scrub. The species occurs mainly in the Indian Peninsula, but extends into Gujarat, Madhya Pradesh and southern Rajasthan. They are found more along the foothills of the Himalayas.

Food and Habits: They feed on grains including bamboo seeds, berries, insects and termites

Conservation Status: Jungle fowl is listed as "Least Concerned" as per IUCN version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: They are hunted for meat and for the long neck hackle feathers that are sought after for making fishing lures.

2.11.12 Gyps bengalensis

Figure 2.17 : Photograph of *Gyps bengalensis*

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Accipitriformes, Family:Accipitridae

Genus: Gyps, Binomial Name: *Gyps bengalensis*

Description: Immature *G. bengalensis* are dark brown and their lower back and rump area are brown rather than white. The underwing coverts are dark brown. Eyes are dark brown, and the legs are blackish but lighter than the adult. Generally, adults tend towards black coloration, while younger individuals are browner.

Behavior and Reproduction: These are social animals, living in flocks year-round, often with other vulture species. Up to 15 large nests may be observed in a single roost tree. At night, vultures roost in trees. Typical flight speeds are between 50 and 55 miles /hour but can reach speeds up to 90 miles/hour. The breeding season of G. bengalensis is from October to March.

Distribution and Habitat: These are very common on the Indian subcontinent. *Gyps bengalensis* is generally found in open areas and fields enclosing scattered trees.

Food Habits: Feed almost exclusively on the remains of dead animals, regardless of whether it is fresh or putrid. Many populations of *G. bengalensis* forage through dumpsters for food.

Conservation Status: The species is listed as "Critically Endangered" species as per IUCN version 3.1. As far as the Indian WPA, 1972 amended further in Dec., 2022, is concerned; the species is placed in Schedule-I.

Threats: Disease, pesticides, environmental contamination, poisoning, reduced food availability, calcium deficiency, reduced nesting habitat, nest predators, are the most common.

2.11.13 Slender billed vulture

Figure 2.18 : Photograph of Slender billed vulture

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Accipitriformes, Family:Accipitridae

Genus: Gyps, Binomial Name: *Gyps tenuirostris*

Description: Immature. This mid-sized vulture (80 to 95 cm in length) is mostly grey with a pale rump and grey undertail coverts. The thighs have whitish down. The neck is long, bare, skinny and black.

Behavior and Reproduction: Spends most of the time soaring on spread wings, using the thermal currents along the cliffs that help the bird to rise into the air. It rarely flaps the wings, except at take-off. The breeding season occurs between October and March. The female lays a single white egg with some pale reddish flecks and blotches. The incubation lasts about 50 days, shared by both parents. The chick is regularly fed by the adults at nest, and for some weeks more after fledging.

Distribution and Habitat: The Slender-billed Vulture is found throughout much of Asia, including India, Nepal, Bangladesh, Cambodia, Laos, and Burma. These use savannas, arid open country mixed with some wooded patches, generally in lower elevations, to forage, feed, roost and nest.

Food Habits: These are scavengers, feeding mostly from carcasses of dead animals. They also scavenge at rubbish dumps and slaughterhouses

Conservation Status: The species is listed as "Critically Endangered" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is due to consumption of meat and tissue of dead livestock which contains this drug Diclofenac administered to the animal.

2.11.14 Sparrow hawk

Figure 2.19 : Photograph of Sparrow hawk

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Accipitriformes, Family:Accipitridae

Genus: Accipiter, Binomial Name*: Accipiter nisus*

Description: Adult male sparrow hawks have bluish-grey back & wings and orangey-brown bars on their chest and belly. Females and young birds have brown back and wings, and brown bars underneath. Sparrow hawks have bright yellow or orangey eyes, long, yellow legs and long talons. Females are larger than males, as with all birds of prey.

Behavior and Reproduction: These are excellent bird hunters, catching small species like finches, sparrows and tits; sometimes they ambush their prey from a perch, while other times they may fly low, suddenly changing direction to fool it.

Distribution and Habitat: Sparrow hawks breed in woodland but also visit gardens and more open country. They can be seen in towns and cities, as well as rural areas.

Food Habits: Feed on small birds, insects and rodents. Males can catch birds up to thrush size, but females, being bigger, can catch birds up to pigeon size. Some sparrowhawks catch bats.

Conservation Status: The species is listed as "Critically Endangered" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is due to habitat loss and diclofenac in working farm animals.

2.11.15 Brahminy kite

Figure 2.20 : Photograph of Brahminy kite

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Accipitriformes, Family:Accipitridae

Genus: Hallastur, Binomial Name*: Haliastur indus*

Description: Brahminy kites are medium-sized birds of prey. Adults have a reddish-brown body plumage contrasting with their white head and breast which make them easy to distinguish from other birds of prey.

Behavior and Reproduction: These are excellent bird hunters, catching small species like finches, sparrows and tits; sometimes they ambush their prey from a perch, while other times they may fly low, suddenly changing direction to fool it. They might be monogamous and form long-lasting pair bonds. Their breeding season occurs from December to April. The female lays a clutch of 2 dull-white or bluish-white oval eggs.

Distribution and Habitat: Brahminy kites are found in the Indian subcontinent, Southeast Asia, and Australia. They are mainly seen in the plains but also in coastal regions, estuaries, wetlands, mangrove swamps, and even in urban areas. They are found mainly on the coast and in inland wetlands, where they feed on dead fish and other prey.

Food Habits: They are carnivores and scavengers. They are primarily scavengers and feed mainly on dead fish and crabs, especially in wetlands and marshland, but occasionally hunt live prey such as hares, bats, and flying insects.

Conservation Status: The species is listed as "Critically Endangered" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is due to habitat loss and diclofenac in working farm animals

2.11.16 Booted Eagle

Figure 2.21 : Photograph of Booted Eagle

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Accipitriformes, Family:Accipitridae

Genus: Hieraatus, Binomial Name*: Hieraaetus pennatus*

Description: The Booted eagle is a small eagle, comparable to the common buzzard in size though more eagle-like in shape. Males grow to about 510–770 gm in weight, with females about 840–1,025 gm with a length of 40 cm and a wingspan of 11–132 cm.

Behavior and Reproduction: This eagle lays 1–2 eggs in a nest built from sticks and lined with green leaves in a tree or on a crag, or it takes over the disused nest of another large bird such as a black kite or grey heron. The female incubates the egg for around 45 days.

Distribution and Habitat: It breeds in southern Europe, North Africa and across Asia, and also in western South Africa and Namibia. This is a species found often in hilly countryside with some open areas, it breeds in rocky, broken terrain but migrants will use almost any type of habitat other than dense forest.

Food Habits: Larger insects such as locusts form part of the diet, more commonly a variety of birds, reptiles and mammals are selected even up to the size of rabbits.

Conservation Status: The species is listed as "Least Concern" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is due to habitat loss and diclofenac in working farm animals

2.11.17 Crested serpent eagle

Figure 2.22 : Photograph of Crested serpent eagle

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Falconiformes, Family: Accipitridae

Genus: Spilornis, Binomial Name*: Spilornis cheela*

Description: These are medium-sized raptors with length varying from 55 to 76 cm and weigh from 420 to 1800 gm. Their wingspan ranges from 109 to 169 cm.

Behavior and Reproduction: Crested serpent eagles' mate in monogamous pairs and remain in pairs throughout the year. Courtship displays consist of pairs soaring and calling together. These courtship flights may include rolling and wing vibrating. (Del Hoyo, et al., 1994). In Southern India they lay eggs between December and March; in Northern India and Sri Lanka they lay between February and May. Their nests are usually found midway in tall trees close to a source of water such as a stream.

Distribution and Habitat: In India it is found from the lower Himalayas to the Andamans. They prefer the edges of forests where they can soar and effectively hunt. They can inhabit dry to wet forests, tea plantations, wooded savannas and mangroves.

Food Habits: They prey primarily on snakes, as their name implies, and they are not limited to the non-venomous species. They also eat many kinds of small mammals and birds.

Conservation Status: The species is listed as "Least Concern" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is due to habitat loss and diclofenac in working farm animals

2.11.18 River tern

Figure 2.23 : Photograph of River tern

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Charadriiformes, Family: Laridae

Genus: Sterna, Binomial Name*: Sterna aurantia*

Description: The River tern is a slender bird, about the size of a pigeon, with grey upper parts, black cap on the head, yellow beak, long pointed wings, a deeply-forked tail and short, yellow stubby legs. Both the sexes look alike.

Behavior and Reproduction: It is a resident breeder in the region, found along most of the inland rivers, and breeds on sandy islands. It spends a great portion of its time fishing.

Distribution and Habitat: The River tern has a wide range across Southern Asia. In India, it is found throughout the country, inhabiting rivers and freshwater lakes, occasionally occurring on estuaries.

Food Habits: It predominantly feeds on fish, small crustaceans and insects. More likely to be sighted in flight than on the ground.

Conservation Status: The species is listed as "Vulnerable" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is from predation and flooding of nesting areas. Anthropogenic disturbance due to mining of sand-beds is also a potent threat.

2.11.19 Barn Owl

Figure 2.24 : Photograph of Barn Owl

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Strigiformes, Family: Tytonidae

Genus: Tyto, Binomial Name*: Tyto alba*

Description: The barn owl is a medium-sized, pale-colored owl with long wings and a short, squarish tail. Its size varies from about 33 to 39 cm, with a wingspan of some 80 to 95 cm.

Behavior and Reproduction: It is nocturnal, relying on its acute sense of hearing when hunting in complete darkness. It often becomes active shortly before dusk but can sometimes be seen during the day when relocating from one roosting site to another.

Distribution and Habitat: The Barn Owls have a worldwide distribution and require large areas of open land either be marsh, grasslands, or mixed agricultural fields over which to hunt. For nesting and roosting, they prefer quiet cavities, either in trees or man-made structures.

Food Habits: It predominantly feeds on rats, mice, occasional frog, smaller bird species.

Conservation Status: The species is listed as "Least Concern" species in IUCN version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is from reduction of food supply, with fewer areas of rough grassland available for hunting. By far, the biggest threat to Barn Owls living in proximity to humans is mouse and rat poison. Barn Owls eats almost exclusively rodents.

