ESIA Report

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Environment and Social Impact Assessment (ESIA) of Proposed Greenfield International Airport in Bhogapuram, Andhra Pradesh, India

Prepared for

National Investment and Infrastructure Fund (NIIF)

28 November, 2023

Quality information

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List of Abbreviations

Sl. No.	Abbreviation	Extension
1.	AAQ	Ambient Air Quality
2.	APADCL	Andhra Pradesh Airport Development Corporation Limited
3.	ATC	Air Traffic Control
4.	CA	Concession Agreement
5.	CGWA	Central Ground Water Authority
6.	CPCB	Central Pollution Control Board
7.	CPR	Common Property Resource
8.	CR	Critically Endangered
9.	CSR	Corporate Social Responsibility
10.	CTE	Consent to Establish
11.	CTO	Consent to Operate
12.	COD	Commercial Operation Date
13.	CTE	Consent to Establish
14.	DG	Diesel Generator
15.	DGCA	Directorate General of Civil Aviation
16.	EHS	Environmental Health and Safety
17.	EHSS	Environment, Health, Safety and Security
18.	EPC	Engineering, Procurement and Construction
19.	ESMP	Environment and Social Management Plan
20.	EIA	Environment Impact Assessment
21.	ESIA	Environment and Social Impact Assessment
22.	ESMS	Environmental and Social Management System
23.	EN	Endangered
24.	EPA	Environment (Protection) Act, 1986
25.	ERT	Emergency Response Team
26.	ESMP	Environment and Social Management Plan
27.	FGD	Focus Group Discussion
28.	GRM	Grievance Redressal Mechanism
29.	GVIAL	GMR Visakhapatnam International Airport Limited
30.	FGD	Focus Group Discussions
31.	GO	Government Order
32.	GoAP	Government of Andhra Pradesh
33.	GP	Gram Panchayat
34.	GRC	Grievance Redressal Committee
35.	GRM	Grievance Redress Mechanism

Sl. No.	Abbreviation	Extension
36.	GVIAL	GMR Visakhapatnam International Airport Limited
37.	HSE	Health, Safety and Environment
38.	IBA	Important Bird and Biodiversity Area
39.	IBAT	Integrated Biodiversity Assessment Tool
40.	ICAO	International Civil Aviation Organization
41.	IMD	Indian Meteorological Department
42.	IFC	International Finance Corporation
43.	ILO	International Labour Organisation
44.	IP	Indigenous People
45.	IUCN	International Union for Conservation of Nature
46.	KLD	Kilo Litres per Day
47.	LC	Least Concerned
48.	LOTO	Lock-Out Tag-Out
49.	LULC	Land Use/ Land Cover
50.	MoCA	Ministry of Civil Aviation
51.	MoEF&CC	Ministry of Environment, Forest and Climate Change
52.	msl	Mean Sea Level
53.	NAAQS	National Ambient Air Quality Standard
54.	NIIF	National Investment and Infrastructure Fund
55.	NOC	No Objection Certificate
56.	NT	Near Threatened
57.	O&M	Operations and Maintenance
58.	OBC	Other Backward Classes
59.	OHSP	Occupational Health and Safety Plan
60.	PAFs	Project Affected Families
61.	PAPs	Project Affected Persons
62.	PCC	Pollution Control Committee
63.	PDFs	Project Displaced Families
64.	PESO	Petroleum and Explosives Safety Organisation
65.	PGCIL	Power Grind Corporation of India Limited
66.	PM	Particulate Matter
67.	PPE	Personal Protective Equipment
68.	PTB	Passenger Terminal Building
69.	PS	Performance Standard
70.	PVTG	Particularly Vulnerable Tribal Group
71.	RDO	Revenue Divisional Officer
72.	RFCTLARR	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act

Sl. No.	Abbreviation	Extension
73.	RoW	Right of Way
74.	R&R	Resettlement and Rehabilitation
75.	SEP	Stakeholder Engagement Plan
76.	SoI	Survey of India
77.	SHG	Self Help Group
78.	SPCB	State Pollution Control Board
79.	SPV	Special Purpose Vehicle
80.	ST	Scheduled Tribe
81.	STU	State Transmission Unit
82.	TDS	Total Dissolved Solids
83.	ToR	Terms of Reference
84.	UN	United Nations
85.	UNEP	United Nations Environment Programme
86.	U/s	Under Section
87.	VU	Vulnerable
88.	WHH	Women Headed Household
89.	WMP	Waste Management Plan
90.	WPA	Wildlife Protection Act

Executive Summary

Introduction and Background

The Government of Andhra Pradesh (GoAP) through its Special Purpose Vehicle (SPV), M/s Andhra Pradesh Airports Development Corporation Limited (APADCL) (previously known as Bhogapuram International Airport Corporation Ltd.) has proposed to develop a Greenfield International Airport at Bhogapuram, in Vizianagaram district of Andhra Pradesh. The proposed airport site is located in the border of Visakhapatnam and Vizianagaram districts was selected by the State government. The Bhogapuram International Airport (BIA) is a greenfield airport project proposed to be developed on 2203.26 acres of land spreads over seven villages namely Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru in Bhogapuram Mandal of Vizianagaram District, Andhra Pradesh (hereinafter referred as 'Project' or 'Site').

The GoAP approved the establishment of the BIA vide GO RT No. 63 dated 20th May, 2015 and thereby, the Government of India (GoI) granted its approval for the project vide letter no. AV.20015/111/2015-AD dated 7th October, 2016. The project has also obtained Environmental Clearance from the Ministry of Environment, Forest, and Climate Change (MoEF&CC), GoI under EIA notification, 2006 on 14th August, 2017. The BIA is being developed under a Public-Private Partnership (PPP) model in accordance with the Greenfield Airports Policy of the Ministry of Civil Aviation (MoCA), Govt. of India. Post competitive global bidding in 2019, M/s GMR Airports Limited (GAL) has signed a Concession Agreement with APADCL for development and operation of the Bhogapuram International Airport. The Airport will be built under the Design, Build, Finance, Operate and Transfer (DBFOT) model. M/s APADCL has executed business transfer agreement with M/s GMR Visakhapatnam International Airport Limited[1] (hereinafter referred as 'Company' or 'Concessionaire' or 'GVIAL') for development of Bhogapuram International Airport.

Project Description

The Bhogapuram International Airport (BIA) will be a state-of-the-art airport with modular facilities for both domestic and international passengers and cargo capacity to accommodate the projected air traffic. The Airport will be designed to adopt an airfield layout to accommodate code E aircraft[2] with occasional Code F aircraft[3]. The development of the master plan of the Project was done in accordance with civil aviation requirements as prescribed by the Directorate General of Civil Aviation (DGCA), International Civil Aviation Organization (ICAO) guideline conforming to Good Industry Practice.

The overall layout is segregated into three distinct zones:

- Air side development
- City side development
- City side development for residential development

Natural Resource Demand

Land Requirement

As per the information shared by GVIAL, a total 2203.26 acres of land has been acquired for development of the Bhogapuram International Airport. Out of total 2203.26 acres of land, 1453.71 acres of land is Private land (commonly known as Zeroyiti land in local language), 505.42 acres are of assigned land[4] and 244.13 acres of Government land has been acquired for the Project. The entire land for the proposed Project is acquired by the Government of Andhra Pradesh as per the provision of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR Act) 2013 and Andhra Pradesh RFCTLARR Rules, 2014. The entire land required for the Project is spread over seven (07) villages namely, Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district.

The private land was acquired from 1465 landowners from 7 villages. A total of 405 families were displaced due to the acquisition of land from four (04) villages/ hamlets namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. The District Collector,

[1] A subsidiary of GMR Airports Limited.
[2] Wingspan 52 m but < 65 m. Typical aeroplane B777 Series/B787 Series/A330 Family.
[3] Wingspan 65 m but < 80 m. Typical aeroplane BOEING 747-8/AIRBUS A-380-800.
[4] Assigned land refers to any piece of land assigned by the government to a landless poor for the purpose of cultivation or as a housing site, the person is not allowed to transfer and has no right or title in such assigned land.

Vizianagaram had issued proceedings vide Rc.No.1491/2023/E1 on 26th May 2023 for transferring entire land to the Andhra Pradesh Airports Development Corporation Limited (APADCL). Further, APADCL shall hand over the required land for the project to the GVIAL free from any encumbrance as per clause 4.1.2(a) and 10.3.1 of concessionaire agreement. At the time of site visit, it was informed by GVIAL that the transfer of entire land from APADCL to GVIAL is expected to be completed by August 2023 or latest by September 2023.

The compensation for lost land was paid to all the Project Affected Persons as per the provision of RFCTLARR Act 2013, except 111 landowners comprising 39.86 acres land. As reported by GVIAL, there are 7 court cases are pending on 39.86 acres of land on the title disputes in the Vizag Tribunal for which compensation was deposited by the State Government in the designated account. The compensation amount will be released to the respective titleholders after the title disputes are resolved with the order from Vizag Tribunal.

Except the 7 court cases mentioned above, there are another 54 cases pending with LARR Authority[5] involving demand for additional compensation on 156 acres of land. The entitled compensation amount has been deposited by the State Government with the LARR Authority in the year 2022 and 2023. The petitioners are being advised by APADCL to approach LARR Authority to look into their claims and accordingly the State Government will take final decision on the enhanced compensation amount. As entire land has been already acquired and in possession of APADCL (also handed over to GVIL) the construction of Project can start. On closure of cases, APADCL will deposit additional compensation amount with LARR Authority for payment to the entitled persons who have filed the cases.

Two resettlement colonies have been developed to rehabilitate 405 Project Displaced Families (PDFs) in Gudepuvalasa and Polipalli villages in an area of approximately 17 acres and 23 acres of land, respectively. Each PDFs were given 5 cents (about 240 square yards) of land and INR 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013. The required community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies.

As reported, no land from Scheduled Tribe (ST) was acquired for the Project. Though Vizianagaram district falls under Schedule V areas as defined in the Indian Constitution under Article 342, but Bhogapuram Mandal (where the Project is located) does not fall under the schedule V area.

No forest land was impacted due to acquisition of land. There is no designated archaeological or cultural heritage site within 10 km radius of the Project.

Power Requirement

An estimated, during operation phase of the Project about 25 MVA power will be required. The source of power for the Project will be from APTRANSCO. In addition, some amount of power will be generated from solar PV and rooftop solar in operation phase.

Water Requirement

During construction phase, the domestic water requirement is estimated to be about 320 kilo-liters per day (KLD) and 1663 KLD for civil works. During operation phase the water requirement is estimated to be 1727 KLD including 822 KLD of potable 905 KLD of non-potable water. Reportedly, the water will be supplied from Vizianagaram Municipal Corporation.

Workforce

the total number of workers to be engaged during peak construction period is expected to be 5500 labourers whereas workforce requirement during operation phase will be around 1000. Both, local as well as migrant skilled labourers will be involved for the construction work.

Project Categorisation

Applying the criteria stipulated by the IFC Policy on Environmental and Social Sustainability for environmental and social categorization, NIIFL Environmental and Social Management Framework and US DFC Environmental and Social Policy and Procedures, the Bhogapuram International Airport Project is assigned as '**Category A**' as there will be significant environmental and social impacts, which are diverse, irreversible in nature. The risks and impacts can be mitigated by adopting suitable mitigating measures proposed for the Project. The justification for Project Categorisation has been presented in section 3.7 of this report.

[5] Under section 51 of the LARR Act, the government for the purpose of providing speedy disposal of disputes relating to land acquisition, compensation, rehabilitation and resettlement, establish, an Authorities to be known as — the Land Acquisition, Rehabilitation and Resettlement Authority (LARR Authority).

Environmental Baseline

In order to establish the baseline environmental quality, environmental monitoring was conducted for ambient air quality monitoring at nine (09) locations, noise monitoring at ten (10) locations, ground water monitoring at five (05) locations; surface water quality from five (05) locations and soil quality from six (06) locations. Also, the Project has conducted marine water and sediment sample at one location.

Ambient Air Quality: The ambient air quality results were compared to the National Ambient Air Quality Standards (NAAQS, 2009) for residential area. Ambient air quality parameters were noted to comply with NAAQS, as defined by MoEF&CC during the monitoring period.

Ambient Noise Quality: The ambient noise level was monitored continuously for 24 hours at ten (10) locations from the study area. The results of the ambient noise level were compared with CPCB Noise standards as well as IFC-WB guideline values. The ambient noise level (Leq_{day} & Leq_{night}) at all the locations was noted to be within the permissible standards.

Ground Water Quality: Ground water samples were collected and analysed from the five locations. The ground water sample collected from all the points were observed to be complying with the standards as per IS 10,500:2012 except TDS values. TDS concentration was observed to be higher than the desired level for all the samples. Primary the high concentration in TDS is possibly due to close proximity to marine area having high TDS concentration. Therefore, in general groundwater samples were observed to be fit for drinking purposes with treatment as per IS10,500:2012 standards.

Surface Water Quality: Surface water quality characteristics were assessed against IS 2296 class C specification for the samples SW-2, SW-3 and SW-4. Interpretation for SW-1 and SW-5 has been described in subsequent section being coastal water. Water quality was observed to be slightly alkaline having high TDS value. TDS value in the sample collected from Champavathi was observed to be higher than the standards.

Soil Quality: Nutrient status of the soil samples can be determined from the concentration of N, P, K and organic carbon in soil samples. Nitrogen contents in the soil samples varies from 11.5 mg/kg to 17.5 mg/kg; phosphate content in the soil samples varies from 55.9 mg/kg to 74.5 mg/kg and potassium contents varies from 74.5 mg/kg to 94.5 mg/kg. organic carbon varies from 0.460 % to 0.750% indicating low organic carbon concentration.

Biodiversity Baseline:

The Study Area[6] represents a tract of land situated in the northern coastal regions of Andhra Pradesh in eastern India. The terrain of the Study Area is generally gently undulating, interspersed with hillocks of low elevation of upto 250 meters. A gentle slope gradient runs from west to east (western side has higher elevation as compared to eastern portion); with average elevation ranging from sea level (0 meters) to approximately 255 meters above mean sea level (amsl) in the study area, while it ranges from 18 - 96 meters amsl within the Project site. The Project Site is situated approximately 1.5 km off the Bay of Bengal coast. The Study Area exhibits a mosaic of modified and natural/near natural habitat intermixed with each other. Modified habitat with disused arable land, comprise the main habitat feature of the Project Site. The study area is conspicuous of flat tracts of low-lying land with narrow sand beaches on the eastern side. The main soil in the study area is red soil, sandy loams and sandy clay and they are representing about 96% of the total area.

The ecosystem of the Study Area constitutes of both terrestrial (65%) and marine (35%) ecosystem. On the terrestrial front, the ecosystem profile is majorly composed of dry deciduous and shrub ecosystems. The reported dominant natural vegetation (forest type) of the Study Area is Southern Tropical Dry Mixed Deciduous Forests and Dry Deciduous Scrub Forests. The floristic and faunal profiles is characterized by generalist species and a few habitat-specialist present in the coastal regions. On the marine front, marine pelagic, marine intertidal and marine oceanic ecosystem are present. The reported land-use of the Study Area is predominantly arable land where agricultural crops and horticulture plantation like coconut and casuarina are present. Apart from the two rivers, a few natural village ponds of small size are also present in the study area. Artificial water storage structures in form of aquaculture ponds and embanked seasonal ponds are scattered throughout the study area. The habitat profile of the Study Area is composed of a mosaic of natural and modified habitat intermixed with each other leading to heavy fragmentation of the natural habitat. Within the project site, due to disuse of arable land post land acquisition by the government for the project, the study area is showing progression towards grassland and shrubland ecosystems dominated by *Lantana camara*.

[6] The Study Area refers to a wider area a radius of 10 km of the Project site.

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the Study Area is classifiable into the following forest-types:

Type 5A/C3 [5A - Tropical Dry Deciduous Forests, Sub Type C3- Southern Tropical Dry Mixed Deciduous Forests]

A total of 38 floristic species were recorded in the Study Area during the primary survey. These include 29 woody species, which would be part of the perennial groundcover of the Study Area, and 9 non-woody species.

The review of secondary data shows that at least 85 species of mammals have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include five (05) species designated as Endangered and eleven (11) species as Vulnerable. One (01) of these species were recorded during the primary survey. During field visit none of the Endangered or Vulnerable mammal species were recorded in the Study Area.

The review of secondary data shows that at least two hundred and eighty-one (281) species of birds have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include three (03) species designated as Critically Endangered, three (03) species designated as Endangered and five (05) species as Vulnerable. Thirty-three (34) of these species were recorded during the primary survey. During field visit none of the Critically Endangered, Endangered or Vulnerable avian species were recorded in the Study Area.