2.11.20 Brown wood owl

Figure 2.25 : Photograph of Brown wood owl

Kingdom: Animalia, Phylum: Chordata, Class: Aves, Order: Charadriiformes, Family: Laridae

Genus: Sterna, Binomial Name*: Sterna aurantia*

Description: The Asian brown wood owl is one of the larger owls, with an average length of between 45cm to 57cm. They are perfectly camouflaged to their forest surroundings, with the main body a light chestnut brown, and barred with dark brown and white with faint white patches on the shoulders, and buff and brown streaked under parts. River tern is a slender bird, about the size of a pigeon, with grey upper parts, black cap on the head, yellow beak, long pointed wings, a deeply forked tail and short, yellow stubby legs. Both the sexes look alike.

Behavior and Reproduction: It is a resident breeder in the region, found along most of the inland rivers, and breeds on sandy islands. It spends a great portion of its time fishing.

Distribution and Habitat: South Asia from India and Sri Lanka east to western Indonesia and south China, tropical and temperate forest.

Food Habits: It predominantly feeds on fish, small crustaceans and insects. More likely to be sighted in flight than on the ground.

Conservation Status: The species is listed as "Vulnerable" species in the Red List of International Union for Conservation of Nature (IUCN) version 3.1. As far as the Indian Wildlife Protection Act, 1972 further amended in Dec., 2022 is concerned; the species is placed in Schedule-I.

Threats: The main threat is from habitat loss and deforestation.

2.11.21 Russell's Viper

Figure 2.26 : Photograph of Russell's Viper

Kingdom: Animalia, Phylum: Chordata, Class: Reptilia, Order: Squamata, Family: Vepridae

Genus: Daboia, Binomial Name: *Vipera russellis*

General Description: The head is flattened, triangular, and distinct from the neck. The snout is blunt, rounded, and raised. The crown of the head is covered with irregular, strongly fragmented scales. The body is stout, the cross-section of which is rounded to circular. Russell's viper grows to a maximum body and tail length of 166 cm (65 in) and averages about 120 cm

Distribution and Habitat: Russell's viper is found in India, Sri Lanka, Bangladesh, Nepal, and Pakistan. In India, it is abundant in Punjab, very common along the West Coast and its hills, in southern India especially in the state of Karnataka and north to Bengal. It is uncommon to rare in the Ganges valley, Northern Bengal, and Assam. Russell's viper is not restricted to any particular habitat but does tend to avoid dense forests. The snake is mostly found in open, grassy or bushy areas, but may also be found in second growth forests (scrub jungles), on forested plantations

Behaviour: It is terrestrial and active primarily as a nocturnal forager. However, during cool weather, it alters its behavior and becomes more active during the day. These snakes are strong and may react violently to being picked up.

Feeding: These feed primarily on rodents, although especially it will also eat small reptiles, land crabs, scorpions, and other arthropods.

Reproduction: It is ovoviviparous. Mating generally occurs early in the year, although pregnant females may be found at any time. The gestation period is more than six months. It is a prolific breeder. Litters of 20–40 are common, although fewer offspring may occur, as few as one.

Conservation Status: Listed as “Least Concern” (IUCN 3.1) and included in Schedule-I (WPA,1972), further amended in Dec., 2022.

2.11.22 Ptyas mucosus

Figure 2.27 : Photograph of Rat Snake

Kingdom: Animalia, Phylum: Chordata, Class: Reptilia, Order: Squamata, Family: Colubridae

Genus: Pytus, Binomial Name: *Ptyas mucosus*

General Description: The Rat snake is a large snake found in parts of South and Southeast Asia. Their color varies from pale browns in dry regions to nearly black in moist forest areas. These are non-venomous and fast-moving snakes. They eat a variety of prey and are frequently found in urban areas where rodents thrive.

Distribution and Habitat: Oriental rat snakes are found in Afghanistan, Bangladesh, Burma (Myanmar), Cambodia, China (Zhejiang, Hubei, Jiangxi, Fujian, Guangdong, Hainan, Guangxi, Yunnan, Tibet, Hong Kong, Taiwan), India, Sri Lanka, Indonesia (Sumatra, Java, Bali), Iran, Laos, West Malaysia, Nepal, Myanmar, Pakistan (Sindh area), Thailand, Turkmenistan, Vietnam, Nepal. They inhabit forest floors, wetlands, rice paddies, farmland, and suburban areas.

Behaviour: Oriental rat snakes are solitary creatures. They are diurnal and semi-arboreal. Adult members emit a growling sound and inflate their necks when threatened.

Feeding: These prey upon small reptiles, amphibians, birds, and mammals.

Reproduction: It mates in late spring and early summer, though in tropical areas reproduction may take place year-round. Females produce 6–15 eggs per clutch several weeks after mating.

Threat: Rat snakes are hunted by humans in some areas of their range for skins and meat.

Conservation Status: Listed as “Not Evaluated” (IUCN 3.1) and included in Schedule-I (WPA,1972, amended in December,2022).

2.11.23 Indian Cobra

Figure 2.28 : Photograph of Indian Cobra

Kingdom: Animalia, Phylum: Chordata, Class: Reptilia, Order: Squamata, Family: Elapidae

Genus: Naja, Binomial Name: *Naja naja*

Distribution: Indian cobras are found throughout the Indian subcontinent, including India, Pakistan, Bangladesh, Sri Lanka, Nepal, and Bhutan.

Habitat: They inhabit a variety of habitats, including forests, grasslands, agricultural areas, and human settlements.

Ecology and Behavior: Indian cobras are highly venomous snakes known for their iconic hood, which they display when threatened. They primarily feed on rodents, birds, frogs, and other small vertebrates. They are primarily nocturnal but can also be active during the day.

Breeding: Breeding occurs seasonally, with females laying clutches of eggs in hidden locations, such as under leaf litter or in termite mounds. Hatchlings emerge after an incubation period of around 50 to 60 days.

Conservation Status: Indian cobras are not separately assessed on the IUCN Red List, but they are generally considered to be of least concern due to their wide distribution and adaptability to various habitats.

Threats: While Indian cobras face some threats such as habitat loss and persecution by humans due to fear and misunderstanding, they are less impacted compared to other snake species due to their ability to thrive in a variety of habitats

2.12 WILDLIFE CORRIDORS

No elephant corridor, tiger reserve, wildlife migration corridor etc., is located within 1 Km. from boundary of the forest land proposed for diversion.

3 PROBABLE IMPACTS OF PROJECTS ON FLORA AND FAUNA

3.1 IMPACTS DURING PROJECT CONSTRUCTION

During the construction phase, various adverse impacts on the wildlife are anticipated in the surrounding areas of the proposed project in terms of increased noise levels, land vibrations during tunneling and blasting, release of air and water pollutants, etc. Mammals and birds are the most vulnerable group affected by these negative impacts, which affect their movement, behavior and breeding habits.

3.1.1 Disturbance Due to Blasting

Blasting shall have adverse impact on fauna using the area contiguous with the surrounding habitation area as habitat. Construction and operation activities generate noise and artificial light, which can disturb wildlife. Nocturnal animals may be particularly affected by light pollution, altering their behavior and disrupting natural processes. The noise generation has an adverse impact on terrestrial fauna and avi-fauna. Intervention in the project area will impact butterflies and birds which are quite sensitive to noise and human presence. The traffic noise has detrimental effect on the survival rates and breeding success of such fauna which reside in the small habitats along roadside communicating using acoustic signals. Sometime as a result of habitat loss and physical disturbance, the fauna shall move from the habitat along roadside. Based on the field observations and interaction with local people and forest officials, it was noted that the Project area does not constitute part of any wildlife migratory routes and construction activities won't affect animal movement.

All precautions shall be taken as envisaged under the relevant acts in respect of handling of explosive material and blasting which shall invariably be carried out by a qualified blaster.

3.1.2 Impact on Soil Materials, Vegetation and Human Health

Excavation results in land degradation and formation of loose soil particles which are mainly fugitive dust. The transportation of excavated/construction material on unpaved roads cause fugitive dust emission. These dust particles are usually blown away along the wind direction and get deposited on the canopy of surrounding vegetation and agricultural crops thereby interfering with photosynthesis and other physiological activities of the green cover. Finally, this may result in reduced ecological functions of the forest ecosystems as well as economic productivity of the agro-ecosystems. Since the fugitive dust particles neither move far away from point of emission nor ground level concentration (GLC) is high it has been found from dust dispersion modelling that PM10 and PM2.5 at the nearest habitation shall be merely 0.40 µg/m^3, 0.05 µg/m3 respectively. Thus, there shall not be significant impact.

The gaseous pollutant Oxides of Nitrogen (NOx) react in the atmosphere to form Nitrogen Dioxide (NO2) which can have adverse effects on health, particularly among people with respiratory illness. NOx are pollutants that cause lung irritation and weaken the body's defenses against respiratory infections such as pneumonia and influenza, it can cause shortness of breath and chest pains and increase a person's susceptibility to asthma. Air quality modelling shows that predicted concentration of NOx at the nearest habitation shall be merely 0.38 µg/m3. The air quality modelling for haul road has revealed that the increased GLC in respect of NOx were insignificant being 0.14 µg/m3 up to 25m and 0.12 µg/m3 up to 50m and 0.10 µg/m3 up to 1km.

3.1.3 Increase in Biotic Pressure

Due to labour inflex (3000 workers), pressure on land and water resource would occur. The disposal of sewage, solid waste would be required. If the labour force is not provided with proper fuel arrangements, the pressure on adjoining forest for fuel wood may take place. Besides, labour may engage in activities that are detrimental to natural habitat such as hunting, illegal extraction of timber for fuel wood and non-timber forest products.

To reduce the dependence on forest, the project proponent / contractors shall provide alternate fuel substituting fuelwood with LPG for cooking and domestic electricity connection for lighting.

3.1.4 Loss of Habitat

Habitat loss is construed to occur when an area supporting good genetic diversity and population growth rate is diverted for non-forestry purpose. This shall lead to loss of some of the plant species used for various purposes by man and animals. About 243.74 ha of forest land will be brought under submergence along with standing trees, which shall have to be clear felled. The area proposed for diversion is a habitat for mega animals with other species. The area proposed for diversion is substantial and any changes occurred would be recoverable with appropriate mitigation measures. For mitigating loss due to forest land, Compensatory Afforestation plan have been formulated, which shall be further implemented by the Forest Department.

3.1.5 Fragmentation of Habitat

Habitat fragmentation bisects the landscape and leaves smaller, more isolated land for wildlife, causing local and population level changes to native flora and fauna. The construction may lead to habitat fragmentation and destruction. The alteration of river flow, excavation, and infrastructure development can disrupt ecosystems, affecting plant and animal species that rely on specific habitats.

Out of 243.74 ha forest land proposed for diversion, about 139.52 ha of forest land will be used for creating upper and lower reservoir, which shall be brought under permanent submergence, and shall act as a physical barrier for wildlife. Animal movement in this patch of area will be totally blocked. The forest land 11.813 ha is required for underground works and 44.9 ha is needed for muck sites which shall not lead to any fragmentation of habitat. Forest land (37.83ha) required for roads infrastructure can fragment wildlife corridors, hindering animal movement between habitats. This can isolate populations, reduce genetic diversity, and impact long-term survival. Habitat fragmentation bisects the landscape and leaves smaller, more isolated land for wildlife, causing local and population level changes to native flora and fauna.

3.1.6 Species Displacement

Increased human presence and infrastructure development can lead to the displacement of native species. Animals may avoid areas near the project site, affecting their feeding, breeding, and migration patterns

3.1.7 Water Quality Impairment

During the construction phase, the local drainage is supposed to catch considerable amount of sediment from the underground works. Impairment in water quality can lead to changes in water temperature,

sediment load, and chemical composition may harm aquatic organisms, including fish, amphibians, and invertebrates. For overcoming this, the water coming out from such area will be dislodged of sediment in the silt trapping tanks before being released to local drain.

3.1.8 Impact of Illumination of Work Site

For facilitating the construction works at night, adequate lighting facilities such as flood lights, halogen lamps provided by the contractor at the site of work, storage area of materials and equipment and temporary access roads within project area can disturb wildlife. Nocturnal animals may be particularly affected by light pollution, altering their behaviour and disrupting natural processes.

3.1.9 Increase in Greenhouse Gas (GHG) Emissions at Work Site

The construction activities related to Project shall generate GHG emissions from construction machinery and transport vehicle, which run on fossil fuels The project's impact on local climate patterns, such as altered precipitation and temperature, could indirectly affect flora and fauna. Species adapted to specific conditions may face challenges due to climate shifts.

3.2 IMPACTS DURING PROJECT OPERATION

The following impacts are anticipated during operation of project.

- Improved habitat for mainly water birds due to creation of new reservoir.
- Improvement in food chain of birds and mammals due to creation of reservoir and increase in humidity level.
- The butterfly diversity in the area would be enhanced, as scrub habitat around the submergence will receive substantial amount of moisture, which will help in natural regeneration of forest canopy.
- Stray animals, however, may occasionally drift to the upper reservoir site, but, chances of their drowning or fall into reservoir are not there as the top of dam section is well above the natural ground level and dam section is made of concrete.
- During initial years of filling of reservoirs, the GHGs (CO2 and CH4) shall be emitted due to biomass resulting from putrefaction of biomass (root material) of trees fell. There shall be 89.9 ton and 85.1 ton CO2 equivalent emission respectively from upper and lower reservoirs resulting from purification of soil organic carbon present in topsoil and below ground biomass during initial years of reservoir filling (**Table 3.1**).

Table 3.1: GHG Emissions from Reservoirs

S.N.	GHGs	Emission Type	Factors (kg/ha/day	Total emissions during year	Total emissions (kg)	Total CO_2 e (kg)
Upper Reservoir						
1	CO_2	Diffusive	6.3	81862.2	81862.2	81862.2
2	CH_4	Diffusive	0.022	285.9	285.9	8005.2
Total						**89867.4**
Say						**89.9 Ton**

Lower Reservoir						
1	CO_2	Diffusive	6.3	77493.15	77493.2	77493.2
2	CH_4	Diffusive	0.022	270.6	270.6	7576.8
Total						**85070**
Say						**85.1 Ton**

3.3 IMPACTS IDENTIFICATION AND EVALUATION

Leopold et al were first to devise the use of matrix method for environmental impact assessment. Matrices are particularly useful as they reflect the impacts from series of interactions among the activities and the environmental elements. Although, the Leopold matrix is believed to largely depend on the subjective evaluation of experts that allows the judgments to be converted into empirical numbers, but, it is still a valid and widely used approach for the assessment of environmental impact. The Leopold matrix is a qualitative environmental impact assessment method pioneered in 1971. It is used to identify the potential impact of a project on the environment. In the matrix, the rows cover the key aspects of the environment and society, while the columns list the project's activities during all stages of the project. Environmental factors must correspond to all those that could be affected by the development of the activity in the project area and the area of influence.

A simplified/modified two-dimensional matrix inspired by Leopold matrix has been adopted for the environmental and social impact assessment of the project. Twenty-three key impact factors have been singled out from a wider list of less significant potential factors.

The interaction of activities and their impacts vary between construction and operational phase. Regarding the project, major activities occur in the construction phase. Therefore, major impacts are anticipated during construction. Some of the impacts will be of short duration particularly during construction phase, whereas some impacts will be long lasting. Each impact was analyzed under the categories mentioned above and quantified using modified Leopold matrix. Each impact was assigned with a score using a scale of 0-4, (**Table 3.2**) depending on the magnitude and potential. The magnitude, potential and significance of an impact were assessed based on the nature of the impact (short term/long term. reversible/irreversible. local/regional. direct/indirect. minor/major). A positive or negative sign was provided for beneficial and harmful nature of the impacts. The rows' totals of the matrix reflect the total impacts of an action on the various environmental components while the columns' total reflects the impact of all actions on one environmental variable

Table 3.2: Criteria for Evaluation of Impact

S.N.	Criteria	Score
1	No impact	0
2	Minor Impact	1
3	Medium Impact	2
4	Significant Impact	3
5	Major Impact	4

Major positive and negative impact factor; major short term and long-term impacts and irreversible and reversible impacts and direct & indirect environmental impacts are interpreted in Table **3.3** through **Table 3.6** respectively.

Table 3.7 and **Table 3.8** sum up most of the impacts during construction and operation phase of the project. Notably, the magnitude of negative impacts decreases considerably in the operational phase of the project. In the construction phase, total score is -25 of which 78 stands for negative impacts and 53 for positive impacts. During the operational phase total score changes to +29 of which negative impacts score are 16 and positive are 45. Considering the project actions during construction phase excavation, quarrying and migrant population are major activities which pose major impacts on the environmental and social components while community development is most positive impact

Table 3.3:Major Positive and Negative Environmental Impacts

Description	Positive Impact Factor		Negative Impact Factor	
	Construction Period	Operation Period	Construction Period	Operation Period
Physical Environment	No Significant impact	Improvement in land status of impact and catchment area. Improvement of soil water regime of catchment area. Improvement in water quality of local nala of villages due to implementation of sewage treatment command works	Land degradation due to excavation for project components and roads Temporary increase in GLC of ambient air at construction site & nearby settlements. Increase in noise levels at construction site. Water and soil pollution due to improper disposal of waste and malfunctioning of equipment. Spread of water borne disease.	No significant impact except impairment of water quality in reservoir during initial period.
Biological Environment	No Significant impact.	Improvement in vegetal cover in impact and catchment area. Improved habitat for mainly water bird, mammals due to creation of reservoir. With the upliftment of rural economy, dependency on forest will reduce poaching and will ease out pressure on wildlife.	Loss of habitat due to diversion of forest land. Increase in temporary stress levels of wildlife and loss of productivity. Increased turbidity shall reduce primary productivity due to siltation of periphyton producing substrates, as well as due to reduced light penetration of the water column and stress on sensitive aquatic life. Inhibition of free movement of wildlife. Threat due to poaching might increase.	Inhibition of movement of fishes across barrage.
Economic Environment	Enhancement in job opportunity. Increase in demand for fuel and other construction material.	Better opportunities for cattle rearing. Hike in the prices of land in area. Recreation and tourism potential Revenue generation by sale of energy. Free power (12 %) to state.	The loss of agriculture land and agriculture produce. Loss of livelihood and income.	Likelihood of Loss of jobs after completion of project.
Social & Cultural Environment	Creation of social unity amongst people of project area.	Betterment in social welfare of locals Better living Standards Preventing migration to other cities for earning livelihood.	Loss of land assets over which the PAFs have developed affinity. Increase in pressure on the existing roads. Conflict for employment between local populace and migratory labor population. Conflict between beneficiaries and non-beneficiaries.	Conflict between beneficiaries and non-beneficiaries.

Table 3.4: Major Short-term and Long-term Environmental Impact

Description	Short- term Impact Factor		Long -term Impact Factor	
	Construction Period	Operation Period	Construction Period	Operation Period
Physical Environment	Land degradation due to excavation for project and borrow/disposal area Temporary increase in GLC of ambient air at project sites. Increase in noise levels at project site and nearby settlement. Water and soil pollution due to improper disposal of waste and mal functioning of equipment. Spread of water borne disease.	No significant Impact except impairment of water quality in reservoir during initial period.	Change in the land use of agriculture land, barren and forest land. Land degradation due to excavation for project components, approach road and borrow area. Spread of water borne diseases due to stagnation of water in pits.	Change in hydraulics and hydrological pattern of river flow. Decrease in water quality in the local streams due to run off from agriculture fields. Spread of water borne diseases due to stagnation of water in pits
Biological Environment	Increase in temporary stress levels of wildlife and loss of productivity. Inhibition of free movement of wildlife and fishes. Threat of poaching due to migration of labor	No significant impact.	Loss of habitat due to diversion of forest land. Disturbance in existing ecological balance.	Fragmentation of habitat. Improved habitat for mainly water bird mammals, due to reservoir creation. Improvement in vegetal cover in project and catchment area. With upliftment of rural economy dependency on forest will decrease.
Economic Environment	Increase in Temp. job opportunity Increase in demand for fuel and other construction material	Not applicable	The loss of agriculture land and agriculture produce for PAF. Loss of livelihood and income for PAF	Loss of jobs Employment in other sectors. Hike in the prices of land in the area. Benefits to economy and commerce and better market facilities Recreation and tourism potential Revenue generation by sale of energy.
Social &Cultural Environment	Conflict between beneficiaries and non-beneficiaries. Conflict for employment between local people and migratory labor population. Increase in pressure on roads.	Not applicable	Loss of assets over which the PAFs have developed affinity	Betterment in social welfare of people of project area Better living Standards for people of project area. Preventing migration to other cities for earning livelihood.