The review of secondary data shows that at least eighty-six (86) species of reptiles have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include one (01) species as Critically Endangered and seven (07) species as Vulnerable. None of these species was recorded during primary survey. All of these species have large known ranges beyond the study area and hence, are not deemed as species of conservation concern with respect to the Study Area.

The review of secondary data shows that least eighteen (18) species of amphibians have reported ranges that fully or partially overlap the Study Area. None of these species are significant with respect to the IUCN Red List. None of these was recorded during the primary survey. Additionally, all of these species have large known ranges beyond the study area and hence, are not deemed as species of conservation concern with respect to the Study Area.

The habitat-profile of the Study Area is a mix of marine and terrestrial habitats; the latter being majorly dominated by modified habitat intermixed with natural and near natural habitat. The structure of the terrestrial habitat is largely modified and highly fragmented with natural habitats being indistinguishable from modified habitats at times due to the presence of horticultural plantation such as coconut, palm and Casuarina. Natural and near-natural habitats mainly comprise of marine habitats and terrestrial habitats like shrubland and tropical dry forest habitats which suffer from anthropogenic pressure. Areas of modified habitat mainly include the rural establishment, arable land, plantations and artificial-aquatic habitats (aquaculture ponds developed for rearing fish, shrimp, prawn etc). The chief habitat-fragmenting features of the Study Area consist of a metalled road, dirt roads and dirt tracks. The aerial envelope within the Project Site is largely uninterrupted although the arial envelope of the Study Area is interrupted by power transmission pylons, and associated transmission cables and also a cellular phone tower.

The natural and near natural habitats constitute approximately 55% of the study area. The natural habitats consist of tracts of terrestrial and marine habitat which comprises approximately 35% and 20% of the study area respectively. The terrestrial natural habitats of the Study Area consist of natural patches of Southern Tropical Dry Mixed Deciduous Forests and Dry Deciduous Scrub Forests.

The modified habitats of the Study Area comprise approximately 45% of the Study Area and majorly constitute arable lands, plantations, rural habitations, aquacultural ponds and metalled road. Artificial waterbodies for aquaculture of fish, shrimps, prawns, oysters etc form the artificial aquatic habitats in the Study Area. The aerial habitats within the Project site is largely uninterrupted while most of the Study Area has presence of transmission pylons and cables and cellular phone towers.

Socio-Economic Baseline

Demographic Profile: The proposed Project site spreads over seven (07) villages namely, Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district. The total population of 7 impacted villages is 21,252 persons of which 10,707 are male and 10,545 are female. Hence it is concluded that the male-female ratio is equivalent in the study area. Among all impacted villages, Kavuluvada has the highest percentage of female population (52.50%) which is even higher than the Bhogapuram Mandal and Vizianagaram District. Ravada Village reported the lowest female population (47.78%).

The Scheduled Caste (SC) population of Bhogapuram Mandal constitutes 6.66% of the total population of the tehsil whereas Scheduled Tribe (ST) population constitutes only 0.19% of the total population. A. Ravivalasa,

Gudepuvalasa and Kancheru villages has no ST population, whereas Ravada village has highest 1.67% of ST population among all study villages. However, Gudepuvalasa has highest SC population which is 12.23% among the study villages. During site visit, it was reported that, the SC population in study villages are mainly from Relli community.

Literacy level

Vizianagaram district and Bhogapuram mandal record literacy rates of 58.89% and 51.22%, respectively. Female literate population in these administrative units comes up at 49.87% and 38.81% which is much lower than the literacy rate of the male population. Among all study villages, the literacy rate is highest in Ravada village which is 56.67% and lowest in Kancheru village 38.36%. Female literacy rate is highest in Ravada village 49.47% and lowest in Kancheru village 32.35% in the study villages. The average and female literacy rate is much lower than the national female literacy rate.

Workforce participation

In Vizianagaram district, 82.32% of workers earn their livelihood as main work (employment or earning more than 6 months) while 17.68% were involved in marginal activity providing livelihood for less than 6 months. In Bhogapuram mandal, 68.07% of workers earn their livelihood as as main work, while 31.93% were involved in marginal activity. Of 25,512 workers engaged in main work, about 2,064 were cultivators (owner or co-owner) while 7,489 were agricultural labourers. Among impacted villages, out of total 10,409 workforce, about 7498 were engaged in main work while the rest 2,911 were involved as marginal work.

Vulnerable groups

Though Vizianagaram district falls under Schedule V areas as defined in the Indian Constitution under Article 342 of the same but Bhogapuram Mandal (where the Project is located) does not falls under the schedule V area.

As reported by the GVIAL, the land acquired for the Project does not comprise of any tribal land and this was further confirmed by the Revenue Division Officer (RDO) -Vizianagaram during the consultation meeting. According to the 2011 census and the review of secondary data shows that A. Ravivalasa, Gudepuvalasa, Kancheru villages has no ST population, whereas Savaravilli (0.35%), Kavuluvada (0.05%), Ravada (1.67%) and Munjeru (0.03%) has few ST population as compared to Vizianagaram district (10.05%) and Andhra Pradesh State (7%).

During site visit, AECOM identified some vulnerable PAPs through consultation. These vulnerable persons are Women Headed Households (WHH), Elderly people (above 65 years) and landless from whom land has been acquired. However, the exact number and extent of impact is not ascertained due to unavailability of data.

Stakeholder Engagement

During site visit, the stakeholder groups identified and consulted were (i) Project Affected Persons (PAPs), (ii) village representative (iii) site representatives, (iv) institutional stakeholders – Revenue Divisional Officer (RDO)-Vizianagaram, forest department, state pollution control board (v) local communities of impacted villages, (vi) SC community, (vii) fishermen community (viii) women member of the community and (ix) nomadic shepherd.

The summary of findings of all stakeholders are presented below.

- The state government has transferred the entire land to APADCL. As reported, APDCL will transfer the entire land to GVIAL for development of the Bhogapuram International Airport.
- Total 405 families are displaced due to the acquisition of land from 4 village and hamlets and compensation were paid to all the PAPs except 111 landowners, whose land acquisition matter is under litigations on the title disputes in the Vizag Tribunal (at the time of site visit).
- Based on discussion with the various stakeholders, AECOM noted that they were mostly aware about the upcoming Project.
- Though no ST land was acquired for the Project, however, about 65 SC families are displaced from Rellipeta village who are resettled in Gudepuvalasa R&R colony.
- No forest land is impacted or diverted for the Project.
- No encroachment and squatters were reported during the consultation with PAPs and RDO-Vizianagaram.
- As few of the PAPs lost their entire land, this leads to landlessness among them. Few vulnerable PAPs (women headed household, elderly people above 65 years living alone and landlessness people) were identified during the consultations and site visit.

- During visit, AECOM noted that few landowners spent the entire amount received as compensation on construction of their new house in the R&R colony. The acquisition of land envisages to have an impact on livelihood of PAPs.
- Most of the consulted women are engaged in household work or work as daily wage labour.
- All the stakeholders expressed positive feedback towards the Project. The local people's expectations from the Project are for creation of job in the form of unskilled or semi-skilled workmen in construction and operation phase of the Project.
- About 2000 shepherds families live in Kongavanipalem and other nearby villages. They usually use the open field within 10-15 km area for grazing of livestock. During consultation, it was observed that grazing is not a big concern as lot of open fields are available for grazing in and around the area.

Pollution Sources and Characterisation

The major construction activities of airport project are levelling of site, construction and erection of main airport structures like terminal buildings, runways, taxi ways, auxiliary buildings, etc. The impacts are on land use, soil, air quality, noise levels, water resources, water quality, groundwater quality, solid waste generation, etc.

The potential significant impact includes the following:

- **Air Quality**: The major sources of air pollution during construction phase are use of machinery and equipment, vehicular emissions, emissions from crushers, dust emission from Aggregate Processing Plant/Batching Plant. The main sources of airport air emissions include combustion exhaust from aircraft during landing and takeoff and ground operation, from ground service vehicles, vapours from fuel storage and handling, and emissions from local ground transportation activities servicing the airport.
- **Noise**: The construction activities such as operation of construction machinery, vehicular movement, operation of DG sets is expected to have adverse impacts on the ambient noise levels in the area. During operation phase main noise sources will be aircraft noise and ground noise.
- **Wastewater Generation**: It is estimated that approximately 320 KLD of domestic water will be required for the labour camp. The quantity of sewage generated from labour camps will be 280 KLD (considering 80% of sewage generation from the domestic demand). The sewage will be treated in the septic tank and soak pit/ portable STP. The treated water will comply with discharge standards.

  During operation phase, it is estimated that approximately 1254 KLD of sanitary wastewater will be generated. The sewage will be treated in the proposed Sewage Treatment Plant (STP) of 1400 KLD capacity. The treated water from the STP will be recycled for flushing, horticulture and HVAC make up water, thereby reducing the load of freshwater requirement.
- **Solid Waste Management**: Airports produce a large quantity of wastes from a wide variety of sources including waste food from food establishments, packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers from offices and common passenger areas.

Other Aspects

- **Occupational Health and Safety**: higher noise levels, mechanical vibrations, exposure to hazardous materials, safety of workers, etc. are expected from the Project.
- **Community Safety**: The impact on community infrastructures, health and safety of community, aesthetic changes etc. anticipated in and around the airport area.
- **R&R:** Each PDFs were given 5 cents (about 240 square yards) of land and INR 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013. The required amenities such as internal roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies.
- **Community Willingness**: At present, the community is well aware about the Project, and people welcome the Project. During consultation with community members and PAFs, they do not show unwillingness for the Project as the airport will improve the socio-economic conditions of the region through generation of employment. The Project is expected to provide employment opportunities for 2500 workers during construction phase (through direct and through contractors). For the operation phase, it is expected that direct employment opportunities at the airport will be about 1000 employees on regular and contractual basis.

- **Indigenous People**: As reported by the GVIAL, the land acquired for the Project did not impact any indigenous people or any tribal land and this was further confirmed by the RDO-Vizianagaram during the consultation.

An Environmental and Social Management and Monitoring Plan has been proposed to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the construction and operation of the project. The ESMP delineates the monitoring and management measures to avoid and/or minimize the identified impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures.

The anticipated impacts matrix during the construction, operation and decommissioning phases and after mitigation have been summarized in the Table below:

Impact Description	Impact Nature	Significant of Impact without mitigation	Overall Impact after mitigation
Pre-construction and Construction Phase			
Landuse, Topography, Soil Erosion, soil contamination	Negative	Major	Moderate
Ambient Air Quality	Negative	Moderate	Minor
Ambient Noise Quality	Negative	Major	Moderate
Water resources Quality	Negative	Moderate	Minor
Solid and Hazardous Waste Management	Negative	Moderate	Minor
Traffic Safety	Negative	Moderate	Minor
Occupational Health and Safety of Workers	Negative	Moderate	Minor
Community Health and Safety	Negative	Moderate	Minor
Degradation of Habitats	Negative	Moderate	Minor
Fragmentation of Habitats	Negative	Moderate	Minor
Loss of Ecosystem Services	Negative	Moderate	Minor
Impacts on landowners	Negative	Major	Moderate
Impact on livelihood	Negative	Major	Moderate
Impact on immovable assets at site	Negative	Major	Moderate
Impact due to impeded access roads	Negative	Moderate	Minor
Impact on animal grazing	Negative	Minor	Insignificant
Labour Rights and Welfare	Negative	Moderate	Minor
Operational Phase			
Noise Quality	Negative	Moderate	Minor
Air Quality	Negative	Moderate	Minor
Water Resources and Quality	Negative	Moderate	Minor
Solid Waste	Negative	Moderate	Minor
Occupational Health and Safety Hazards Impacts	Negative	Moderate	Minor
Degradation of Habitats	Negative	Major	Moderate
Fragmentation of Habitats	Negative	Moderate	Minor
Loss of Ecosystem Services	Negative	Minor	Insignificant

Environment and Social Management Plan

An Environmental and Social Management Plan (ESMP) has been developed to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the operation of the proposed project. The ESMP delineates the monitoring and management measures to avoid and/or minimize the identified impacts by allocating management responsibility for implementation of these measures. To cover all the E&S attributes, ESMP has been divided into following components.

- Pollution prevention plan with respect to air, water, noise and soil (detailed out in ESMP)
- Waste Management Plan
- Occupational Health and safety Plan
- Environmental and Social Monitoring Plan
- Emergency Preparedness and Response Plan
- Community Health and Safety Management plan
- Community Development Plan under CSR
- Stakeholder Engagement Plan
- Grievance Redressal Mechanism

Conclusion and Recommendations

This ESIA presents the findings and outcomes of the overall assessment carried out by the AECOM with respect to the applicable reference framework and all identified gaps and issues. Based on the ESIA, an implementable Environmental and Social Management Plan (ESMP) has been developed for the Project to address the identified risks and impacts. The Project is required to implement the following recommendations to mitigate adverse E&S risks and impacts.

Environment Findings

1. As construction phase of the Project involved major construction activities, the EPC contractor is required to prepare pollution prevention plan with respect to air, water, noise and soil quality by adhering to regulatory requirements and industry best practices. These include the following:
    a. Providing with air pollution control devices, acoustic enclosures as per pollution control board guidelines, maintaining appropriate stack heights, regular monitoring etc.
    b. Construction of settling tank to settle the suspended impurities from various plants (HMP/ BMP/WMM) at construction site before discharging.
    c. Provision of dust suppression, raw material to be covered with tarpaulin sheet during transportation and storage.
    d. Provision of oil interceptors for refuelling areas, vehicle parking, washing areas.
    e. Management of waste mater and any discharge from the Project site should comply with CPCB/APPCB and IFC discharge standards.
    f. The EPC contractor to prepare a traffic and transportation management plan to ensure provision of safe and convenient passage for workers, vehicles, pedestrians and general public while using the common access roads in and around the Project site.
2. GVIAL is required to prepare Noise Management Plan for compliance of the Airport Noise Standards as per CPCB's requirement7 under GSR 568 (E) dated 18 June 2018. GVIAL to take necessary noise prevention and control strategies in noise abatement zones (e.g. sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities.
3. GVIAL is required to undertake Airport Noise Mapping as per the requirements specified in the DGCA's requirements considering future aircraft movement and traffic projections of the airport as per the Master Plan of the Airport. Noise mapping shall be displayed at a prominent place of the Airport as well as in the company's website.
4. There is no natural major drains flowing inside or close to the project site so that the development of airport could majorly alter the drainage pattern of the project site. During the development of roads and site preparation the drainage courses/ natural gradient to be properly maintained to drain the runoff water from the

[7] https://cpcb.nic.in/uploads/Standerds/Noise-Standards/Airport_Noise_Standards_06.07.2018.pdf

airport. Adequate drains will be provided within the airport area to drain out standing water in case of waterlogging. The drainage plan to consider highest rainfall of the area, engineering design with respect to natural gradient of the site, ground water aquifer recharge data, stormwater network and impact on the upstream and downstream areas so that runoff water from the airport does not impact the village/ community.

5. The Project is required to develop a waste management plan including for hazardous wastes as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The hazardous waste should be kept in an access controlled and weather proof area with provision of secondary containment and disposed off through authorized vendors.
6. The Project is expected to have a large footprint with respect to consumption of water in both construction as well as operation phase. Though GVIAL has received the water supply approval for the project. The EPC contractor and GVIAL to ensure water availability through sustainable sources. If the Project decides to use borewell prior permission to be obtained from Central Ground Water Authority (CGWA).
7. As the project is located in an open landscape the possibility of movement of wild animals (such as snakes, monitor lizards etc) cannot be ignored. The EPC contractor to install snake deterrent mechanism at locations of high movement area to reduce man animal conflict with within the project premises and labour camps.
8. The EPC contractor will obtain required E&S approvals (CTE/CTO/ HWM approvals, PESO license, permission for mining, CLRA license, ISMW license, PLI etc.), maintain compliance of these approvals (along with reporting to authorities), conduct construction phase environment monitoring (as suggested in environment monitoring plan), implement good construction practices, dumping/ disposal of wastes in designated area/ through authorised vendors and take appropriate mitigation measures with respect to EHS risks at all times during the construction phase.