Table 3.5: Major Reversible and Irreversible Environmental Impacts

Description	Irreversible Impact Factor		Reversible Impact Factor	
	Construction Period	Operation Period	Construction Period	Operation Period
Physical Environment	Change in the land use of agriculture and forest land. Land degradation due to excavation for project components, approach road and borrow area.	Change in hydraulics and hydrological pattern of river flow. Impairment in water quality of reservoir due to impounding Improvement in land status of impact and catchment area. Improvement of soil water regime of catchment area.	Temporary increase in GLC of ambient air at project site. Increase in noise levels at project site and nearby villages. Water and soil pollution due to improper disposal of waste and mal functioning of equipment Spread of water borne disease due to stagnation of water in pits.	Spread of water borne disease due to stagnation of water in pits
Biological Environment	Loss of habitat due to diversion of forest land. Fragmentation of habitat and disturbance in existing ecological balance.	Loss of habitat due to diversion of forest land. Fragmentation of habitat and disturbance in existing ecological balance.	No significant impact.	No significant impact.
Economic Environment	Hike in the prices of land in the project area.	Loss of jobs Better opportunities for cattle rearing. Employment in other sectors. Hike in the prices of land in project area. Benefits to economy and commerce and better market facilities Recreation and tourism potential	Increase in Temporary job opportunity Increase in demand for fuel and other construction material	No significant impact

Social &Cultural Environment	The pang of involuntary acquisition of land shall cause many social pressures and stress on the affected families	The pang of involuntary acquisition of land shall cause many social pressures and stress on the affected families Betterment in social welfare of farmers of command area Better living Standards for project area. Preventing migration to other cities for earning livelihood.	Conflict between beneficiaries and non-beneficiaries. Conflict for employment between local people and migratory labor population. Increase in pressure on the existing provincial / state road.	No significant impact

Table 3.6: Major Direct and Indirect Environmental Impacts

Description	Direct Impact Factor		Indirect Impact Factor	
	Construction Period	Operation Period	Construction Period	Operation Period
Physical Environment	Land degradation due to excavation Temporary increase in GLC of ambient air at project site, Increase in noise levels at project site. Water and soil pollution due to improper disposal of waste and mal functioning of equipment.	Changes in the land use of agriculture and forest land. Changes in hydraulics and hydrological pattern of river flow. Improvement in water quality of local nala of villages due to implementation of sewage treatment works Improvement in land status of impact and catchment area.	Spread of water borne disease due to stagnation of water in pits.	No significant impact
Biological Environment	Increase in temporary stress levels of wildlife and loss of productivity. Inhibition of free movement of wildlife. Threat due to poaching due to migration of labor.	Loss of jobs for contractors' labor after completion of project.	Loss of habitat due to diversion of forest land. Fragmentation of habitat and disturbance in existing ecological balance.	Fragmentation of habitat. Improved habitat for mainly water bird mammals, due to reservoir. Improvement in vegetal cover With upliftment of rural economy dependency on forest will decrease.
Economic Environment	Increase in Temporary job opportunity Increase in demand for fuel and other construction material	Revenue generation by sale of energy. Free power (12 %) to state. Free power (1%) to local area for development fund Tourism & recreation potential of the area as well as state shall increase.	Loss of livelihood and income for PAF	Loss of jobs Better opportunities for cattle rearing. Employment in other sectors. Hike in the prices of land in the project area. Benefits to economy & commerce and better market facilities.
Social & Cultural Environment	Increase in pressure on the existing provincial / state road. Involuntary acquisition of land assets. Loss of assets over which the PAFs have developed affinity	Betterment in social welfare of farmers of project area Better living Standards for locals. Preventing migration to other cities for earning livelihood.	Conflict between beneficiaries and non-beneficiaries. Conflict for employment between local people and migratory labor population.	Betterment in social welfare of farmers of command area Better living Standards for famers of command area. Preventing migration to other cities for earning livelihood.

Table 3.7 : Modified Leopold Matrix of Environment Impacts in Construction Phase

Environmental Effects →	Physical Environment											Biotic Environment				Economic				Social and Cultural				Total -ve	Total + ve	Total
Development Activities	Landscape	Hydraulics of	Water pollution	Air pollution	Noise pollution	Vibration	Land degradation	D/s water users	Exploitation of resources	Spread of Malaria	Ground water	Aquatic life and Fisheries	Fragmented Habitat	Ecological balance	Stress on biodiversity	Employment	Social values	Basic Amenities	Marketing	Cultural conflict	Archaeological	Demographic change	S.S. Business			
Dam exc.	-2	0	-2	-2	-2	0	-1	0	0	0	0	0	-2	-2	-2	+2	0	0	0	0	0	0	0	-15	+2	-13
Road const.	-2	0	-1	-2	-1	0	-2	0	0	-1	0	0	-2	-1	-2	+2	0	+1	+1	0	0	0	0	-14	+4	-10
Tunnelling	-1	0	-1	-1	-2	-1	-1	0	0	0	-1	0	0	-1	-1	+2	0	+1	+1	0	0	0	0	-10	+4	-6
Powerhouse	0	0	-2	-1	-1	-1	-1	0	0	0	0	0	0	-1	0	+2	0	+1	+1	0	0	0	0	-7	+4	-3
Submergence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dumping	-2	0	-1	-2	-1	0	0	0	0	0	0	0	0	0	-2	+1	0	0	0	0	0	0	0	-8	1	-7
Agg. Crushing	0	0	-2	-2	-1	0	0	0	0	-2	0	0	0	-1	-2	+1	0	0	0	0	0	0	0	-10	1	-9
Colony	-1	0	0	0	0	0	-1	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	-3	0	-3
Diversion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT & other EMP	0	0	+1	0	0	0	0	0	0	+2	0	0	0	+1	0	+2	+3	0	0	+2	0	0	0	0	+11	+11
Vehicular Movement	0	0	0	-3	-3	0	0	0	0	0	0	0	0	0	-2	0	+1	+1	0	0	0	0	+1	-8	+3	-5
Migrant Population	0	0	-2	0	0	0	0	0	-2	0	0	0	0	-2	-2	0	-2	+4	+2	-3	0	-2	+4	-15	+10	-5
L A.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-4	-3	0	0	0	-3	0	-12	0	-12
Comm Development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+4	+2	+3	+2	0	0	0	+2	0	+13	+13
Energy Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**-8**	**0**	**-10**	**-13**	**-11**	**-2**	**-6**	**0**	**-2**	**-1**	**-1**	**0**	**-4**	**-10**	**-13**	**+14**	**0**	**+8**	**+7**	**-1**	**0**	**-5**	**+7**	**-78**	**+53**	**-25**

Table 3.8 : Modified Leopold Matrix of Environment Impacts in Operation Phase

Environmental Effects →	Physical Environment											Biotic Environment				Economic				Social and Cultural				Total -ve	Total +ve	Total
Development Activities ↓	Landscape	Hydraulics of river	Water pollution	Air pollution	Noise pollution	Vibration	Land degradation	D/s water users	Exploitation of resources	Spread of Malaria	Ground water	Aquatic life and Fisheries	Fragmented Habitat	Ecological balance	Stress on biodiversity	Employment	Social values	Basic Amenities	Marketing	Cultural conflict	Archaeological	Demographic changes	S.S. Business			
Dam excavation	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	1	0	0	0	0	0	0	0	-1	1	0
Road const.	-1	0	0	0	0	0	-1	0	0	0	0	0	0	0	-1	0	0	2	0	0	0	0	0	-3	2	-1
Tunnelling	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	-1
Power house	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	-2	6	4
Submergence	2	0	-1	0	0	0	0	0	0	-2	0	0	-1	-1	0	2	1	0	0	0	0	0	0	-5	5	0
Dumping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agg, Crushing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colony	0	0	0	0	0	0	0	0	-1	0	-1	0	0	0	0	0	0	0	1	0	0	0	1	-2	2	0
Diversion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAT& other EMP	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	1	0	0	0	0	0	0	7	7
Vehicular Movement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
Migrant Population	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	-1	0	-1	0	-2	2	0
Land assets acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Comm. Development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	0	0	0	1	0	9	9
Energy Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	2	3	0	0	0	0	0	10	10
Total	**1**	**0**	**-1**	**0**	**-1**	**-1**	**-2**	**0**	**-1**	**-2**	**2**	**0**	**-2**	**2**	**-1**	**12**	**4**	**10**	**9**	**-1**	**0**	**-1**	**2**	**-16**	**45**	**29**

4 MITIGATION MEASURES

During construction phase excavation, quarrying transportation and migrant population are major activities which pose major impacts on the environmental and social components which need to be addressed *pari passu* with construction.

4.1 MITIGATION MEASURES FOR IMPACT TO PHYSICAL & SOCIAL ENVIRONMENT

The construction activities shall be impacting physical environmental attributes like air, noise land and water and social environment to various magnitude which have been quantified and based on this mitigation measures in the form of Environmental Management Plan have been prescribed with financial implications. These are enumerated in **Table 4.1.**

Table 4.1: Potential Impacts, Mitigation Measures with Cost

Potential Impacts	Mitigation Measures	Cost
Land Environment		
Land degradation/soil erosion resulting from disturbance to soil surface and landscape from excavation and disposal of generated muck (64.51 lakh cum)	• Reusing of 36.08 lakh cum on project work • Properly retaining muck pile by providing 6m high RCC Counterfort retaining wall. • Plantation through bio-technological method over surface of muck piles. • Spreading topsoil, stacked separately, over plantation area after amending with FYM and bio-fertilizer.	Provision of Rs. 2390 lakh made under Muck Management Plan
Land contamination due to MSW Disposal	• Solid wastes generated shall be collected and disposed as per arrangement with Igatpuri Municipal Council (ULB) under Nashik Division for disposal of municipal solid waste.	For this Rs 135 lakh have been earmarked under Solid Waste Management
Reduction in soil fertility due to contamination with cement, oil, and lubricants	• Contaminated soil shall be addressed by in-situ bioremediation	Engineering cost in DPR
Due to soil organic carbon present in topsoil and below ground biomass, there shall be GHG emission from reservoir.	• Topsoil from submergence area shall be scraped and stacked separately before filling of reservoir. • The whole root mass of the trees should be removed, and pits so created should be filled with stones,	Engineering cost in DPR
Air Environment		
Maximum 24 hour predicted GLC in air for PM_{10} at upper and lower reservoir has been	• Wet drilling shall be adopted. • Dust mask will be provided to the workers. • Regular maintenance of machineries	For control of air pollution by sprinkling water, a provision of Rs. 91.08 lakh made

found to be 10.8 µg/m^3 &13.8 µg/m^3 respectively while the resultant concentration shall be and 63.7 µg/m^3 and 67.4 µg/m^3 respectively.	• Dumpers are not overloaded, and their speed kept within the prescribed limits. • Copious sprinkling of water at the work site shall be carried out through contractors • Periodical monitoring of air quality	under Management Plan for Control of Water, Air& Noise Pollution. For air quality monitoring, Rs 81.60 lakh provided under
On unpaved haul roads, Air pollution (at 25 m predicted GLC for PM_{10} is 9.9 µg/m3 which reduces to 6.2µg/m3, 2.7 µg/m3 and 1.1 µg/m3 at 50m, 150m and 500 m respectively.	• Periodical monitoring of ambient air quality. • Regular sweeping of roads, sprinkling of water and periodical repair of haul roads. • Vehicles with PUC engaged in construction activities shall be maintained properly.	For control of air pollution on haul roads by sprinkling water through tankers, a provision of Rs. 316 lakhs made under EMP for safeguards during road construction
Spillage of material on roads and dust emission on haul road	• Tippers shall be covered with tarpaulin • Proper sprinkling of water on loose material being transported on roads	For control of air pollution, a provision of Rs, 316 lakhs made
Air Pollution form running of DG Sets.	• DG sets shall not be located on downstream of prominent and first prominent wind direction. • The emission norms prescribed by the CPCB should be adhered. • The norms prescribed by the CPCB in respect of fixing the minimum stack height for generator, should be strictly complied with	Rs. 16.32 lakhs for Air Quality Monitoring for one year post construction and thereafter the cost shall be met from maintenance funds
Generation of dust from Batching Plant	• At aggregate mixing plant, wind breakers will be erected, and water sprinklers installed.	Engineering cost under DPR
Noise Environment		
Temporary Increase in noise levels at the construction site.	• Regular noise level monitoring • Barriers may be erected around batching plant • Distribution of earmuffs/earplugs to workers • Reducing the exposure time of workers to the higher noise levels by resorting to rotation.	For noise level monitoring, Rs 8.00 lakh provided under Rs 0.60 lakh provided for PPE under Plan for Control of Water, Air & Noise Pollution
Setting up of ground vibration & generation of instantaneous high noise levels due to blasting	• Optimum charge per delay shall be kept low. • Controlled blasting will be done. • Adoption of two row blasting and V pattern of firing and use of milli-second delay detonators • Blasting not to be undertaken in night hours.	Engineering cost under DPR

increase in noise levels at turbine, generator floor of underground powerhouse, during operation	• Implementing acoustic noise controls in penstock area, all floors in the powerplant, control room, by using acoustic absorption panels in main plant walls and control room, acoustic plaster, spray on damping material on cooling ducts.	Engineering cost under DPR
Noise generation due to operation of DG Sets and air compressors	• Silent DG Sets shall be installed. Stationary air compressors to be housed in acoustic enclosures	Engineering cost under DPR
Water Environment		
Reduction in capacity of reservoirs due to sediment deposition	• To address gully erosion, stream bank erosion, enhancing the forest cover for increasing soil holding capacity, biological and engineering treatment have been proposed.	Provision of Rs. 250 lakhs made under Catchment Area Treatment
Impairment of water quality by silt laden water from surface & underground works crusher &workshop.	• Silt laden water from work site and stone crusher to be desilted through settling tanks. The washings of workshop floors shall be collected in oil separators provided in channel.	Rs 4.0 lakh earmarked for construction of settling tanks under Management Plan
Contamination of water through sewage and solid waste generation.	• The sanitary waste generated from labour camp is proposed to be treated in STP. Solid waste generated in the project and labour colony, shall be managed as per MSW Rules.	For Solid Waste Management, Rs 135 lakh earmarked Rs. 13.20 lakhs provided for water quality monitoring Rs 44.0 lakh provided for STP under water pollution control
During initial years of filling of reservoir, there shall be GHG emissions	• Planting trees in 4 ha along reservoir periphery shall develop the potential of absorbing and retaining 111 ton of carbon as biomass, which implies carbon sequestration of 407 ton of CO2 equivalent. •	Provision of Rs. 30 lakhs made under Reservoir Rim Treatment
Social Environment		
Public apprehension to project	• Interactions with the local people to assure the villagers against their worries and appraise them of the measures being taken to safeguard their interests.	Rs.600 lakh &Rs.100 lakhs provided under CSR and LADP Rs.500 lakhs provided under Watershed Development Plan

	• Development of infrastructure in the area by implementing CSR initiatives and Watershed Development Plan	
Increased fugitive dust emission.	• The traffic in project area shall be properly controlled. • Copious sprinkling of water on haul roads	For control of air pollution, Rs 316 lakh provided (Sec. 10.19)
Impacts on health of locals	• Periodical health check-up camps/ mobile health facilities in villages and strengthening of existing health services.	Rs 144 lakh provided under CSR
Accidents during construction activities	• Explosive will be kept in safe custody as per Indian Explosive Act • All workers shall be provided with PPE • Lighting devices and safety signal devices will be installed • Traffic rules and regulations will be strictly adhered • Blasting time, signal and guarding time to be regulated • First aid / dispensary facilities to be made available	Rs 87 lakhs provided under Occupational Health & Safety Management Rs 10 lakhs provided under Public Health Management Plan

4.2 MITIGATION MEASURES FOR IMPACT TO BIOLOGICAL ENVIRONMENT

For implementation of project large parts of forests and wildlife habitats and human settlement and agriculture land shall have to be cleared for constructing dam seat, reservoir space, job facility area, roads, muck disposal sites and portals for adits leading to degradation, fragmentation, and loss of habitat and significant losses to the biological diversity and imperative imbalance in ecological equilibrium. The mitigation measures for addressing potential impacts are described in following sub sections: -

4.2.1 Mitigation Measures for Loss of Habitat

For construction of project 243.74 ha forest land with standing trees shall be diverted. This shall lead to loss of some of the plant species used by man and animals and cause un-equilibrium of biodiversity. To compensate for loss of trees new trees shall have to be planted in some other area for maintaining biodiversity equilibrium. The user agency shall have to pay replacement cost of diverted forestland by way of either afforestation.

For mitigating loss due to forestland Compensatory Afforestation plan shall be implemented by the Forest Department In 243.746 ha land identified in Durgewadi Khurd/Chiplun/ Ratnagiri. The cost of compensatory afforestation has been estimated as Rs. 4854 lakhs.

4.2.2 Mitigation Measures for Loss of Ecosystem Services

Diversion of 243.74 ha forest land with Eco Class-I (53.359 ha-dense forest and 173.508 ha open forest) and the vegetal cover over it, felling of standing trees shall be consequential for loss of eco-system services with economic value of Rs 2834 lakh. The loss to ecosystem services provided by the forest shall be addressed by raising compensatory plantation @ 1111 saplings/ha in 243.74 ha of land demarcated for plantation Under Compensatory Afforestation Plan (Rs2020 lakh). Benefits from such compensatory afforestation shall accrue over next 50 years @ discount rates of 2% /year of NPV i.e. Rs 56.68 lakh /year.

4.2.3 Mitigation Measures for Loss of Animal Husbandry Productivity

Diversion of forest land with and, felling of standing trees shall be consequential for loss of animal husbandry productivity with economic value of Rs 283.4 lakh. To address the loss to animal husbandry productivity by resorting to measures like habitat improvement work (management of grass land, eradication of weeds, plantation of fodder and fruit bearing trees) fire protection.

4.2.4 Mitigation Measures for Fragmentation of Habitat

Habitat fragmentation bisects the landscape and leaves smaller, more isolated land for wildlife, causing local and population level changes to native flora and fauna. In the context of current project animal movement in the area required for creation of upper reservoir will be totally blocked as it will be brought under permanent submergence. The water conductor system and the powerhouse are all underground and are in non-forest land. Thus, no fragmentation of forest is envisaged due to locating these components. For mitigating partial fragmentation of the area surrounding upper reservoir, plantation is proposed in 20 ha area under Catchment Area Treatment Plan. Trees planted in 20 ha shall have the potential of absorbing and retaining carbon within their biomass, which@ 39.5 ton/ha based on study carried out by Salunkhe et al (2016) for mixed forest, shall be 790ton and equivalent to carbon sequestered of 2900 ton of CO2 equivalent.

In due course of time more contiguous land for wildlife will be available. In addition to this, plantation shall be carried out in 21.04ha of land around muck disposal sites and 6600 saplings along project road. It is brought out here that project is not a linear project like canal projects, so the problem of fragmentation of habitat is not consequential.

4.2.5 Mitigation of Impacts Due to Labour Influx

Due to labour influx, the pressure on adjoining forest for fuel wood may take place. Besides, labor may engage in activities that are detrimental to natural habitat such as hunting. For averting such situation, the following steps are proposed:

- Labour camps shall not be established near to the forest area.
- To reduce the dependence on forest the project proponent / contractors shall provide alternate fuel substituting fuelwood with LPG for cooking.
- Labors will be trained for protection of trees and conservation and importance of wildlife.
- Smoking shall be strictly prohibited in the forest areas and regular monitoring will be undertaken to avoid forest fires.

4.2.6 Mitigation of Impacts During Construction

- Dust generated due to drilling, blasting, ripping, and vehicular movements will be suppressed by water spraying during and after the operations.
- Water sprinkling will be done on the haul road and other roads at regular intervals.
- To avoid the dust generation during the drilling operations, wet drilling method will be practiced or wet drill machine will be used.
- Speed of the vehicles will be kept within the prescribed limits in forested area.
- At the feeding points stone crusher air mist spray shall be carried out.
- Hooded conveyer belts shall be used so that no stone or aggregate material fall and cause damage to small mammals.
- The optimum charge per delay shall be kept as low as possible so as to avoid excessive rock fall which has potential to hurt or kill animals.
- The blasting shall not be carried out during night to avoid scaring of animals. Mammals are the most vulnerable group affected by these negative impacts, which affect their movement, behavior and breeding habits.
- The noise pollution will be checked and maintained by installing sound barricades around crushing plants and by taking up regular maintenance of heavy earth moving vehicles.
- Stray animals, however, may occasionally drift to the construction site. It should be ensured through stringent anti-poaching surveillance that the stray animals are not killed.
- The traffic noise shall be kept minimum as it has detrimental effect on the survival rates and breeding success of such fauna which reside in the small habitats along roadside communicating using acoustic signals.