Social Findings

1. The EPC contractor is required to develop appropriate labour accommodation standards by adhering to EBRD/ IFC guidelines and BOCW guidelines. The workers accommodation should have basic facilities such as provision of bedding, sanitation facility (toilets, bathroom, washing area separate for male/ female workforce), clean kitchen area, potable drinking water, waste/ sewage management facility, fuel for cooking etc.
2. Washing and bathing areas in the workers camp to be provided with proper drainage system so that wastewater is not accumulated. The disposal of wastewater from workers camp needs to be routed to the septic tanks and soak pits (or temporary STP) constructed in the labour camp. The drainage system at the vehicle repairing workshop to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff. Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc.
3. The EPC contractor is required to develop a labour influx management plan to ensure no conflict between the migrant labour and local community due to different cultural behaviour and sharing of local resources.
4. Both, GVIAL and the EPC contractor are required to prepare and implement a site-specific grievance management plan and made aware to all construction workforce and nearby community. The grievances should be resolved on priority basis.
5. GVIAL is required to prepare and implement a site-specific stakeholder management plan for both construction and operation phase of the project and engage with the stakeholders (EPC contractors, regulators, lenders/ investors, impacted persons, community and media perrons etc).

Health and Safety Findings

1. The EPC contractor is required to develop and implement a Health and Safety (H&S) plan throughout the construction phase. The EPC contractor is required to prepare a job safety assessment and provide adequate PPEs to workforce as per the nature of job and impart periodic OHS training to ensure safety of workforce.
2. The EPC contractor to maintain records of various permit to work system, working at height, lifting operations, periodic inspection of heavy equipment, keeping health inspection record of workers working in hazardous operations and provide training on OHS aspects.
3. The EPC contractor is required to develop a project specific emergency response plan including provision of fire extinguishers, first aid personnel, ambulance, emergency contact no. etc. along with mechanism of incident and accident investigation and reporting procedure.

4. The EPC contractor during construction phase and GVIAL in operation phase ensure that appropriate earthing and bonding connections are attached to tank farm areas, spark plugs and other exposed terminal connections are properly insulated. GVIAL to ensure the following in operation phase:
    a. Presence of at least 2 x 9kg ABC dry powder fire extinguishers at both sides of the refuelling browser/ dispenser,
    b. All vehicles other than those performing fuel servicing, are not driven or parked under aircraft wings,
    c. Electric tools, drills or similar tools likely to produce sparks or arcs are not used,
    d. The ground service activities do not impede the egress should there be an emergency,
    e. A clear area for emergency evacuation of the aircraft is maintained at the rear (or front) aircraft exit door.
5. GVIAL is required to ensure that the EPC contractor (and other contractors as well) are complying to regulatory compliance, keep overall monitoring with respect Project construction activities, and conduct construction phase quarterly E&S monitoring audit to ensure adequate implementation of the mitigation measures are adhered as suggested in the ESMP.

Land Acquisition and Livelihood Findings

1. The land for the Project was acquired by Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014 in a span of 7-8 years between 2015 and 2022. The land acquisition involved compulsory government driven acquisition process through expropriation and compensation was paid to land owners as per provisions of the said Act. As no separate Social Impact Assessment (SIA) study was conducted for the Project, hence a comprehensive data was not available (or shared with AECOM) for review to estimate the exact impact on the project affected persons. As the land acquisition resulted into physical and/or economic displacement, and the land was acquired through expropriation in accordance with the legal system of the country, hence the provision of PS 5 is applicable to this Project. In absence of SIA and a comprehensive land database, AECOM recommends to prepare/ generate a baseline data of project impacted persons to arrive at the magnitude of actual impact.
2. As landlessness is envisaged (due to complete physical and economic displacement), but the quantum of livelihood lost couldn't not be assessed due to unavailability of data, the Client may require preparing a supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and take corrective action as per the findings of RAP/ LRP. The Client is required to implement the findings of RAP/ LRP to assess the loss of livelihood among the impacted families.
3. The Project had acquired land from total 1465 landowners in 7 villages. A total of 405 families were displaced due to the land acquisition from 4 villages (or hamlets) namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. Two resettlement colonies have been developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approximately 17 acres and 23 acres, respectively. Each PDFs were provided 5 cents (240 square yards) of land and INR 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013 for construction of houses and for other provisions. During site visit, AECOM noted that the few facilities (such as community hall, temple, road and drainage construction) were under construction at the R&R colony. NIIF to take an update with respect to completion of all facilities in these two R&R colonies.
4. The Project may create employment generation during construction and operation phase. To offset the loss of livelihood the GVIAL/ the EPC contactor may priorities offering unskilled and semi-skilled employment opportunities to local people especially the impacted land owners.
5. Compensation for lost land and assets were paid to landowners between 2016 and 2022. At the time of site visit, the compensations were paid to all the affected persons (landowners), except 111 landowners of 39.86 acres land. As reported by GVIAL, there are 7 court cases are pending on 39.86 acres of land on the title disputes in the Vizag Tribunal for which compensation was deposited by the State Government in the designated account. As the matter is under litigations due to title disputes in the Vizag Tribunal, the compensation was deposited by the state government in the designated account. Hence, NIIF is required to obtain the present status and resolution of litigation to safeguard its reputational risk.

6. Except the 7 court cases, there are another 54 cases pending with LARR Authority[8] involving demand for additional compensation on 156 acres of land. The entitled compensation amount has been deposited by the State Government with the LARR Authority in the year 2022 and 2023. The petitioners are being advised by APADCL to approach LARR Authority to look into their claims and accordingly the State Government will take final decision on the enhanced compensation amount. As entire land has been already acquired and in possession of APADCL (also handed over to GVIL) the construction of Project can start. On closure of cases, APADCL will deposit additional compensation amount with LARR Authority for payment to the entitled persons who have filed the cases. NIIF is required to obtain the present status, deposit of additional compensation and closure of cases to safeguard its reputational risk.

[8] Under section 51 of the LARR Act, the government for the purpose of providing speedy disposal of disputes relating to land acquisition, compensation, rehabilitation and resettlement, establish, an Authorities to be known as — the Land Acquisition, Rehabilitation and Resettlement Authority (LARR Authority).

1 Introduction

1.1 Background

The Government of Andhra Pradesh (GoAP) through its Special Purpose Vehicle (SPV), M/s Andhra Pradesh Airports Development Corporation Limited (APADCL) (previously known as Bhogapuram International Airport Corporation Ltd.) has proposed to develop a Greenfield International Airport at Bhogapuram, in Vizianagaram district of Andhra Pradesh. The proposed airport site is located in the border of Visakhapatnam and Vizianagaram districts was selected by the State government. The Bhogapuram International Airport is a greenfield project proposed to be developed on 2203.26 acres of land spreads over seven villages namely Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru in Bhogapuram Mandal of Vizianagaram District, Andhra Pradesh (hereinafter referred as 'Project' or 'Site').

The GoAP approved the establishment of the BIA vide GO RT No. 63 dated 20th May, 2015 and thereby, the Government of India (GoI) granted its approval for the project vide letter no. AV.20015/111/2015-AD dated 7th October, 2016. The Project has also obtained Environmental Clearance from the Ministry of Environment, Forest, and Climate Change (MoEF&CC), GoI on 14th August 2017 under EIA notification, 2006. The Bhogapuram International Airport is being developed under a Public-Private Partnership (PPP) model in accordance with the Greenfield Airports Policy of the Ministry of Civil Aviation (MoCA), Govt. of India. Post competitive global bidding in 2019, M/s GMR Airports Limited (GAL) has signed a Concession Agreement with APADCL for development and operation of the Bhogapuram International Airport. The Airport will be developed under the Design, Build, Finance, Operate and Transfer (DBFOT) model. M/s APADCL has executed business transfer agreement with M/s GMR Visakhapatnam International Airport Limited[9] (hereinafter referred as 'Company' or 'Concessionaire' or 'GVIAL') for development of Bhogapuram International Airport.

The National Investment and Infrastructure Fund (hereinafter referred as 'Client' or 'NIIF') has been established by Government of India (GoI) to catalyse capital from international and domestic investors into infrastructure and allied sectors in India. NIIF is looking for a potential investment opportunity in the proposed Project'. As part of the investment process, Environment and Social Impact Assessment (ESIA) is required to be conducted as per NIIF's E&S policy to assess the environmental and social risks associated with the identified investment opportunity. AECOM was commissioned by NIIF to perform an Environmental and Social Impact Assessment (ESIA) study for the Project.

This ESIA report has been prepared based on site reconnaissance survey, documentation review, consultation with stakeholders and in accordance with International Finance Corporation's (IFC) Performance Standards (PS) on Environmental and Social Sustainability, 2012; World Bank Group Environment, Health and Safety Guideline, Equator Principles; Relevant ILO conventions covering labour standards, NIIFL Environmental and Social Management Framework and US DFC Environmental and Social Policy and Procedures. The study also has assessed the regulatory requirement with respect to the local and national regulations relevant to the project.

1.2 Identification of the Project Proponent

Project Proponent – Andhra Pradesh Airports Development Corporation Limited (APADCL): APADCL was formed as a Special Purpose Vehicle (SPV) by the GoAP for implementation of the Project. The APADCL is the nodal agency of the energy, infrastructure and investment department of the GoAP and is engaged in facilitating the development of airport infrastructure projects in the State.

The Concessionaire – GMR Visakhapatnam International Airport Limited (GVIAL): GMR Visakhapatnam International Airport Limited (GVIAL) has signed the Concession Agreement with APADCL on 12th June, 2020 to develop, operate and maintain the Project. The Project was awarded to GMR airports Limited through letter no APADCL/BIA-RFP/2020/18 dated 14th April, 2020.

GVIAL is a subsidiary of GMR Infrastructure Limited. GMR Group is a leading global infrastructure conglomerate with interests in Airport, Energy, Transportation and Urban Infrastructure. The Group's Airport portfolio has around 172 million (mn) passenger capacity in operation and under development, comprising of India's busiest Indira Gandhi International Airport in New Delhi, Hyderabad's Rajiv Gandhi International Airport and Mactan Cebu International Airport in partnership with Megawide in Philippines.

[9] A subsidiary of GMR Airports Limited.

1.3 Project Rationale

Andhra Pradesh (AP) located in southern east coast of India is one of the fastest growing economies in the country. The state is ranking on the top position consistently in Business Reforms Action Plan (BRAP) 2020 under Ease of Doing Business (EODB). Economic growth in Andhra Pradesh has been driven by a combination of the agriculture, industry, and service sectors. The primary industries include food processing, software exports, financial services, electronics, power, textiles, and tourism. The state accounts for 4% of the country's population and stands as 7th in terms of contribution to the national income.

The Government of Andhra Pradesh (GoAP) is committed to establish world class infrastructure for Andhra Pradesh. As a part of this initiative, GoAP proposes to set up Greenfield International Airport in Bhogapuram mandal in Vizianagaram district. The Present airport project is of national importance which also plays a vital role in the economic and financial growth of the State of Andhra Pradesh.

INDIAN OVERVIEW: AVIATION MARKET AND GROWTH DRIVERS

India's aviation market is the world's 3rd largest market just behind US and China. The Indian aviation sector has grown tremendously in recent past, especially in the domestic market. The total passengers handled at Indian airports has increased from 143.4 million in FY11 to 341.05 million in FY20, a CAGR of ~10.10 %. Similarly, Volumes of air cargo have grown nearly 1.4 times during FY11-20.

The Indian economy in the last decade has grown at about 6% per annum till 2020. Currently, India's propensity to fly is 0.06 trips per capita, which is projected to grow steadily, as India's GDP per capita increases. It is expected that India will require 2,210 new aircrafts over the next 20 years to satisfy the demand. India, one of the fastest growing economies of the world has all the possibilities to support a large aviation market.

ANDHRA PRADESH: AVIATION MARKET AND GROWTH DRIVERS

Andhra Pradesh is one of the fastest growing states in India in terms of air passenger traffic growth. During FY07-FY19, domestic air traffic movement (ATM) numbers has increased from 7,155 to 21,889 with a CAGR of almost 10%. International ATM numbers grew from 86 to 1,806 during the same period. The year-on-year freight traffic has been growing impressively at 33%.

Andhra Pradesh has robust air-connectivity infrastructure with six operational airports and aircraft movement of over 45,000 flights.

GREENFIELD BHOGAPURAM INTERNATIONAL AIRPORT (BIA)

As per the estimates passenger traffic at BIA is predicted to reach nearly 43 million passengers by FY 60. Total domestic traffic is forecast to reach nearly 40 million passengers while the international sector is expected to increase to 3 million passengers. Project passenger traffic and cargo volume is shown in **Figure 1-1**.

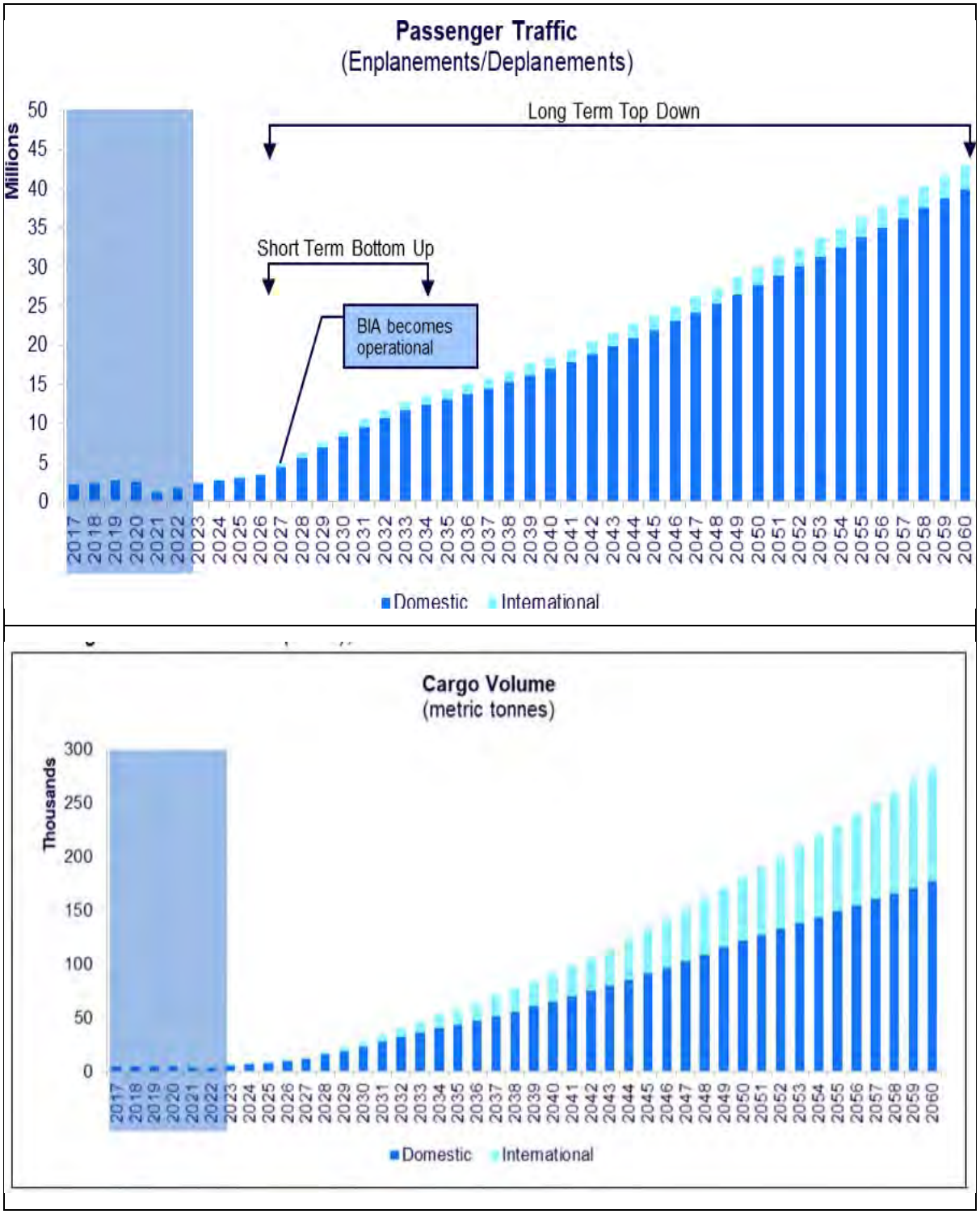

Figure 1-1: Projected passenger traffic volume (up) and Cargo Volume for BIA (source: client data)

1.4 Objectives and Scope of Work

The broad objectives of the ESIA study will be the following:

- To analyse, quantify the impacts, and design project activities keeping in view environmental and social issues and integrate such issues in the project planning and design.
- To analyse specific risks associated with the Project and its impact considering the Project footprint (including associated facilities).

- To establish the environmental baseline in the study area and to identify any significant environmental issues.
- To prepare an inventory of biodiversity (Flora and Fauna) affected due to the Project activities.
- To conduct socio-economic survey using tools such as Focus Group Discussion (FGD) to identify expectations and concerns of project affected persons.
- To identify and prepare a profile of stakeholders involved in the project, including community, through suitable survey using internationally acceptable tool/s, as applicable.
- To establish the socio-economic status of the project affected community based on data collated through secondary as well as primary information.
- To mitigate adverse impacts by provision of the requisite avoidance and compensation measures of proposed project activities.
- To evaluate and suggest suitable community and livelihood development activities (as applicable) for the specific project.
- To develop Environment and Social Management and Monitoring Plan (ESMMP) for implementation and monitoring of the mitigation measures along with indicative Budget.
- To categorize the Project as per IFC/DFC/NIIF Categorization, based on outcome of the ESIA study.

1.5 Approach and Methodology

The approach and methodology applied for the execution of the impact assessment study is as provided:

i. Desk based Review,
ii. Screening and Scoping,
iii. Site visit and Primary Data Collection,
iv. Stakeholder Consultation,
v. Analysis of alternatives,
vi. Assessment of E&S impacts, and
vii. Preparation of ESIA and ESMP report.

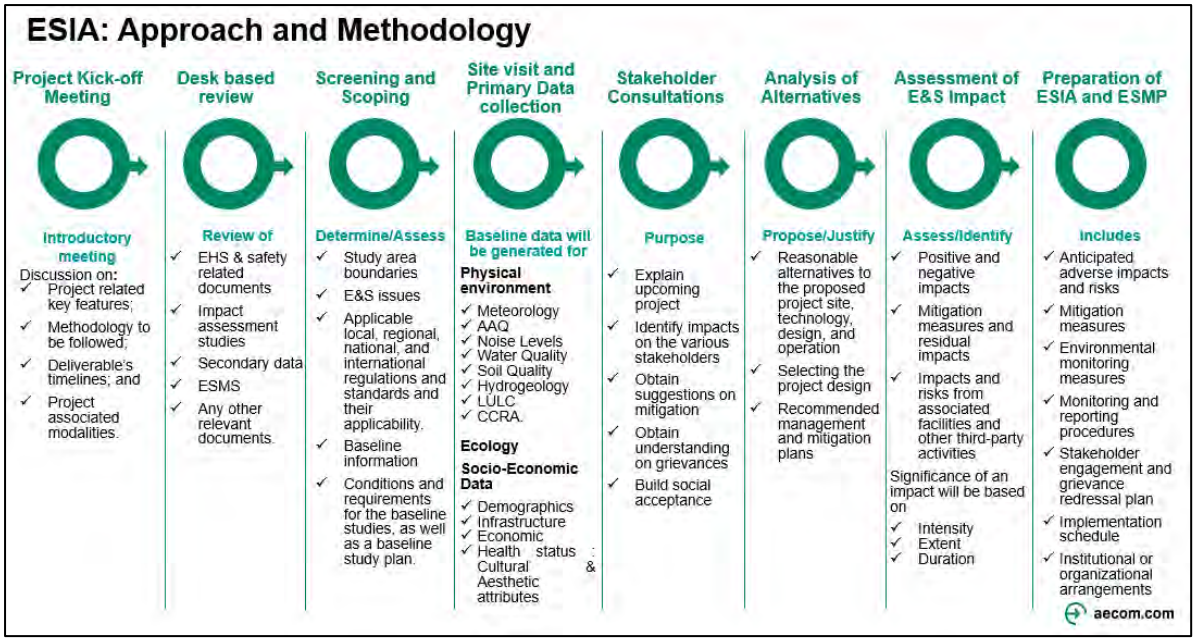

Figure 1-2: ESIA Approach & Methodology

1.5.1 Desktop Review

AECOM carried out a desk-based review of the information shared by the Company prior to mobilizing for the site. As part of the review, the project area was screened using survey of India (SOI) toposheet and latest satellite imagery. Based on review of satellite imagery, preliminary environmental and social sensitivities were identified which were evaluated during site visit and subsequently scoped in. The desk-based review was primarily focussed on but was not limited to the following documents:

- Project Feasibility report
- Master Plan
- Site layout plan;
- Concession Agreement
- Available Regulatory Clearances and Approvals
- HSE related plans and procedures
- Various land related documents;
- Organizational chart;
- Relevant projects maps; and
- Publicly available secondary information of the project sites;

1.5.2 Screening

The screening process was conducted with respect to GoI legal regulations, IFC performance standard requirements, NIIFL Environmental and Social Management Framework and US DFC Environmental and Social Policy and Procedures requirements to determine the project categorisation as well as deciding the area of influence (AoI).

1.5.3 Scoping

The objective of scoping exercise is to identify the potential receptors and activities that may impact baseline E&S set up in the area of Influence (AoI). Scoping stage identifies potential project impacts on environment and social components, providing a clear focus for the assessment, and outlines the content of the assessment report. Scoping is further used as a basis for defining the impact assessment, planning and implementation of mitigation, monitoring and reporting mechanisms for the project to meet project framework requirements. The scoping stage

of the ESIA study identify the range of environmental and socio-economic topics to be studied and the geographical area to be covered (spatial scope). Thus, the objective of the scoping process will be to:

- Determine and firm up the study (data) boundaries, clarify what is to be included in the ESIA study, and what are the focus areas.
- Clearly determine the E&S issues (incl. direct, indirect and cumulative impacts) that will be addressed in the ESIA, together with the required level of detail and level of aggregation.
- Identify applicable local, regional, national, and international regulations and standards, and their applicability to the project.
- Provide an assessment of the current available baseline information and their use (or fit) for the ESIA.
- Outline the conditions and requirements for the baseline studies, as well as a baseline study plan.

During scoping phase, schedule for the site reconnaissance (detailing topics and interviewees) and the preparation of questions and elements to be cross-checked are finalized.

1.5.4 Site Survey

A multidisciplinary team comprising project manager, environmental specialist, social specialist, and an ecology & biodiversity specialist conducted the site survey during 16-19th August, 2023. The following activities were undertaken during this visit:

- Visit to airport site and general study area to understand the potential environmental and social risks and impacts.
- Study of key environmental receptors such as nearest settlements, man-made sensitivities such as schools, colleges, hospitals, etc., large water bodies, migratory routes of fauna, forest, ecological sensitive area, national park, wildlife sanctuary, biosphere reserve, ESZ boundary, cultural resources, agricultural land, grazing land, etc.
- Undertake environmental monitoring and collection of baseline environmental and social data to establish the baseline;
- Undertake biodiversity assessment including collection of biodiversity baseline data.
- Undertake consultations in the form of individual interviews and focussed group discussions (FGDs) with the various key stakeholder groups:
  - Project proponent
  - Project Affected Persons (PAPs)
  - Local stakeholders such as Village representative, women group, SC community, Fishermen community etc; and
  - Institutional stakeholders/government departments.

1.5.5 Environmental Baseline Data Collection

Environmental baseline data was collected through primary monitoring in the study area (10 km distance from Aerodrome Reference Point (ARP)). Baseline environmental monitoring was conducted through NABL accredited and MoEF&CC recognised laboratory M/s SHREE KRISHNA ANALYTICAL SERVICES PVT LTD, (SKAS) New Delhi. Secondary information through literature surveys was also collected for the study area. The baseline study included the following:

- The primary environmental baseline data was collected with respect to ground water and surface water, ambient air quality (AAQ), ambient noise level, soil quality, traffic survey and socio-economics profile. The ecology and biodiversity data were also collected as part of the primary data collection;
- The GIS mapping of the study area was done to present details on land use pattern, forest/ vegetation cover, settlements, water bodies, drainage pattern, spot heights and contours, etc.;
- Information on geology, meteorological conditions, water and ecological resources, socio-economic status, etc. were observed.

1.5.6 Stakeholder Identification and Analysis

On the basis of the understanding developed in the initial stages, the potential stakeholders for the project were identified and the individual concerns, expectations and influences of the stakeholders on the project were identified. The purpose of such an understanding was to allow for a proper assessment and mitigation of the impacts. On the basis of this understanding, an exercise of stakeholder mapping was undertaken:

- To identify each stakeholder group;
- To study their profile and nature of stakes;
- To understand each groups' specific issues, concerns and expectations from projects; and
- To gauge their influence on the project.

During the site visit for ESIA, following groups of stakeholders were consulted with the objective of collecting baseline data/information and to understand concerned issues:

- **Landowners**: About 16 number of landowners whose land are acquired for the project.
- **Local communities**: Consultations and FGD with local community members, Village representatives, SC community, Women members, Fishermen community and Shepherds in the impacted villages.
- **GVIAL land team:** Consultations were undertaken with the GVIAL land team during visit.
- **Consultation with Govt. Department**: Consultations were undertaken with the officials from Forest department, Andhra Pradesh Pollution Control Board, and Revenue department.

1.5.7 Impact Assessment

Impact identification and prediction are undertaken on the basis of environmental and social baseline data collected. The major processes involved were:

- Identification – to define the impacts associated with different phases of the project and the activities to be undertaken;
- Prediction – to forecast the nature, magnitude, type, duration, extent, scale, frequency likelihood and sensitivity of the major impacts; and
- Evaluation – to determine the significance of impacts including residual impacts considering how mitigation will reduce the predicted impact.

The significance of an environmental impact is generally based on any of these three factors:

Intensity of Impact: This is defined by the severity of each potential impact and indicates whether the impact is irreversible or, reversible and estimated potential rate of recovery. The intensity of an impact is considered to be High if the impact is irreversible or residual in nature. On the other hand, the magnitude can be Low or Moderate if the intensity is Low or reversible in nature.

Extent of Impact: The spatial extent or the zone of influence of the impact would be determined. An impact can be site-specific or limited to the project area; sometime, impacts can extend beyond the project boundary to the regional or a national scale.

Duration of Impact: Environmental impacts have a temporal dimension and needs to be considered in an impact assessment study. Impacts arising at different phases of the project cycle would be considered. The impacts are generally classified as short-term, medium-term, and long-term.

Professional judgement, experience and knowledge of similar projects were used for impact analysis. The extent and potential consequences of the impacts are compared against applicable reference framework. Mitigation measures are suggested for each of the identified adverse impacts.

1.5.8 ESIA and ESMP Report

Based on the documents reviewed, site visit conducted, and gaps identified, ESIA and ESMP report are prepared as per the applicable framework and statutory guidelines.

The purpose of the ESIA study is to evaluate the potential E&S impacts whereas ESMP is to ensure Project activities comply with the reference standards and that the design control and mitigation measures for avoiding or minimising potential impacts through all phases of the Project. An ESMP will suggest economically feasible control

technologies and procedures to minimize any impact on environment and social aspects. All impacts identified as the result of impact evaluation will need to be considered for mitigation and control. The mitigation measures should follow the three-step mitigation hierarchy of:

- **Avoid** or prevent negative impacts on the environment. Mitigation by avoidance means measures considering location, design, process, technology, route alternatives and 'no go' options to avoid impacts. This type of mitigation represents the most (cost) effective form of impact mitigation and offers the greatest benefit early in the planning cycle.
- **Minimise** and rehabilitate on-site effects if impacts cannot be avoided. Mitigation by reduction (minimise and reduction) means measures attempting to reduce impact or to limit the exposure of receptors to impacts. This approach aims at limiting the severity of impacts and is applicable only in the implementation phase of the project.
- **Compensation/**offset measures that are undertaken as a last resort (on or off-site) for the residual adverse impacts. Mitigation by compensation/offset means measures undertaken to restore the environment to its previous condition or at least to a new acceptable stable environment. This 'end of pipe construction' restorative approach helps to counteract adverse conditions created by the Project.

1.6 Limitations

Professional judgements expressed herein are based on facts and information provided by the client. Wherever AECOM has not been able to make a judgement or assess any process, it has highlighted that as an information gap and suggested a way forward. AECOM shall not be held responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed by the company representatives, contractors, lenders and other relevant stakeholder engaged during the time of this assessment.

The ESIA study of the Project is limited to project information made available by the client, discussion with client's representative, primary monitoring, secondary data collected, consultation with local community and observations made during site survey. Professional judgement and interpretation of facts has been applied for presenting inference from the collected information.

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1.7 Layout of Report

The current ESIA report has been arranged under the following chapters:

1. **Chapter One – Introduction** (this chapter) provides a background of the Project, objectives with which the study has been undertaken and the scope of work.
2. **Chapter Two – Project description:** This chapter provides details of the project location, key project components and utilities, land requirements, power purchase agreement, current project status, etc.
3. **Chapter Three – Environment and Social Regulatory framework:** This chapter encompasses the national administrative requirements, applicable permits, licences, approvals and consents and project categorisation as per IFC Performance Standards and other reference framework.

4. **Chapter Four – Environmental and socio-economic baseline:** This chapter illustrates the environmental baseline, socio-economic baseline and ecology baseline.
5. **Chapter Five – Stakeholder Engagement and Consultation:** Presents the stakeholder engagement carried out for the Project.
6. **Chapter Six – Analysis of alternatives:** This section presents the analysis of alternatives for the project.
7. **Chapter Seven – Impact Assessment:** This chapter highlights the impact assessment criteria, key environmental risks and key social risks.
8. **Chapter Eight – Environment and Social Management Plan:** This chapter highlights the organization structure, training, inspection monitoring and audit and documents and record keeping.
9. **Chapter Nine – Conclusion and Recommendations:** Presents conclusion and recommendations for the Project.

2 Project Description

The proposed greenfield Bhogapuram International Airport project is being set up by the State of Andhra Pradesh under a public-private partnership (PPP) model. The Project will be developed and operated by M/s GMR Visakhapatnam International Airport Limited through Design, Build, Finance, Operate and Transfer (DBFOT) protocol. The scope of work broadly includes the design, finance, construction, development, operation and maintenance of the air-side, terminal, Maintenance, Repair and Operations (MRO) and land-side infrastructure (car parking, retail area and other such activities as defined in the Concession Agreement) for the Project in accordance with the provisions of the Concession Agreement.

This section provides an overview of the project and describes its location, associated infrastructure, equipment, and various activities that are being planned for construction and operation of the project. The section also highlights proposed airport amenities and facilities, resource requirement as well as various pollution sources along with essential environmental controls planned to be installed during construction and operation of the project.

2.1 Project Location

The proposed Project site spreads over seven (07) villages namely, Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district, Andhra Pradesh. The site lies on the border of Visakhapatnam and Vizianagaram districts and was selected by the GoAP. The Bhogapuram International Airport will spread over an area of approximately 2203.26 acres and is predominantly a coastal plain area. The approximate ground elevation of the proposed site ranges between 20 meters (m) and 70 meters (m) above mean sea level (amsl).

The Project site is located about 45 km form Visakhapatnam through National Highway (NH)-16 and 25 km from Vizianagaram district headquarter. The site is bounded by Bay of Bengal at a distance of about 1.5 km on the eastern side and NH-5 on the western side at about 1.5 km. The northern and southern sides are relatively open agricultural land. The Project location is shown in **Figure 2-1**. The Project area superimposed on Survey of India (SoI) toposheet having a buffer of 10 km is presented in **Figure 2-2**. The Bay of Bengal is situated about 1.5 km from the Project boundary and the Project Site is away from the Coastal Regulation Zone (CRZ) notified area and hence CRZ clearance is not applicable to the Project. The CRZ notified area lies about 0.7 km away from the CRZ no development zone and 0.4 km away from the CRZ boundary. The Project area superimposed in CRZ map is presented in **Figure 2-3.**

The footprint of the Project with respect to associated facilities such as R&R colony and mining area (likely to be allocated) is presented in Figure 2-4.