4.2.7 Mitigation Of Impacts Due to GHGs Emissions Around Reservoir

During initial years of filling of reservoirs, the GHGs (CO_2 and CH_4) shall be emitted due to biomass resulting from putrefaction of biomass (root material) of trees felled. There shall be 89.9ton and 85.1Ton CO_2 equivalent emission respectively from upper and lower reservoirs resulting from purification of soil organic carbon present in topsoil and below ground biomass during initial years of reservoir filling This impact shall be addressed by planting trees in 4ha along reservoir periphery under Reservoir Rim Treatment Plan (Rs30 lakh) shall develop the potential of absorbing and retaining carbon within their biomass, which@ 39.5 ton/ha based on study carried out by Salunkhe et al (2016) for mixed forest, shall be 158ton and equivalent to carbon sequestered of 580 ton of CO2 equivalent.

4.3 CONSERVATION STRATEGIES OF WILDLIFE

The people living in the surrounding area and employee of the company would be motivated towards the protection of the animal. Motivation will lead to timely information to the concerned authorities about any threat to wildlife or any cases of poaching/hunting. Proper incentive shall be given to such locals who pass on information about the illegal poaching. Water holes should be made away from such places where

the local people bring their animals for grazing. The ban on use of plastic bags should be strictly followed. The dangerous chemicals should not be indiscriminately disposed near to the water holes otherwise the water quality shall be impaired to dangerous proportion. The database of natural habitat of wild animals should be prepared and the information disseminated to the gram Panchayat.

The conservation aspects for formulation of Wildlife Conservation Plan of the Mega-fauna (Schedule-I) have been identified based on their habitats, behavior, breeding sites, food and water availability in the region has been elucidated in **Table 4.2.**

Table 4.2: Conservation Aspects for Megafauna

Species	Conservation Aspects
Panther	• Research works like Census of Panthers and other wild animals • Purchase of Solar Home Lights and Batteries for Antipoaching Camps/villagers • Mitigation of Man Animal conflict
Striped Hyaena	• Striped hyena is under threats due to habitat degradation, poaching, loss of prey species and livestock grazing. • Regular watch and ward
Jackal	• They are sometimes hunted for their fur. • Purchase of Solar Home Lights and Batteries for Antipoaching Camps/villagers. • Regular watch and ward
Khokad	• Lack of habitat protection is the greatest threat • Purchase of Solar Home Lights and Batteries for Antipoaching Camps/villagers. • Regular watch and ward
Jungle Cat	• The main threat is due to reduction in vegetative cover due to destruction of wetlands, and other anthropogenic activities • Restoration of vegetative cover by plantation • Regular watch and ward
Indian Porcupine	• The Indian porcupine is hunted as a food source (Gurung and Singh 1996). • Purchase of Solar Home Lights and Batteries for Antipoaching Camps/villagers • Regular watch and ward
Wolf	• Increase public awareness and understanding about the role of wolves in natural functioning ecosystems and their conservation. • Managing wolf habitat through landscape management. • Protection of habitat areas on sustaining populations of wolves and their prey
Barking deer	• The main threat is due to reduction in vegetative cover due to destruction of wetlands, and other anthropogenic activities Restoration of vegetative cover by plantation • Regular watch and ward
Russell's vipers	• Habitat conservation and management practices that promote biodiversity and maintain healthy ecosystems. • Public education and awareness campaigns can help reduce human-snake conflicts and promote coexistence.
King Cobra	• Habitat protection, enforcement of wildlife protection laws. • Public awareness campaigns to reduce demand for king cobra products.

	• Research to better understand their ecology and behavior for effective conservation strategies.
Rat Snake	• Habitat conservation and management practices that promote biodiversity and maintain healthy ecosystems. • Public education and awareness campaigns can help reduce human-snake conflicts and promote coexistence.
Grey junglefowl	• Habitat conservation and restoration, protection of nesting and foraging habitat • Enforcement of wildlife protection laws to prevent hunting and trapping, • Public awareness campaigns to promote coexistence with local communities.
Peafowl and other avifauna	• Habitat conservation and restoration, protection of nesting sites and suitable foraging habitat, • Regulation of hunting and trapping. • Public education and awareness campaigns to promote coexistence with local communities and reduce human-wildlife conflicts.

5 FINANCIAL IMPLICATION

5.1 CONSERVATION OF RARE, ENDANGERED & THREATENED PLANT SPECIES.

In the study area there are 3 Near Threatened (NT) species viz., *Aegle marmelos*, *Pterocarpus marsupium* and *Habenaria grandifloriformis* and two Vulnerable (VU) species viz., Acacia ferruginea and *Dalbergia latifolia.*

Bael (Aegle marmelos)

Based on the information obtained in research work, seeds of bael could be hydro primed (soaked in water and dried back to original moisture content) for 6 h, adopting the seed to solution ratio of 1:1 to obtain uniform and successful establishment (B. Venudevan and P. Srimathi, Vol. 7(24), pp. 1780-1783, 25 June 2013 DOI: 10.5897/JMPR2013.5071).

Pterocarpus marsupium

Found in fully exposed deciduous forests from 250-1400m. Timber highly valued. The resin is used in medicines and in European wines. General habitat is moist and dry deciduous forests, also in the plains. Common on hill slopes even in dry and fully exposed areas above 750-1400m. Pterocarpus marsupium Roxb. (Fabaceae) is one of the most valuable multipurpose forest trees in India and Sri Lanka, as it is cultivated for quality wood as well as pharmaceutically bioactive compounds, especially from the stem bark and heartwood. However, propagation of the tree in natural conditions is difficult due to the low percentage of seed germination coupled with overexploitation of this species for its excellent multipurpose properties. P marsupium propagates only by seed; the germination rate has been reported to be less than 30%, apparently because of the hard fruit coat coupled with poor viability and pod setting. The mature fruits are harvested from the trees in April and May or before they drop to the ground. Pathogenic infections of fallen fruit also affect the germination rate under natural conditions Ahmad et al recommended freshly collected seeds as a good planting source for obtaining healthy plantlets. The oleo-

resin exudates of this species contain several unique active constituents, including vijyayosin, pterosupin, marsupsin, and pterostilbene, all of which show a wide range of pharmacological activity.

Chikarkanda (*Habenaria grandifloriformis*)

It is herb found in grassy land and on higher hills on grassy slopes up to 1600m, in full sun.

Acacia ferruginea

Acacia ferruginea is normally a smallish, drought-resistant, deciduous tree, not more than 12 m tall and 50 cm DBH. Commonly attaining 35 cm DBH with a bole rarely straight for more then 2-3 m. Branches slender, armed with conical prickles; spine persist on bole until it reaches about 15 cm DBH. The flowers are usually yellow but occasionally white and have many stamens apiece, giving each one a fuzzy appearance. Traditionally, different parts of this plant is used for treating various skin infections, itching, leucoderma, ulcers, inflammation of the mucous lining of the mouth and throat. The plant is also credited for treatment of helminthiasis. dysentery, piles and diabetes. Seeds are edible and are frequently crushed into flour, and gum flows from the stems and branches due to environmental conditions or stress

Dalbergia latifolia

Under natural conditions, D. latifolia reproduces by seed, root sucker or coppice. Artificial reproduction is common by seed, root cutting, and stump sprout. Direct seeding is possible under moist conditions with good weed control. Root cuttings can be planted directly in the field or raised in a nursery for future transplanting. Fresh seed germinates at 50-75% within 7-21 days of sowing. Stored in gunny sacks or earthen pots, seed remains viable for six months (Kadambi, 1954). Seed viability can be extended to 9-12 months by drying seeds to 8% moisture content and storing them in airtight containers, however, germination will decrease to 30-40%. One kilogram contains 21,000 seeds (DITSI, 1980).

For conservation of these near Threatened and vulnerable species, it shall be endeavored to collect seeds of these and propagate them in nurseries and plant them in already identified areas. The species shall be planted under green belt as avenue plantation and colony area besides. For collection of seeds, its drying and storing in bags, its pre-treatment and sowing in mother bed in nursery and then planting in suitable location and yearly maintenance. For developing school nurseries as sum of **Rs 10 lakh** has been provided.

Nursey at Mukne shall be created at a cost of **Rs 25 lakh** for raising tall plants. For planting RET species **Rs 15lakh** have been include in the plan. Beside this, measures shall be Implemented to conserve rare flower species on the plateau inside Wildlife Sanctuary, for which a sum of **Rs 5.0 lakh** have been provided.

5.1.1 Protection of Dead trees and Logs

The dead trees and wooden logs fallen shall not be removed from their place as they act as good habitat for ants and termites which in turn are good forms of food for birds, lizard etc. The residue of non-survival species (Snag) may be kept as it is for the water birds.

5.1.2 Conservation of Biodiversity Hotspots

In forest patches where biodiversity is very good should be identified and protected as these are good repository of gene pools.

5.1.3 Good Practices during project Construction

For conservation of biodiversity and management of the wildlife habitat and population the following good practices shall be adhered by contractor and the officials of SJVN during construction period

- Temporary construction camps (TCF), site office and material laydown yard should be constructed in low vegetation areas and away from forest and wildlife habitats. Further, efforts should be made to minimize the footprint of the TCF using appropriate technologies such as provision of energy-efficient lighting, waste & water management in accordance to applicable standards of the state and central govt.
- All workers of project will be provided with identity cards and would not be allowed to enter in forest areas and villages without a valid permission. The exploitation of forest produce including fuel wood and plant species would be prohibited.
- Adequate measures to prevent exposure of any of local floral and faunal species from the wastes generated during construction activities must be ensured through the immediate wastes collection and storage of waste on designated location.
- Construction vehicles should always use the designated Right of Way (RoW) only to minimize soil compaction and impacts on vegetation.
- Use dust screens in the construction site during all construction activities.
- The Project authority will be bound by the rules and regulations of the Wildlife Protection Acts or any such agency of the State, which may exist or will be promulgated from time to time for the preservation of habitats and protection of biodiversity.
- Use regular dust suppression (water and dust stop powder etc.) in the designated RoW and construction areas to reduce/minimize dust generation
- Considering the movement of wild animals at night, project proponent shall adopt a controlled blasting. Workers will be encouraged to remove alien and invasive plant species from the working sites. The workers will be discouraged to plant any alien species in project areas.