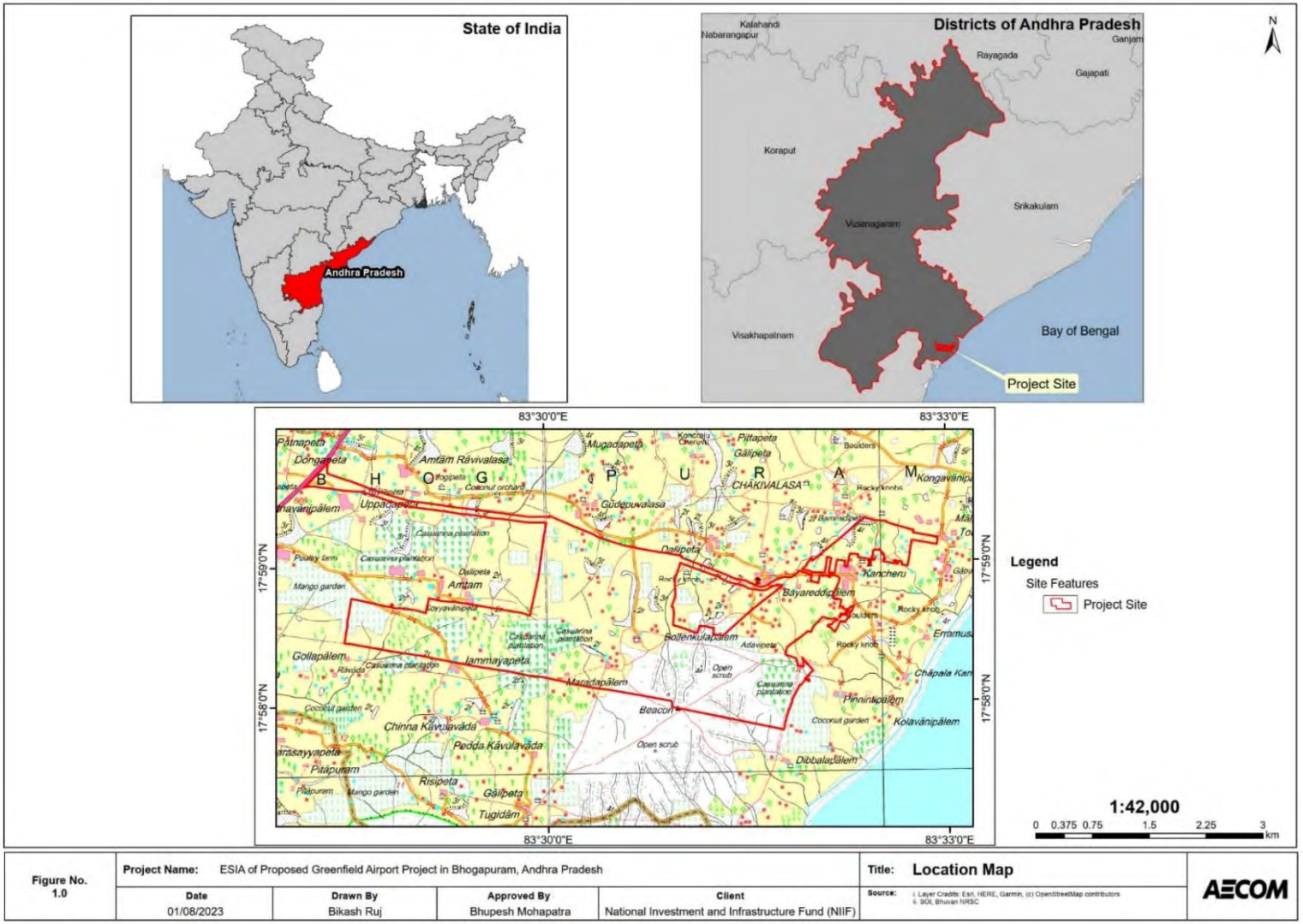


Figure 2-1: Geographical Location Map

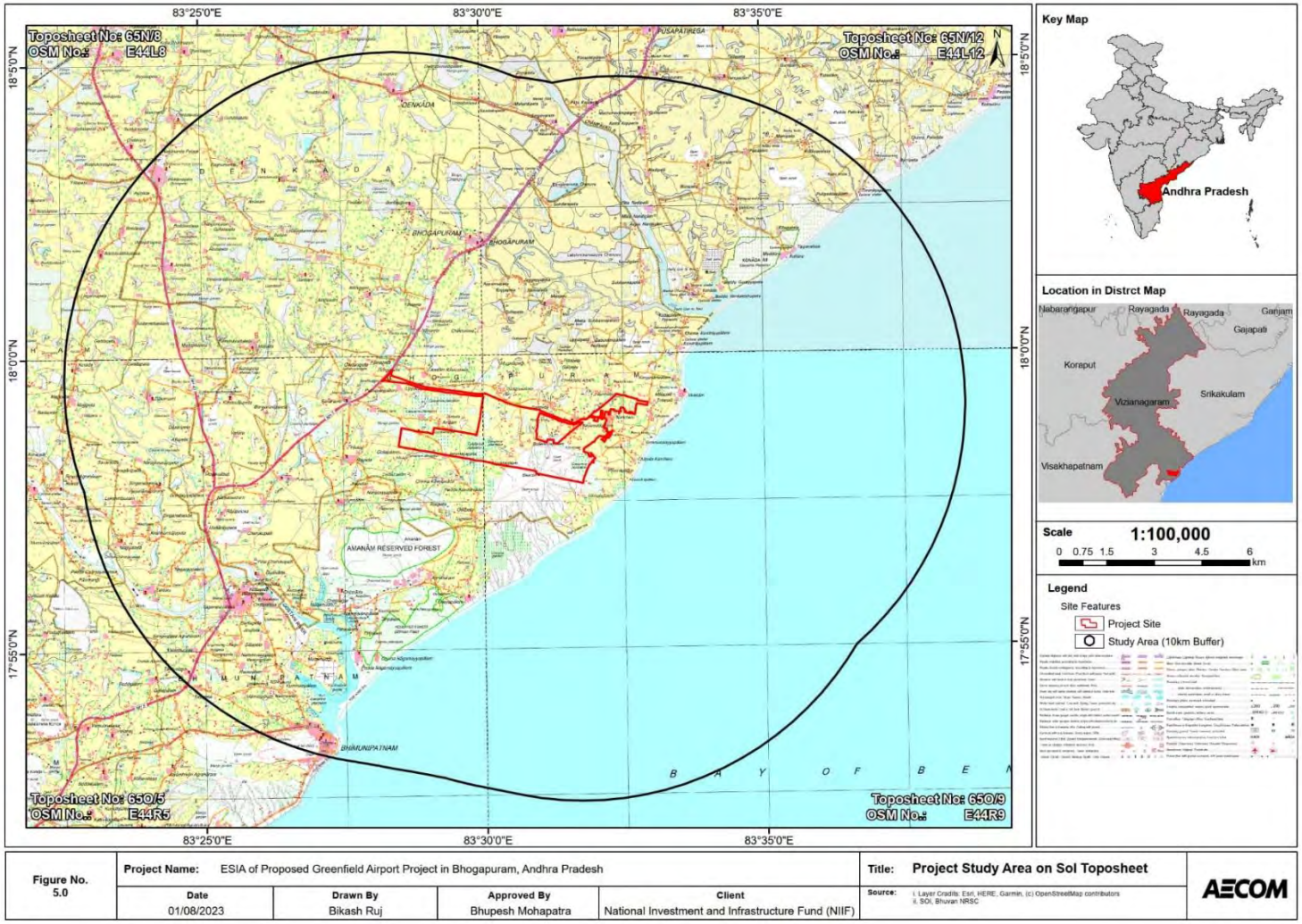


Figure 2-2: Map Showing project area superimposed in Survey of India Toposheet

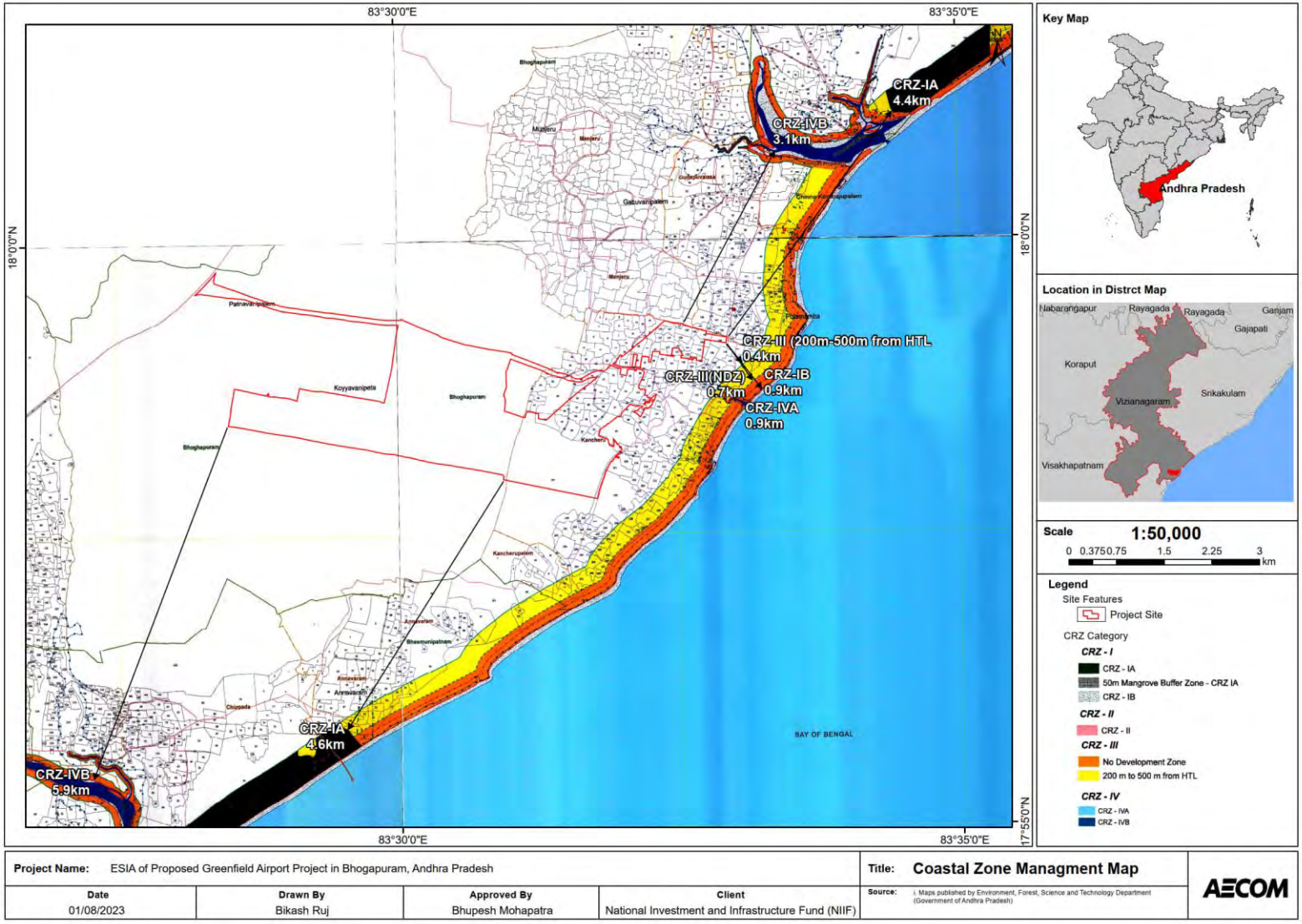
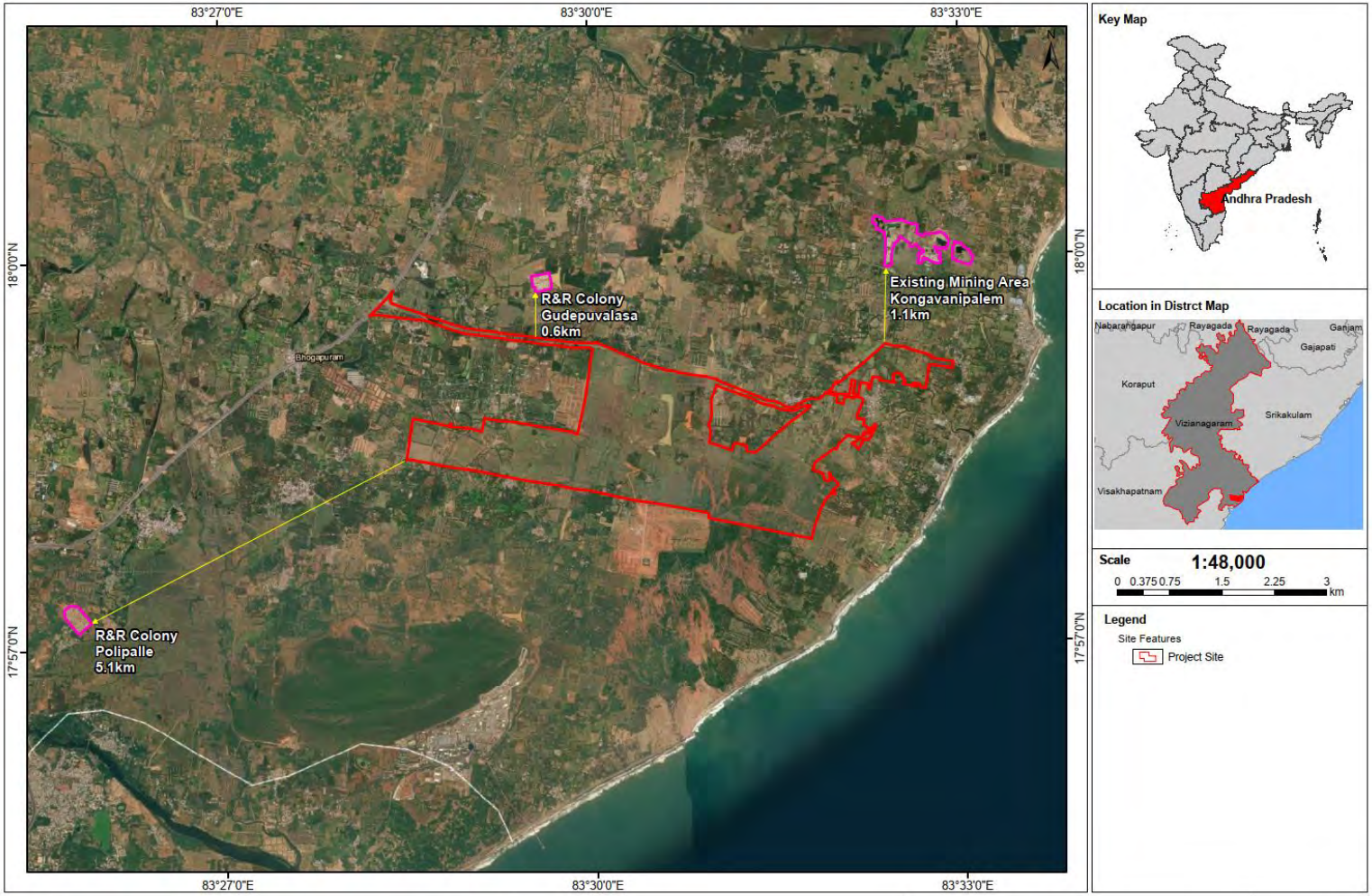


Figure 2-3: Map Showing Project Area Superimposed in CRZ Map



Project Name:	ESIA of Proposed Greenfield Airport Project in Bhogapuram, Andhra Pradesh			Title:	Site Vicinity Map
Date	Drawn By	Approved By	Client	Source:	i, Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors
01/08/2023	Bikash Ruj	Bhupesh Mohapatra	National Investment and Infrastructure Fund (NIIF)		

AECOM

Figure 2-4: Map Showing Location of Project with respect to R&R Colony and Mining Area

2.2 Salient Features

Salient features of the Project is summarized in **Table 2-1.**

Table 2-1: Salient Features of the Project

Sl. No	Salient Features	Details
1.	Project Name	Bhogapuram International Airport (BIA)
2.	Project Concessionaire	GMR Visakhapatnam International Airport Limited (GVIAL)
3.	Project Owner	Andhra Pradesh Airports Development Corporation Limited (APADCL)
4.	EPC Contractor	Not finalized yet
5.	Project Capacity	6 million passenger per annum (MPPA) (with scope of further expansion to 24 MPPA)
6.	Location of Site	Village- Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru in Bhogapuram Mandal, A.P.
7.	Tehsil/Mandal	Bhogapuram Mandal
8.	District	Vizianagaram district
9.	State	Andhra Pradesh
10.	Nearest Town	Vizianagaram (15 km, NNW)
11.	Nearest Railway Station	Vizianagaram (17 km, NNW)
12.	Nearest Highway	NH 16 (approximately 1.5 km)
13.	Nearest Airport	Visakhapatnam Airport (38 km, SSW)
14.	Nearest port	Vizag Port (37 km, SSW)
15.	Present status of the project/ project phase	Construction not started (Under planning finalization stage)
16.	Proposed COD	30 months from the start of construction activity
17.	Total Cost	INR 4750 crores

2.3 Site Accessibility

The proposed Project site is located in Bhogapuram Mandal in Vizianagaram district. The district is a part of the northern coastal plains of Andhra Pradesh. It is bounded on the East by Srikakulam district, on the West and South by Visakhapatnam district, on the South-East by Bay of Bengal and North-West by Orissa State. The Project Site is located about 15 km away from district headquarter, Vizianagaram. The Site can be accessible through National Highway 16 (NH-16) which runs parallel to the Project at a distance of 1.5 km in North-South direction and connects Odisha in the North, to Tamil Nadu in the South. The accessibility to Project site can be through road, railway and air links as per the following details:

Road: The Project is located towards the southern side of the Vizianagaram district. The Site is accessible through NH 16 which is around 1.5 km from the project boundary.

Rail: The nearest railway links to the project site is at Vizianagaram railway station which is at about 17 km from the Project site.

Air: The nearest airport is in Vishakhapatnam Airport which is at about 38 km from the Project site.

Port: The nearest seaport is Vizag port which is at about 37 km from the Project site.

The accessibility map of the project is shown in **Figure 2-5**.

2.3.1 Planned Local and Regional Connectivity

The GoAP has also proposed to develop, additional modes of public transport (such as metro connections), in accordance with the overall town planning for the area in and around the proposed airport. The GoAP also plans to extend the coastal road connectivity from Bheemili to the Airport which will provide easy access in the future.

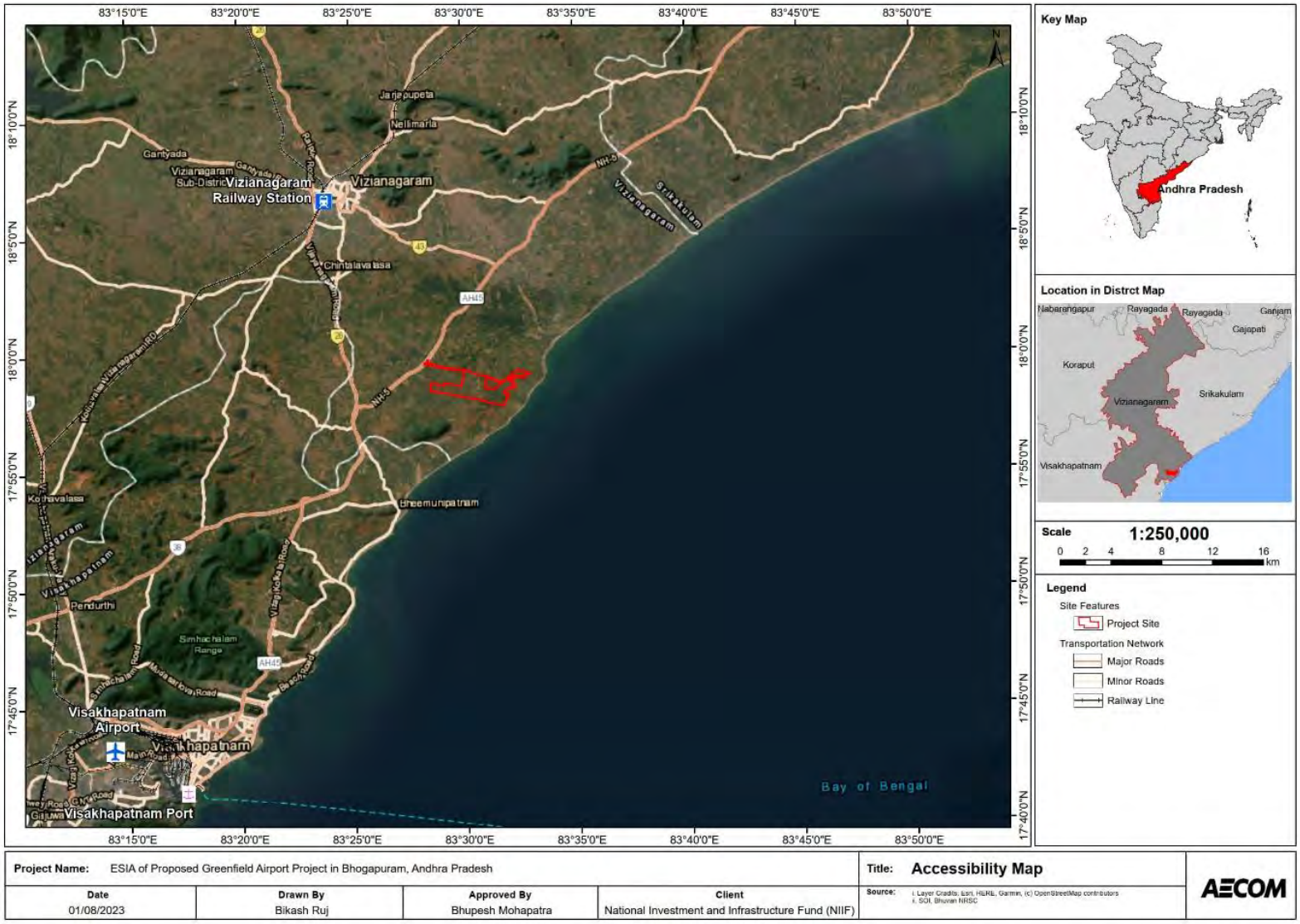


Figure 2-5: Project Accessibility Map

2.4 Proposed Developments: Project Master Plan

The Bhogapuram International Airport (BIA) will be a state-of-the-art airport with modular facilities for both domestic and international passengers and cargo capacity to accommodate the projected air traffic. The Airport will be designed to adopt an airfield layout to accommodate code E aircraft[10] with occasional Code F aircraft[11]. The development of the master plan of the Project has been done in accordance with civil aviation requirements as prescribed by the Directorate General of Civil Aviation (DGCA), International Civil Aviation Organization (ICAO) guideline conforming to Good Industry Practice.

The Master Plan addresses all the required facilities related to air traffic operations viz. runway, taxiway, aprons and isolation bay, navigational aids, passenger terminal building, cargo complex, control tower and technical building, maintenance work shop for ground handling equipment and vehicles, service buildings, fuel farm and fuel hydrant system, aircraft hangar, car parking area, sewage treatment plant, utilities, housing, etc.

The Project will be developed in phases. During final phase, the Project is expected to handle 24 MPPA. Expected annual passenger traffic and forecasted air traffic movement (ATM) during different phase of the project is presented in **Table 2-2**.

Table 2-2: Annual Traffic and Air traffic movements (ATM) forecasts

Phase	Year	Annual Traffic	Domestic Traffic	International Traffic	Domestic ATM	International ATM
Phase 1	2030	6 MPPA	5,758,884	366,311	44,292	3,195
Phase 2	2043	12 MPPA	11,455,132	862,776	83,472	76,960
Phase 3	2052	18 MPPA	16,784,045	1,302,906	113,891	104,851
Phase 4	2061	24 MPPA	22,686,712	1,788,147	151,108	139,308

Source: client information

The present master plan has been designed for accommodating 6 million passenger per annum.

Air Traffic Movements (ATM) forecasts

For domestic traffic the average number of passengers per ATM is expected to grow progressively from 120 passengers in beginning year to 162 in 2061. The domestic market will be predominantly operated by Code C Aircraft.

In the opening year the demand for cargo capacity has been estimated to be around 10,000 tonnes per year. Calculated air traffic peaks and design parameters in shown in **Table 2-3.**

Table 2-3: Air traffic peaks and design parameters

Combined Peak Hour Passengers	Combined Peak Hour ATM	Domestic Peak Hour Passengers	Domestic Peak Hour ATM	International Peak Hour Passengers	Int. Peak Hour ATM
2033	18	2027	17	558	5
2992	23	2971	21	909	7
3685	27	3660	25	1145	9
4322	30	4298	28	1362	10
Busy hour – Arriving					
1199	11	1196	10	310	3
1902	15	1889	14	571	5
2460	18	2444	16	776	6
3023	21	3006	19	992	7
Busy hour – Departure					

[10] Wingspan 52 m but < 65 m. Typical aeroplane B777 Series/B787 Series/A330 Family.
[11] Wingspan 65 m but < 80 m. Typical aeroplane BOEING 747-8/AIRBUS A-380-800.

Combined Peak Hour Passengers	Combined Peak Hour ATM	Domestic Peak Hour Passengers	Domestic Peak Hour ATM	International Peak Hour Passengers	Int. Peak Hour ATM
1199	11	1196	10	310	3
1902	15	1889	14	571	5
2460	18	2444	16	776	6
3023	21	3006	19	992	7

Source: Master Plan

The overall layout can be segregated into three distinct zones:

- Air side development
- City side development
- City side development for residential development

2.4.1 Airside Development

The airside facilities will include passenger and cargo terminal buildings, runway systems, aprons, taxiways, airfield lighting systems, air traffic control towers, Navigational Aid Systems (NAVAIDs), utilities and infrastructure including approach road, car parking, power supply system, stormwater drainage system, sewage treatment plant, etc. The salient design features of key project components of airside development are highlighted below:

Runway system

The Runway system is a defined rectangular area for the landing and take-off of aircraft. As it is intended to operate Code E aircraft[12], the length of the runway will be 3,800 meters while width of the runway is proposed as 45 m with paved shoulders of 7.5 m and grassed shoulder of 7.5 m on both sides giving a total width of 75m. The runway will also be able to take care of occasional landing/ take-off of Code F aircraft[13]. The planned runway orientation is in East - West (10-28) direction.

Table 2-4: Details of Runway System

Runway Orientation	10	28
Direction	West North West	East South East
Easting	17º58'27.41"	17º58'04.32"
Northing	83º29'03.84"	83º31'10.66"

Taxiway System: A taxiway connected to a runway at acute angle and designated to allow landing aeroplanes to turn off at higher speeds than are achieved on other taxiways and thereby minimizing runway occupancy times. A parallel taxiway is proposed at 190 m (taxiway centreline) from the runway centreline. The parallel taxiway has been planned to serve as an Emergency Runway for Code E aircraft during periods of maintenance, or operational requirements. A dual parallel taxiway is provisioned at 107.5 from the emergency runway/ full length parallel taxiway with length about 2607 m. The minimum width of the taxiways will be 23 m with shoulders of 7.5 m on either side giving a total width of 38 m.

Apron: Apron is a defined area on a land aerodrome intended to accommodate aircraft for the purposes of loading and unloading of the passengers, cargo, fuelling, parking or maintenance. Multiple apron taxi lanes have been planned to allow both aircraft push-back and aircraft circulation to occur simultaneously for code C aircraft[14].

Cargo Building: 10 acres land has been earmarked for cargo on the Eastern side of the airport land. Initially a cargo terminal will be developed in an area of 5,000 m^2. The proposed cargo facility will have International Cargo and Domestic Cargo operations as part of an integrated cargo complex. The cargo complex would provide with all ranges of facilities, under one roof at par with any international airport. The proposed cargo complex facilities shall be, as far as possible, of flexible and modular design, thus enabling the facilities to be adapted to the needs of the

[12] Wingspan 52 m but < 65 m. Typical aeroplane B777 Series/B787 Series/A330 Family.
[13] Wingspan 65 m but < 80 m. Typical aeroplane BOEING 747-8/AIRBUS A-380-800.
[14] Wingspan 24 m but < 36 m.

users and expanded as required in line with growth in cargo volumes and the changing trends and demands of the market. It will be equipped with modern cargo handling equipment like:

- Elevated Transfer Vehicle
- Forklifts
- High Mast Stackers
- Power Hydraulic Pallet trucks

A part of the cargo complex will be reserved for customs and other quarantine facilities. The cargo complex will be connected to cargo apron by taxiway and will have spaces reserved for parking of vehicles.

Passenger Terminal Building (PTB): The Passenger Terminal Building (PTB) has been planned with capacity of 6 MPPA. The gross floor area of the entire PTB in the initial phase will be 62,500 m^2. The PTB will consist of the following main elements:

- The Airport Plaza and Forecourt
- The Central Processor
- The Pier

The PTB is composed of two different zones - the Central Processor and the Pier. Each zone has the ability to expand independently of the other. This modular approach is the key to maximizing flexibility for phased development.

Traffic Forecourt: Traffic forecourt has been designed in a way that departing passengers are dropped off on the eastern side of the traffic forecourt while arriving passengers depart from the western side of the terminal. Taxis and buses will have dedicated kerb sides.

Airport Plaza: Airport Plaza is a general circulation area for passengers as well as for meters and greeters. Self-service check-in kiosks, ticketing counters, retail units and food and beverage outlets will be available in the Plaza. Departing passengers will enter the PTB through Plaza, while arriving passengers will exit the PTB into the Plaza. The Plaza is sheltered from sun and rain by the terminal roof, which extends over the outdoor space.

The Central Processor: The Central Processor is a two-level space with a roof that may cantilever over the large airport plaza. On the ground floor, the Central processor contains check-in, baggage reclaim area, outbound/ inbound baggage screening and sorting functions, service areas and airline offices. The passenger security screening, immigration, emigration, offices and commercial, Food and Beverage (F&B) offerings are planned on the first level.

The Pier: The Pier is a two-level space. Bus lounges, airport service areas and mechanical rooms and offices are located on the ground floor. The first floor contains boarding gate areas with seating and area for additional lounges, retail, food and beverage units.

ATC Tower and Offices: Air traffic control (ATC) will be centrally located towards west of the terminal. The control room will be on level 3 whereas other floors will be used for technical and other support. ATC tower will be constructed on a plot size of 11,000 m^2. ATC will allow 360-degree view of aerodrome. The ATC tower will provide Aerodrome Control and Flight Information Services.

Maintenance Repair and Overhaul (MRO) facility: MRO refers to buildings, apron and associated support facilities for maintenance and testing of aircraft. Unlike facilities which can be planned in-line with forecasted growth (i.e., terminals, fuel farm, cargo), MRO requirements are subject to demands from airlines utilizing the airport, and more importantly their need for MRO operations. The required area for aircraft maintenance, including apron, hangars, engine run up bay, aircraft washing area airside and landside circulation and support/ancillary facilities, is planned in western side for phase I and North East corner of the Airport for future phases of development.

An area of 25 Acres has been ear marked in the master plan for MRO of which 7 acres is identified at the Western Apron and 18 acres is allocated at the extreme North East corner of the Airport for future phases of development. The MRO facility will provide full Aircraft base maintenance service infrastructure. It will cater to the maintenance needs of the regional and global Airline customers.

GSE Maintenance Facility: The GSE maintenance area will include garages, workshops, rest rooms, break areas, mess facilities, storage rooms, paint booths, waste disposal, offices and employee parking and required facilities. The proposed GSE maintenance compound will have an overall size of about 10,000 m^2.

Airside Security Gates: Airside Security Gates are planned to control and ensure secure movement of only authorized/required persons, vehicles and other equipment or goods between the landside and airside areas. Emergency gates to be used in the event of any emergency are planned near each runway end.

Animal Quarantine: Livestock and livestock products can be imported as cargo through an airport. Upon arrival, the said consignments must be referred by Customs for Animal Quarantine Clearance to be compliant with quarantine health rules of the Government of India.

Security System: Security systems will be implemented within the passenger terminal for the following in line with Bureau of Civil Aviation Security (BCAS) regulations:

- Passenger and hand baggage screening;
- Hold baggage screening;
- Staff and goods delivery screening.

Green Space & Landscape Development: Green Space and Landscape development is an integral part of BIA Master Plan, and an important element of its environmental sustainability measure.

Landscape will be developed along approach road to Airport through plantation of avenue trees on either sides and through palms and flowering shrubs in the median. The car park area will be landscaped through a combination of shade bearing trees and shrubs. The entire landscape area will be irrigated though an automated irrigation system network with drips and sprinklers for water efficiency.

Interior Landscape inside the Passenger Terminal Building will be done through a diverse palette of plant materials with diverse and complementing textures, achieving a harmony between built and natural environment to create maximum impact to Air travellers.

Trees selected for plantation throughout the Airport will be so selected that they do not attract birds and bat species.

2.4.2 Cityside Development

Master plan for city side development will be developed separately from the airport master plan. Permitted Activities for the city side development will include the following:

Hospitality

- 5-start Hotels
- Eco, Adventure and Wellness Resorts
- 3-start Hotels
- Budget Hotels

Public Amenities:

- Post Office
- Telephone Exchange
- Police Station
- Conveniences
- Health Centre
- Hospital

Commercial & Office Space

- Shopping Plaza/shopping malls
- Office Space
- Airline Offices
- Government Offices

Education and Training

- Aviation Institute
- Aviation Related training

- College/university
- Skill Development Centres
- Facilities for associated employment

Logistic Facilities

- Logistic Operators Offices
- Custom Clearing Offices
- Warehouses
- Cold storage
- Packing centres
- Loading/unloading facilities, weighbridge, etc.
- Truck parking
- Drivers facilities
- Petrol/diesel/CNG pumps and other support services.

Tourist/ visitors' center, and cultural venues

- Leisure, entertainment and cultural venues
- Information desks and kiosks
- Tourist facilities, rest rooms
- Conference area
- Café and recreation
- Indoor and outdoor exhibition space
- Cultural Centre
- Museum and Art galleries
- Amphitheatre
- Open exhibition ground
- Art and craft workshop
- Recreation club
- Promotional activities of tourism

Access Road: The access road to the airport from the trumpet interchange at NH 16 will be provided by the Concessionaire as part of scope. A four-lane access road is proposed between the NH–16 connection point to the airport and the terminal area traffic loop.