Any construction, chemical, or hazardous wastes generated during the construction stage should be appropriately collected, stored, and disposed of to minimize exposure to flora and

5.2 STRATEGIES FOR CONSERVATION OF SCHEDULE-I WILDLIFE:

The buffer areas are essential for ensuring forest connectivity for land tenure dynamic as these constitute habitats for sub-adult, transients and old members of the Wildlife population. The aging wild animals from the source population residing in core zone migrate to the buffer zone while the adult replace them in source population zone (core zone). With habitat depletion of the buffer area, the source population shall be easily targeted and will always be at the risk of being eliminated. The buffer / fringe areas have immense importance as they have high corridor value which calls for maintaining and improving their ecological sustainability. Otherwise, they are likely to become ecological source sinks. Forest areas can be

developed as wildlife habitat by resorting to restorative strategies which inter alia would into the following:

5.2.1 Wildlife Monitoring and Research

Main objective of conducting wildlife survey in the study area is to observe/record the presence or absence of species and to prepare the distribution of list of a particular species including threatened species. These are carried out to prepare an elaborate inventory of flora and fauna of a particular area. By conducting the study systematic inventory of the wildlife resources can be prepared. This shall also help in providing data for census of wildlife in the area. For enabling research of inland aquatic bodies and their conservation in Nashik, a sum of **Rs 12 lakh** has been earmarked.

5.2.2 Facilitating Staff for Protection and Anti-poaching

To support the existing Staffs of forest department for patrolling and protection of the fauna and flora under their jurisdiction and an additional equipment's i.e. dress, raincoat, gumboots, sticks, water bottles and wireless set for communication shall be provided. Under this sub-head deployment of anti-poaching squads shall be the main constituent of the plan. Besides this establishment and maintenance of patrolling camps/ chokies equipped with wireless sets/mobile phones and procurement of solar lights shall be the other ingredients. For facilitating effective patrolling e-vehicles shall be provided at a cost of **Rs28.50 lakh**.

5.2.3 Redressing Man Animal Conflict

The villages near forest have small chunks of agricultural land and people are mainly depending upon rain fed crops. Wild animals like often damage their crops which is the main man-animal conflict around the area. Though Wildlife (Protection) Act, 1972 further amended in Dec., 2022 authorizes Chief Wildlife Warden and Officers acting on his behest to permit killing of such wild animals causing destruction to life and property, yet the local due to religious sentiments do not opt for animal killings. In such a scenario adequate compensation shall be made to suffering stake holders near the buffer areas. Besides this crop protection structures can be erected at prominent places and cages/traps to catch problematic animals can be deployed. It will also be necessary to compensate the conflict cases early. Besides this it will involve procurement and deployment of traps, cages to catch aberrant animals besides procurement of tranquilizing equipment for capturing problematic and aberrant animals. With a view to Provide cage to rescue injured animal/ birds in Mamdapur Conservation Reserve a sum of **Rs 6.0 lakh** is earmarked.

5.2.4 Conservation of Vulture

For conservation of vultures in protected areas under jurisdiction of DCF Nashik, a provision of Rs 10 lakh has been made under the plan. Special measures shall *inter alia* include the following:

- Aggressive awareness campaigns about the adverse ecological effects of the drug Diclofenac,
- Conducting population surveys (nesting, recruitment, survival) and review them
- Safe disposal of Diclofenac contaminated carcasses,

5.2.5 Conservation of Wolf/Foxes

For conservation of Wolf/foxes in protected areas under jurisdiction of DCF Nashik, a provision of Rs 10 lakh has been made under the plan. Special measures shall inter alia include the following:

- The public shall be informed on a regular basis about species status, management and research and ways to reduce damage. The most influential ways of communication shall be chosen – radio, TV, biggest newspapers and other social media platforms. Seminars for specialists from relevant fields on jackals (large carnivore) conservation news shall be held.
- Stricter implementation/ penalization for poaching, hunting and illegal trade of jackal products
- Livestock owners will be informed about possible ways of preventing jackal attacks.
- Surveillance with people's participation for which they should be given incentive.

5.2.6 Habitat Improvement Measures

The activity under this sub-head mainly comprises of such initiative which will improve the forage and browse values of the habitat for wild animals. The works like creating water holes, water retaining structures, pastureland reclamation (grass improvement) and eradication of weeds. The improvement in the floral diversity in the buffer area can also be partly achieved from plantation under green belt to be carried out under the environment management plan proposed under the EIA/EMP report.

While developing proper habitat for wild animals besides water availability, availability of food has to be looked into. Most viable and effective alternative is to go for fodder development and planting of edible fruit species which will provide fruits, leaves, branches and flowers for wild animals to consume and will also provide cover for their movement. The trees should be indigenous and utility oriented. The suitable areas on annual basis can be taken up in compartments suggested for fruit tree and fodder plantation. For habitat development following activities are suggested: -

Management of Existing Grasslands

Herbivore wildlife has affinity towards grassland. Therefore, scientific management of existing grassland along with plantation/seeding of prime and palatable grass species in natural and degraded areas shall be undertaken after removal of invasive species for which a provision of **Rs 20.0 lakhs** has been made. Within grass land area water holes /water body also need to be maintained/developed and these need to be protected from fire. For development of Grass lands/ pastures **Rs 50.0 lakh** have been earmarked. In addition to this for collecting and production of grass seedling is proposed in research plots at Chandani for which a provision of **Rs20 lakh** has been made.

Eradication of Weeds/ Alien Species

Invasive weeds like Parthenium, Lantana and other exotic species shall be uprooted, before flowering, manually and burnt to avert further propagation of seeds as these interfere with germination of native species and ground flora, which are food for herbivorous. By end of August soil is sufficiently moist and loose and at that time uprooting can be taken up. It must be ensured that no root piece is left inside the soil. The uprooted material should stack separately and should be burnt when sufficiently dry. This process should be continued for couple of years to ascertain that these do not reappear. The process should continue till these are eradicated from the location. For removal of invasive alien species and planting palatable species grass a sum of **Rs 25 lakh** has been made.

Plantation of Fodder and Fruit Bearing Trees

As the aim is to distribute fruit tree all over the area and near specifically chosen sites, no concentrated planting is suggested. Plantation of fruit trees is suggested near breeding areas and other suitable spots approved by the forest officers. Each year in suitable patches approved by forest officers, two-year-old

plants of suitable species will be planted in pits of size 45x45x45 cm. filled with good soil and manure. Fruit, fodder and shelter providing trees such as Alanglum salvifolium, Annana squamosa, Bobax ceiba, Erythrina suberosa, Sygum cumini, Ficus religosa, Ficus racemose, Madhuca longifolia, wild Mangifera indica and Zizipuus maurtiana will be planted to attract birds as well as other wildlife such as bats and small mammals. Under the plan it is envisaged to plant tall trees of Umber (*Ficus racemosa*) in secure area of army/defence forces, for which **Rs 50 lakhs** have been earmarked. Apart from this a sum of **Rs 10 lakh is** earmarked for distribution of free fruit trees to farmer through SFD.

Plantation of Ethno-botanically important plant species

Table 2.7 lists 36 ethno botanically important plant species that fall between FRL and MDDL of reservoirs. These species will be divided into two categories: those that can survive submergence and those that cannot. Species that cannot survive in submergence will be replaced by those that can, subjected to it will not affect the reservoir volume. Under the plan it is conceived to develop these species by making and throwing seedballs. On this count **Rs 10 lakh** has been earmarked.

Plantation of breeding grass for wildlife birds

To improve the habitat for wildlife bird breeding by planting breeding grass on the reservoir's outskirts. For artificial breeding and rearing of grassland birds like Jungle fowl, quails, partridges etc., a provision of **Rs 15 lakh** has been made.

Development of Water hole

It is proposed to provide a water hole within Bhorgad Conservation Reserve by drilling a borewell and lifting water through solar pump with proper fencing around for which **Rs 5.0 lakh** have been provided.

Removal of Water Hyacinth

Water hyacinth is a rapidly spreading aquatic weeds which adversely impacts the ecosystem. It also affects fish, crop and livestock productions and human health. Being a floating plant, it can be removed by raking the ponds surface. In view of its ability to multiply rapidly multiple cleanings throughout the year shall be required. For removal of Ipomea/ water hyacinth in water bodies like Nandur Madhameshwar etc., a provision of **Rs 10.0 lakh** has been earmarked under the plan.

5.2.7 Public Awareness & Celebration of Wildlife Week etc.

This is the most important aspect of wildlife conservation. People will be educated regarding the importance of wildlife conservation through mass publicity by installing sign boards and distributing literature in respective villages in the study area. Experts in the field of wildlife conservation will also be invited to deliver talks through slides. Special emphasis should be placed for raising awareness in school children through conducting debates and conducting audio visual classes. On this count a provision of **Rs 5 lak**h is being made.

5.2.8 Capacity Building

Under this sub-head specialized training in the field of management planning, park interpretation through conducting workshops / seminars / study tours for appraisal of good practices followed in other reserves. Apart from this training in the use of GIS systems and anti-poaching operations shall be imparted. For

training of staff/ capacity building for HWC and ornithology (Territorial/Wildlife/Social Forestry a provision of **Rs 5 lakh** is being made.

5.3 IMPLEMENTATION & MONITORING of PLAN BY CWLW OFFICE

The plan shall be approved by the Forest Department, Government of Maharashtra and demand for fund shall be raised to the Project Proponent. The success of implementation of Wildlife Conservation Plan can be fathomed by continuous monitoring of wildlife and changes in their movement, behavior and population. For this a provision of **Rs 5 lakh** is being made.

5.4 COST ESTIMATES

Budget for conservation of RET species, biodiversity hotspots, Nursery Raising and Maintenance, Improvement of Escape and Reproductive cover, Fencing of Natural Habitat to check the encroachment, Protection equipment i.e., wireless, tranquilizing gun, tranquilizer binocular, water bottles, Identification of densely populated areas of wildlife, Identification of vulnerable areas is shown in Table 6.1. Funds to the tune of **Rs.326.50 lakh** shall be allocated to the forest department for implementing plan. The Plan has been approved by Chief Wildlife Warden, Maharashtra vide letter no.: Room-23 (2)/WL/Survey/Pr.No.163/4377/2024-25 on 29.11.2024 and according to the rommadation and inspected the site visit of CCF, Nashik the revised activitites proposed as per actual situation on the site (Site specific) in the said plan and accordingly the same plan has been approved by Chief Wildlife Warden, Maharashtra vide letter no. Room-23 (2)/WL/Survey/Pr.No.163/2269/2025-26 on 16.09.2025.