The access road will be provided with four major roundabouts. The first roundabout is to the Airport utility functions in the West and to the area allocated for commercial development, the second roundabout will lead to the passenger terminal building, the third roundabout will serve the goods delivery, staff and admin buildings and the fourth roundabout at the extreme east will serve the cargo and the proposed logistics park adjacent to the cargo facility.

Loop road and parking areas: The car parking area is located to the North of the traffic forecourt. The Passenger Terminal, parking and taxi reservoirs are served by loop roads designed to facilitate way finding, minimising the internal traffic and to create an attractive approach to the Airport.

A traffic loop system has been included in front of the terminal building for connecting the main access road and other facilities. Proposed two loop roads will be as follows:

- One eastern loop for departures, with the departures forecourt
- One western loop for arrivals, with the arrivals forecourt

Parking for passengers is situated within the eastern loop. Within the western loop there is a taxi pick-up kerb. The car park area is divided into 2 zones for private cars and taxis; the private car zones are located in front of the departure zone behind the bus bays.

The area in front of the arrival zone will house taxi queuing for pick-up zone. Outside the loop, area for longer term taxi hold areas is provided in the landside aero support area The longer-term taxi hold areas for over 3,000 taxis is located adjacent to the western loop.

The car park will have facilities such as driver's restrooms, cafeteria and police booth.

2.4.3 Cityside for Residential Development

The total land earmarked for residential development is 139.16 acres. Master plan for the residential development will be separate from the airport master plan. Construction of residential facilities will be as per the applicable law.

Proposed master plan of the Bhogapuram international airport is shown in **Figure 2-6**.

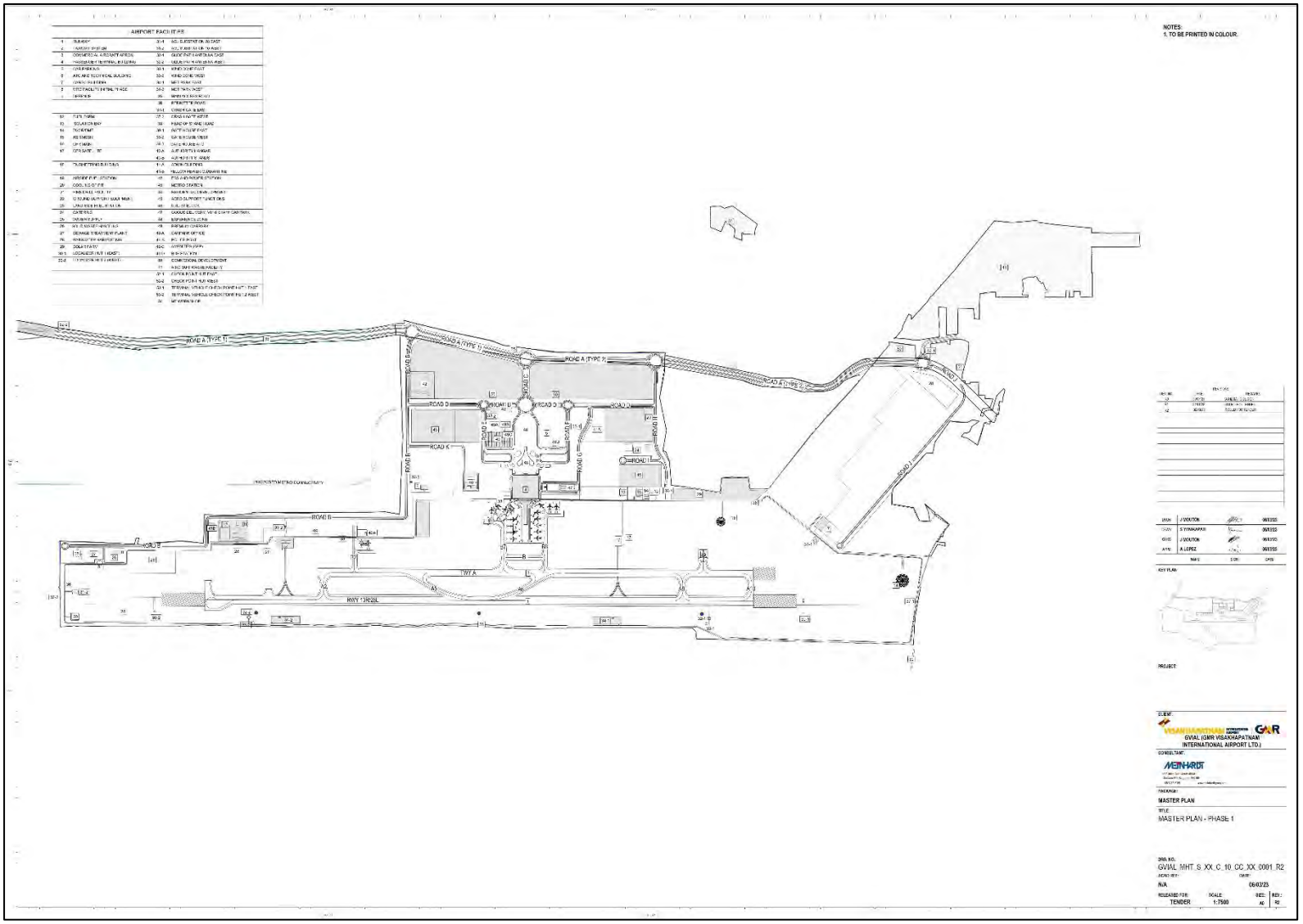


Figure 2-6: Diagram showing proposed Master Plan for BIA

2.5 Project Development Works

Various project development works in different phases of the project is described in section below:

2.5.1 Planning Phase

Pre- Development Works refer to the site development / enabling works undertaken to prepare the site for airport development. The planning and pre-construction phase involved the conceptualization of the project and has the following five components:

- Site selection.
- Preparation of DPR
- Land purchase process
- Site surveys as topographic, geo-technical investigations, micro-siting studies, etc.
- Preparation of Master Plan and various engineering drawings as per the requirement
- Approvals/clearances/ permits
- Displacement of Rellipeta, Bollinkalapalem, Mudasarlapeta and Maradapalem hamlets
- Relocation of impacted settlements in nearby R&R colony in Gudepuvalasa and Polipalli
- Design and finalization of contractors; and
- Mobilisation of Contractors

2.5.2 Construction Phase

The Planned construction activities will include the followings:

- Ground improvement works;
- Construction of retaining wall along the boundary of the site
- Construction of airside facilities (runway, taxiway, apron areas, ATC Complex, etc.)
- Construction of passenger terminal building, cargo building
- City side development
- City side for residential development
- Approach road

2.5.3 Operation Phase

Operation of airport includes all matters connected with operation and maintenance of airports. Regular O&M activities of airport includes:

- Management of Passenger traffic movement
- Management of Air traffic movement
- Management of Cargo movement
- Operation and maintenance of utilities
- Operation and maintenance – Runway/Taxiways/Apron
- Operation and maintenance Plant and Equipment

2.6 Resource Requirement

The natural resources required for the Project are given below:

2.6.1 Land Requirement

The Project has the following four key functional areas:

i. Airfield Development;

ii. Terminal Development;

iii. Landside Development; and

iv. Cargo Development.

The land requirement for the Project is in accordance with the Greenfield Airports Policy of the Ministry of Civil Aviation (MoCA) and is highlighted in **Table 2-5.**

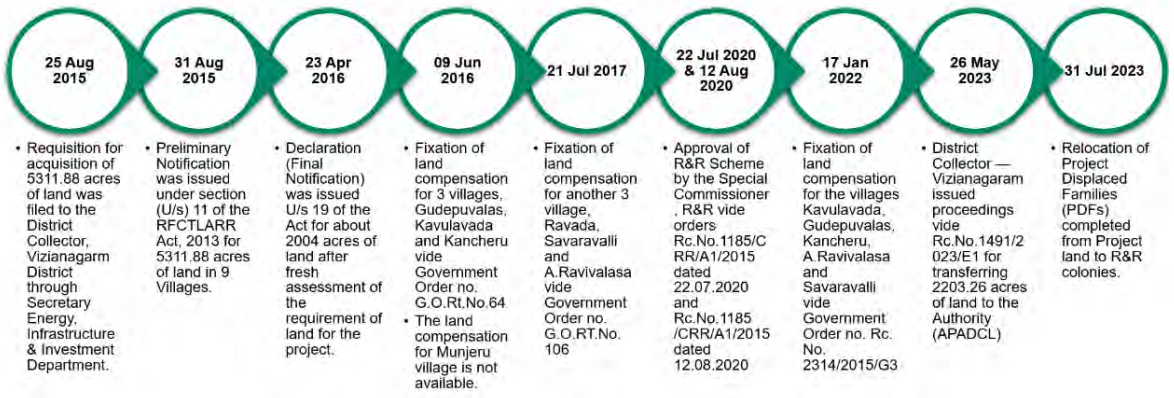
Table 2-5: Land requirement for the project

Sl. No.	Site Details	Area (Acres)
A	**Airport Site**	
i	Airside Development	1733.66
ii	Approach road from NH to Airport	92.20
iii	Approach for commercial/ cargo area	83.50
B	**City Side Development**	
iv	North of terminal building	98.62
v	Land Parcel C1 to C8, C12 & C13 (except C2)	56.12
C	**City Side for Residential Development**	
vi	Land Parcel C2	139.16
Total Area earmarked		**2203.26**

Chronology of Land Acquisition

Initially (in 2015) an estimated 5311.8 acres of land was proposed to be acquired for the Project from nine (09) villages. Later, over period of few years a number of meetings were conducted between APADC, State Government and Project Affected People and finally 2203.26 acres land was acquired. The chronology of land acquisition is shown below.

The land required for the Project is acquired and handed over by the Government of Andhra Pradesh. The acquired land parcel is predominantly a coastal plain area and spread over seven (07) villages namely Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district, Andhra Pradesh.



2.6.1.1 Key Aspects in Land Acquisition

The total land acquired for the development of Bhogapuram International Airport is 2203.26 acres, which includes 1453.71 acres of private land (locally known as Zeroyiti land), 505.42 acres of assigned land (land assigned by the Government to the landless poor persons) and 244.13 acres of Govt. land. The entire land of the Project spreads over seven (07) villages namely, Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district. The land for the Project was acquired by the Government of Andhra Pradesh as per the provision of Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR Act, 2013) and Andhra Pradesh Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014 (Andhra Pradesh Rules, 2014). The District Collector, Vizianagaram had issued proceedings vide Rc.No.1491/2023/E1 on 26th May 2023 for transferring entire land to APADCL (Refer Appendix M for details of the village wise land acquired for the Project, Refer Appendix N for Fixation of Land Compensation). Further, APADCL shall hand over required land to the GVIAL free from any encumbrance as per clause 4.1.2(a) and 10.3.1 of concessionaire agreement. During Site visit, it was informed by GVIAL that the transfer of entire land from APADCL to GVIAL will be completed as per applicable rules and formalities. The village wise procured land is given in **Table 2-6.**

Table 2-6: Details of village wise land acquisition and number of landowners

Mandal	Village	Total (in acres)	Number of affected landowners
Bhogapuram	Savaravilli	11.42	40
	A. Ravivalasa	39.21	55
	Gudepuvalasa	714.62	231
	Kancheru	748.05	716
	Kavuluvada	589.48	386
	Ravada	89.34	28
	Munjeru	11.14	9
Total		**2203.26**	**1465**

The Project had acquired land from total 1465 landowners in 7 villages. A total of 405 families were displaced due to the land acquisition from 4 villages (or hamlets) namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. The compensation of land was calculated after having prolonged negotiations with the landowners under the provisions of G.O.MS.No.262, Revenue Department, dated 13.07.2015 as per the provision Fixation of Higher compensation u/s 28 A of the RFCTLARR Act 2013, including all benefits like market value, solatium etc.

Compensations were paid to landowners for the lost assets on the land such as structures, trees, etc. As reported at the time of site visit, the compensations were paid to all the affected persons (landowners), except 111 landowners of 39.86 acres land. As the matter is under litigations for 39.86 acres on the title disputes in the Vizag Tribunal for which compensation was deposited by the state government in the designated account as per LARR Act requirement. The compensation amount will be released to the respective titleholders after the title dispute issues are resolved by the Vizag Tribunal.

As the landowners were not willing to receive the compensation fixed as per the LARR Act, the District Collector, Vizianagaram has fixed the market value of land on mutually agreeable compensation package reasonably higher than provided under LARR Act including all benefits like market value, solatium as per the provisions of G.O.Ms.No.262, Revenue (LA) Department, dt.13 July 2015. The State Level Committee agreed to the proposal of the District Collector, Vizianagaram for payment of higher compensation for the land acquisition for establishment of airport.

The rate at which land compensation paid to the landowners in the villages during the acquisition process vide Government Order (GO) is mentioned in **Table 2-7.**

Table 2-7: Village wise land compensation rates

Order No.	Date	Villages Name	Land Compensation (Per Acre)
G.O.Rt.No.64	09 June 2016	Gudepuvalasa	INR 33,00,000
		Kavulavada	INR 28,00,000
		Kancheru	INR 28,00,000
G.O.RT.No. 106	21-07-2017	Ravada	INR 35,00,000
		Savaravalli	INR 36,00,000
		A.Ravivalasa	INR 34,00,000
Rc. No. 2314/2015/G3	17.01.2022	Kavulavada	INR 52,00,000
		Gudepuvalasa	INR 57,00,000
		Kancheru	INR 52,00,000
		A.Ravivalasa	INR 59,00,000
		Savaravalli	INR 60,00,000

2.6.1.2 R&R Assistance

R&R Scheme has been developed and approved by the Special Commissioner, R&R vide orders Rc.No.1185/CRR/A1/2015 dated 22.07.2020 and Rc.No.1185 /CRR/A1/2015 dated 12.08.2020. Two resettlement colonies have been developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approximately 17 acres and 23 acres, respectively. The entire 40 acres of land on which R&R colony is being developed was the government land. Each PDFs were provided 5 cents (240 square yards) of land and INR 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013 for construction of houses and for other provisions.

All community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies after considering the provision of Schedule 3rd of the RFCTLARR Act, 2013. As on 19th August 2023, all the PDFs have voluntarily vacated the houses and relocated to the R&R colony after construction of houses. All the houses in the Project site were dismantled and no family are residing at present.

2.6.1.3 Land Acquisition Process

The land for the Project was acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014. Preliminary Notification under section (U/s) 11 of the RFCTLARR Act, 2013 was issued on 31.08.2015 for acquisition of about 5311.88 acres of land for establishment of an International Greenfield Airport at Bhogapuram in Vizianagaram District. Further, declaration (Final Notification) U/s 19 of the Act was issued on 23.04.2016. Finally, District Collector — Vizianagaram had issued proceedings vide Rc.No.1491/2023/E1 on 26th May 2023 for transferring 2203.26 acres of land to the Authority (APADCL). Further, APADCL shall hand over required land for the project to the GVIAL free from any encumbrance as per clause 4.1.2(a) and 10.3.1 of concessionaire agreement. However, during site visit, GVIAL has informed that the physical possession of the land from APADCL will be completed by September 2023. The procedure used for procurement/ acquisition of the land by the State government is presented in **Figure 2-7** below.