Approval letter of Chief Wildlife Warden, Maharashtra for Wildlife Conservation & Biodiversity Management Plan

वन विभाग

प्रधान मुख्य वनसंरक्षक (वनबल प्रमुख) महाराष्ट्र राज्य, यांचे कार्यालय

O/o Principal Chief Conservator of Forests (HoFF), Maharashtra State

Phone No.- 0712-2560953
E-mail - pccfwlngp@mahaforest.gov.in
Website – www.mahaforest.gov.in

अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) महाराष्ट्र राज्य,
Additional Principal Chief Conservator of Forest (Wildlife) Maharashtra State.
"Van Bhavan", 3rd Floor, Ramgiri Road, Civil Lines, Nagpur – 440 001.

पत्र-ई मेल क्रमांक :-कक्ष-२३(२)/वजी/सर्व्हे/प्र.क्र.१६३/६३६६/२०२४-२५ दिनांक २८/११/२०२४

प्रति,

JSW Energy PSP Two Limited,
JSW Centre, Bandra Kurla Complex,
Bandra East, Mumbai-400051.
Email- lalit.bora@jsw.in

विषय :- Request for issuance of "Certificate and Certified map" mentioning that the project boundry is located outside the ESZ/WLS and no Tiger/Elephant Corridor/Critical polluted area falls in 10 kms of the proposed Bhavali Pumped Storage Project (1500 MW) Nashik and Thane Districts, Maharashtra.

संदर्भ :- १. पर्यावरण, वने व हवामान बदल मंत्रालय, भारत सरकार, (Impact Assessment Division), नवी दिल्ली यांचेकडील पत्र क्र. J-१२०११/०८/२०२२-IA.I (R) दिनांक २७/०६/२०२२ रोजीचे पत्र.
२. अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांचे कार्यालयीन पत्र क्र. कक्ष-३/जमीन/ FCA/ प्र.क्र.१२०/६२६/२०२४-२५, दिनांक १४/११/२०२४.
३. अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांचे कार्यालयीन पत्र क्र. कक्ष-३/जमीन/ FCA/ प्र.क्र.१२०/ ६३६/२०२४-२५, दिनांक १८/११/२०२४.

विषयांकित प्रकरणी आपणांस कळविण्यात येते की, केंद्र शासनाने सदर प्रस्तावाचे अनुषंगाने संदर्भ पत्र-१ अन्वये A. Environmental Management and Biodiversity Conservation मधील अनु क्र. vi वर खालीलप्रमाणे अट घालून दिलेली आहे.

vi. Certificate and certified map from Chief Wildlife Warden shall be submitted mentioning that project boundary is located outside the Eco-Sensitive Zone (ESZ)/ Wildlife Sanctuary and no Tiger/elephant corridor /critically polluted area falls within 10 km. of Project site.

वरील अट क्रमांक vi नूसार प्रस्तावित प्रकल्प क्षेत्राचे हद्दीपासून २.२१ कि.मी. अंतरावर कळसूबाई हरिश्चंद्रगड वन्यजीव अभयारण्य आहे. तसेच सदर अभयारण्याच्या पर्यावरण संवेदनशील क्षेत्रापासून प्रकल्प

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क्षेत्राच्या हद्दीचे अंतर १२.५ मी. आहे. उपरोक्त संदर्भिय पत्र-३ अन्वये प्राप्त झालेल्या अहवालानूसार उपवनसंरक्षक (वन्यजीव), नाशिक यांनी सदर प्रकल्प क्षेत्र व परिसर हे राष्ट्रीय व्याघ्र संवर्धन प्राधिकरण (NTCA) च्या संकेत स्थळावर असलेल्या निर्णय समर्थन प्रणाली (DSS) वर तपासणी करून सदर क्षेत्र व्याघ्र भ्रमण मार्गाचा भाग नसल्याचे कळविले आहे. तसेच सदर क्षेत्र हत्ती भ्रमण मार्ग देखील नसल्याचे या कार्यालयास कळविले आहे.

प्रकरणी संदर्भिय पत्र-२ अन्वये प्राप्त झालेला **नकाशा मुख्य वन्यजीव रक्षक, तथा अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव), महाराष्ट्र राज्य यांचेकडून सांक्षाकन करून यासोबत सहपत्रीत करण्यात येत आहे.** तसेच सदरचा प्रकल्प हा Hydro Project या प्रकारातला असल्यामुळे तसेच सदरचे क्षेत्र कळसुबाई हरिश्चंद्रगड वन्यजीव अभयारण्याचे पर्यावरण संवेदनशील क्षेत्रापासून १२.५ मी. अतंरावर येत असल्यामुळे, आपलेकडून वन्यजीव संवर्धन आराखडा मागविण्यात आलेला होता.

त्यानूसार उपरोक्त संदर्भिय पत्र-२ अन्वये वन्यजीव संवर्धन आणि जैवविविधता व्यवस्थापन आराखडा या कार्यालयाचे मान्यतेसाठी सादर केलेला आहे. प्रकल्प यंत्रणेने एकुण रू. ३१५.०५ लक्ष आर्थिक तरतुद आराखड्यामध्ये केलेली होती. त्यामध्ये या कार्यालयाचे स्तरावरून आवश्यक बदल करून सुधारीत रु. ३२६.५० लक्ष रक्कमेचा आराखडा खालील तपशिलानूसार दिलेले आहे. त्याबाबत आवश्यक कार्यवाही आपले स्तरावरून करण्यात यावी.

Cost of Wildlife and Biodiversity Management Plan

Sr. No.	Activities	Amount (in rs. Lakhs)
1.	Removal of invasive alien species and planting palatable species grass	20.00
2.	Raising tall plants in mukne nursery	25.00
3.	Raising RET tall plants	15.00
4.	Planting tall trees of Umber in secure area of army/ defence forces	50.00
5.	Making and throwing seedballs	10.00
6.	Developing school nurseries	10.00
7.	Collection and production of grass seedling at chandani research plots	20.00
8.	Distribution of free fruit trees to farmer through SFD	10.00
9.	Artificial breeding and rearing of grassland birds like Jungle fowl, quails, partridges etc.	15.00
10.	Removal of Ipomea/ water hyacinth in water bodies like Nandur Madhameshwar etc.	10.00
11.	Cost of providing patrolling vehicle	28.50
12.	Training of staff/ capacity building for HWC and ornithology (Territorial/Wildlife/Social Forestry)	5.00
13.	Vulture Conservation (Dycf Nashik)	10.00
14.	Research of inland aquatic bodies and their conservation (Dycf Wildlife Nashik)	12.00

15.	Conservation of wolf/ fox including maintance of their lair	10.00
16.	Development of Grass lands/ pastures	50.00
17.	Awareness about Wildlife issues in children through चला जावूया वनाला	5.00
18.	Survey & Monitoring of implementation by CWLW office M.S.	5.00
19.	Implementing measures to conserve rare flower species on the plateau inside Wildlife Sanctuary.	5.00
20.	Providing and fencing solar water pump for water hole with borewell in Bhorgad Conservation Reserve	5.00
21.	Providing cage to rescue injured animal/ birds in Mamdapur Conservation Reserve	6.00
	Total cost	**326.50**

वरील रू. ३२६.५० लक्ष रक्कम असलेला वन्यजीव संवर्धन आणि जैवविविधता व्यवस्थापन आराखडा वन्यजीव व्यवस्थापनाच्या दृष्टीने पोषक स्वरूपाचा असल्यामूळे, त्यांस मान्यता प्रदान करण्यात येत आहे.

सहपत्र :- वरीलप्रमाणे.

(विवेक खांडेकर)
मुख्य वन्यजीव रक्षक तथा
अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव),
महाराष्ट्र राज्य

प्रतिलिपी : अपर प्रधान मुख्य वनसंरक्षक (वन्यजीव) पश्चिम, मुंबई यांना माहितीस व आवश्यक कार्यवाहीस सस्नेह अग्रेषित.

प्रतिलिपी : उपवनसंरक्षक (वन्यजीव), नाशिक यांना माहितीस व आवश्यक पुढील कार्यवाहीस अग्रेषित. आपणांस कळविण्यात येते की, या कार्यालयाचे स्तरावरून आराखड्यामध्ये बदल केलेला आहे. त्यानूसार आपले स्तरावरून आवश्यक कार्यवाही करून, आराखड्याबाबतचा पूर्तता अहवाल या कार्यालयास विहित मार्गाने सादर करावे.

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Table 5.1 : A Cost of Wildlife and Biodiversity Management Plan

Sr. No.	Activities	Amount (in Rs. Lakhs)
	Wildlife Mitigation measures under Igatpuri sub-division	
1.	Removal of invasive species eg. *Lantana*, glyricidia, etc.	20.00
2.	Fodder Development work in Igatpuri subdivision	25.00
3.	Raising nursery for fodder species	15.00
4.	Construction of Watch Tower in Igatpuri CR	10.00
5.	Camera traps for wildlife monitoring	15.50
6.	GPS equipments	10.00
7.	Rescue equipments for HWC in Igatpuri and Sinnar	10.00
8.	First Aid Kits to schools	10.00
9.	Provision of Rescue Vehicle/ patrolling Vehicle (2)	30.00
10.	Training of Staff/ capacity building for HWC	15.00
11.	Management of Vulture restaurant	10.00
12.	Equipment and instruments for Rapid Rescue Team	15.00
13.	Awareness signages in CR	10.00
14.	Awareness about wildlife issues in schools	5.00
15.	Monitoring of implementation by CWLW office	5.00
16.	Protection hut(s) in CR	15.00
17.	Water holes with Solar Pump in CR	10.00
	Sub-total	**230.50**

	Wildlife Mitigation measures under Shahapur division	
18.	Rescue equipments for HWC	25.00
19.	Training of staff/ capacity building for HWC	25.00
20.	Awareness about wildlife issues in schools	16.00
21.	Habitat development works	30.00
	Sub-total	**96.00**
	Total Cost	**326.50**

Annexure-IS

Map Showing the Distance of Protected Area from Project: Diversion of Forest Land for Bhavali Pumped Storage Project(1500 MW) in Thane & Nashik District of Maharashtra State