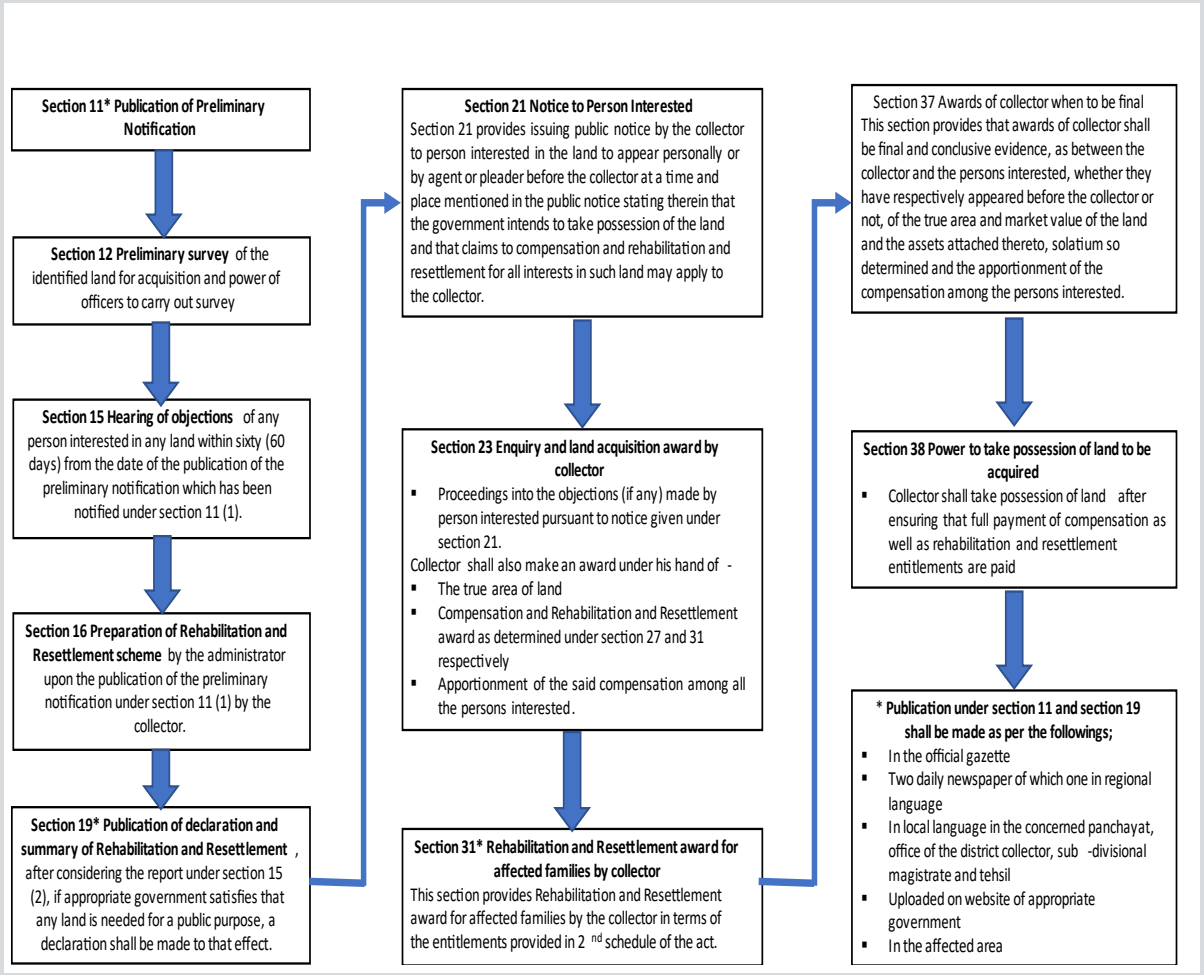


Figure 2-7: Land Procurement Process

As stated earlier, the sensitivities associated with the project land have been identified based on broad understanding of the project location including airport and associated facilities. The land related sensitivities are summarised in **Table 2-8:**

Table 2-8: Key aspects of land procurement process

Sl. No.	Physical Characteristics	Description
1.	Schedule V15 Area and Tribal Land	The land acquired for the Project does not comprise of any tribal land and this was further confirmed by the RDO-Vizianagaram during the consultation meeting. Though Vizianagaram district falls under Schedule V areas as defined in the Indian Constitution under Article 342 of the same but Bhogapuram Mandal[16] (where the Project is located) does not falls under the schedule V area. According to the 2011 census and the review of secondary data shows that A. Ravivalasa, Gudepuvalasa, Kancheru villages has nil ST population, whereas Savaravilli,(0.35%) , Kavuluvada (0.05%), Ravada (1.67%) and Munjeru (0.03%) has limited ST population as compared to Vizianagaram district (10.05%) and Andhra Pradesh State (7%).

[15] Scheduled Areas are areas identified by the Fifth Schedule of the Constitution of India. Scheduled Areas are found in ten states of India which have predominant population of tribal communities.
[16] https://vizianagaram.ap.gov.in/itda-profile/

Sl. No.	Physical Characteristics	Description
2.	Physical Displacement	Total 405 families are displaced from 4 hamlets namely Rellipeta, Bollinkalapalem, Mudasarlapeta and Maradapalem due to the acquisition of land for the project. Rellipeta, Bollinkalapalem falls in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem comes under Kavulavada Gram Panchayat. Out of 405 displaced families, about 65 PDFs are from SC community from Rellipeta hamlet. Two resettlement colonies are developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approx. 17 acres and 23 acres respectively. As reported, the entire 40 acres of land on which R&R colony is developed was the government land and no private land was acquired. Each PDFs were given 5 cents (240 square yards) of land and Rs. 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013. Further, all community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies after considering the provision of Schedule 3rd of the RFCTLARR Act, 2013. As on 19th August 2023, all the PDFs have voluntarily vacated the houses and relocated to the R&R colony after construction of houses. During site visit, all the 405 PDFs houses in the project area were dismantled and no family were residing in the project area. All the 65 SC PDFs from Rellipeta hamlet are relocated in the Gudepuvalasa R&R colony.
3.	Livelihood Dependency/Economic Impact	Individual socio-economic survey with 9 PDFs and stakeholder consultations with the group of few PDFs were carried out at the site. Most of the project affected persons are small and marginal farmers and mostly involved in the agriculture, animal husbandry and daily wage labourers. Some of the affected persons are involved in private jobs in nearby cities/towns and few have their own business such as petty shops. The main crops grown on the acquired land were Coconut, cashew, mangoes, groundnuts etc. During consultations with the PDFs, it was observed that the substantial numbers of PAPs are engaged in daily wage labourers in agriculture and construction works. The average monthly income reported by PDFs are ranging between INR 10,000 to INR 40,000 per month. Some of the consulted landowners have lost their entire land which leads to landlessness. The vulnerable PAPs were identified during the consultations such as women headed households (WHH), Elderly people (above 65 years) living alone and landlessness people. During consultation, it was observed that landowners have invested a large part of compensation on construction of new houses in the R&R colony. The acquisition of land likely to have an impact on livelihood of the impacted people.
4.	Encroachment and Presence of Non-Titleholders	No encumbrance or encroachment are reported on the acquired land parcels during stakeholder consultations with the local people and Village representatives. AECOM team has also not observed any encumbrance or encroachment on the acquired land during the site visit. This was further confirmed by the RDO-Vizianagaram during the consultation.
5.	Common Property Resources and Cultural Heritage sites	As reported during stakeholders' consultation, CPRs such as school building, Panchayat building, temples and communal land were impacted due to the acquisition of land. The state government has made the provision to restore the CPRs and other common amenities such as school building, panchayat buildings, temples, park, roads, drainage, drinking water etc. in both the R&R colonies as per 3rd Schedule of the RFCTLARR Act, 2013. There is no designated archaeological or cultural heritage site within 10 km radius of the study area village and there no cultural or religious important place is affected due to the project.
6.	Grazing Land	At the time of site visit, the project land has the presence of grass and shrubs due to the monsoon season. Construction of boundary wall on the Project land is in

Sl. No.	Physical Characteristics	Description
		process. Some grazing activities of sheep and goat were observed at the acquired land during the site visit. Consultation held with the nomadic shephard at the site, and they informed that they are from Kongavanipalem village which is about 8 km from the Site. These shepherds are from *Yadav* community and their primary occupation is rearing of sheep and goat. As reported, about 2000 shepherds families live in Kongavanipalem and other nearby villages. They usually use the open field within 10-15 km area for grazing livestock. During consultation, it was observed that grazing is not a big concern as lot of open fields are available for grazing for the livestock in nearby area.
7.	Landlessness	During consultations with the project affected persons, it was observed that there are few PAPs who lost entire land and they became landless. However, exact data on landless PAPs are not available for the review. Though the landlessness is likely to be envisaged, but the quantum is not assessed due to unavailability of data by the GoAP. R&R assistance of INR 9.70 Lakh (includes financial assistance of INR 5,00,000 against livelihood loss and INR 36,000 for subsistence allowance) to each 405 PDFs were paid to cater the economic displacement. This R&R assistance is over and above the land compensation given to each PDFs. Further, it is also observed that some of the families have purchased land in the nearby villages from to intact their livelihood.

The following procedure was applied to the Project for land acquisition.

- Publication of preliminary notification U/s 11 of the RFCTLARR act 2013: The appropriate Government that land in any area is required for any public purpose, a notification to that effect along with details of the land to be acquired shall be published U/s 11 (a) in the Official Gazette; (b) in two daily newspapers circulating in the locality of such area of which one shall be in the regional language; (c) in the local language in the Panchayat, Municipality or Municipal Corporation, as the case may be and in the offices of the District Collector, the Sub-divisional Magistrate and the Tehsil; (d) uploaded on the website of the appropriate Government; and (e) in the affected areas.
- Preliminary survey of land U/s 12: The appropriate Government to determine the extent of land to be acquired.
- Hearing of objections U/s 15: Any person interested in any land which has been notified under section 11, as being required or likely to be required for a public purpose, may within sixty days from the date of the publication of the preliminary notification may raise the objection.
- Preparation of Rehabilitation and Resettlement Scheme U/s 16: Upon the publication of the preliminary notification under section 11 by the Collector, the Administrator for Rehabilitation and Resettlement shall conduct a survey of the affected families and prepare a draft Rehabilitation and Resettlement scheme.
- Publication of declaration and summary of Rehabilitation and Resettlement U/s 19: After considering the report U/s 15, if appropriate government satisfies that any land for a public purpose, a declaration shall be made to that effect.
- Notice to persons interested U/s 21: The Collector shall publish the public notice on his website and cause public notice to be given at convenient places on or near the land to be taken, stating that the Government intends to take possession of the land, and that claims to compensations and rehabilitation and resettlement for all interests in such land may be made to him.
- Enquiry and land acquisition award by Collector U/s 23: On the day so fixed, or on any other day to which the enquiry has been adjourned, the Collector shall proceed to enquire into the objections (if any) which any person interested has stated pursuant to a notice given under section 21, to the measurements made under section 20, and into the value of the land at the date of the publication of the notification, and into the respective interests of the persons claiming the compensation and rehabilitation and resettlement.
- Parameters to be considered by Collector in determination of award U/s 28 :–In determining the amount of compensation to be awarded for land acquired under this Act, the Collector shall take various parameters into consideration such as market value, consequences of acquisition damages, etc.

- Rehabilitation and Resettlement Award for affected families by Collector U/s 31: The Collector shall pass Rehabilitation and Resettlement Awards for each affected family in terms of the entitlements provided in the Second Schedule.
- Awards of Collector when to be final U/s 37: The Awards shall be filed in the Collector‘s office and shall, except as hereinafter provided, be final and conclusive evidence, as between the Collector and the persons interested, whether they have respectively appeared before the Collector or not, of the true area and market value of the land and the assets attached thereto, solatium so determined and the apportionment of the compensation among the persons interested.
- Power to take possession of land to be acquired U/s 38: The Collector shall take possession of land after ensuring that full payment of compensation as well as rehabilitation and resettlement entitlements are paid or tendered to the entitled persons within a period of three months for the compensation and a period of six months for the monetary part of rehabilitation and resettlement entitlements listed in the Second Schedule commencing from the date of the award made under section 30.

2.6.1.4 Litigations in Land Procurement

- During site visit, it was informed by the RDO-Vizianagaram that the entire land is under the possession of State government. However, about 39.86 acres of land belongs to 111 landowners are under litigations (7 court cases) on the title disputes in the Vizag Tribunal. As reported, the compensation amount relating to 39.86 acres of land has been deposited by the state government in the court/designated account as per the LARR requirement. The compensation amount will be released to the respective titleholders after the title disputes will be resolved with the order of the Vizag Tribunal.
- Ordinance 5 of 201517 issued by government of India, which introduce section 10A in RFCTLARR Act, 2013 Section 10A referred that Chapter II (determination of social impact and public purpose) and Chapter III (special provision to safeguard food security) of the Act shall not be applicable for certain projects.
- Section 10A(1)(e) of the LARR Act, 2013, mentions that infrastructure project including projects under public private partnership where the ownership of land continues to vest with the Government. As, the proposed Project falls under the provision of this sub-section, hence, Chapter II and Chapter III of RFCTLARR Act is not applicable for this Project. Thereafter, in view of the said ordinance, district collector publishes the preliminary notification under Section 11 (1) of the RFCTLARR Act, 2013 for acquisition of land for the Project.
- Referring and citing a court case verdict, Kakarlapudi Satyanarayana Raju vs the State of Andhra Pradesh 2022 case, where Hon’ble High Court of Andhra Pradesh validated the notification issued under section 11(1) of the RFCTLARR Act, 2013 and uphold that the land acquisition without conducting social impact assessment study for the Project was valid.
- Except the 7 court cases mentioned above, there are another 54 cases pending with LARR Authority[18] involving demand for additional compensation on 156 acres of land. The entitled compensation amount has been deposited by the State Government with the LARR Authority in the year 2022 and 2023. The petitioners are being advised by APADCL to approach LARR Authority to look into their claims and accordingly the State Government will take final decision on the enhanced compensation amount. As entire land has been already acquired and in possession of APADCL (also handed over to GVIL) the construction of Project can start. On closure of cases, APADCL will deposit additional compensation amount with LARR Authority for payment to the entitled persons who have filed the cases.

2.6.2 Power Requirement

During construction phase, the Project will require 2.5 MVA which will be supplied by the GoAP and through dedicated DG sets. During operation phase, the estimated power requirement for the Project will be 20 MVA. The source of power for the Project will be from Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL). The power supply from State electricity board to the airport main intake 132 kV substations will be transmitted through 132 kV overhead line. Further, the voltage will be stepped down to 33/11 kV and all load centres

[17] https://dolr.gov.in/sites/default/files/RFCTLARR%20Act%20%28Amendment%29%20Second%20Ordinance%2C%202015.pdf
[18] Under section 51 of the LARR Act, the government for the purpose of providing speedy disposal of disputes relating to land acquisition, compensation, rehabilitation and resettlement, establish, an Authorities to be known as — the Land Acquisition, Rehabilitation and Resettlement Authority (LARR Authority).

will be fed with 11/0.433 KV substations. The emergency power back will be through six diesel generator (DG) sets of 2000 kVA capacity. Beside this, one additional DG set of 2000 kVA capacity will be kept as standby DG set.

2.6.3 Water Requirement

During construction phase, the domestic water requirement has been estimated to be 320 kiloliters per day (KLD) and 1663 KLD for civil works. Reportedly, the water supply will be met through water supply obtained from Vizianagaram Municipal Corporation. During construction phase, the wastewater generation is estimated at 280 KLD and will be disposed through soak pit and septic tank/portable STP.

During operation phase, the main users of domestic water will include:

- Aircraft potable water supply
- Catering facilities
- Toilets / laundries / cleaning fluids / and other domestic facilities
- Aircraft and vehicle washing
- Water demand from residential facilities and city side facilities

Non-domestic water demand will include water requirement for flushing, HVAC make-up and for landscape. Water is also used for hangars, aircraft washing, GSE and cargo area. Detailed water demand estimation has been carried out for different facilities considering total persons, area, Aircraft numbers, HVAC Tonnage, garden area, housing dwellings etc. for different planning phases as applicable. During operation phase the water requirement has been estimated to be 1727 KLD[19] whereas potable water requirement will be 822 KLD and nonportable water requirement will be 1254 KLD. The water demand for irrigation facility (horticulture) will be around 233 KLD. Water demand for irrigation during monsoon period (June-November) will be minimal or nil.

2.6.4 Construction Material Requirement

Construction materials such as cement, stone, aggregate, sand, steel etc. will be used for construction of various buildings like terminal building, ATC buildings, cargo buildings, etc. Different buildings as required for smooth operation of airport include the followings:

- Air Traffic Control (ATC) Complex for CNS/ATM services
- Gatehouses
- Fuel Farm and Fuel Hydrant System
- Ground Service Equipment maintenance facilities
- Catering Facilities
- Hangar for Authority
- Cargo Facilities
- Parking facilities
- Police Station and Customs Building
- Buildings for Navigational aids including radar
- Building for Meteorological services.
- Office space for other reserved services such as health services, security, customs and immigration.

Besides, other construction material as required for construction of access road, approach roads, runways, taxiways, apron includes asphalt, soil, clay, etc.

Emphasis will be made on choosing materials that are appropriate for a modern airport. The materials will be easy to maintain and should be environmentally friendly both in their means of production and in their use within the terminal building.

[19] Water requirement for commercial development has been done assuming development of 10% area. Water demand for residential area has not been included due to lack of information at the moment.

The tentative estimated requirement of principal materials required for construction of the Project is given below in **Table 2-9**.

Table 2-9: Construction Material Requirement

Construction Material Requirement	Quantity	Unit
GSB	1,19,44,755	Cum
Aggregates	16,29,936	Cum
Bituminous	21,378	Cum
Structural Steel	23,51,250	Kg
TMT Bar	11,57,863	Kg
Sand	15,812	cum
Cement	1,04,806	bags

Source: GVIAL

It has been estimated that the Project will generate 10.5 million cum of excavated material. Excavated material from the Sites will also be recycled for the levelling purpose. However, the required additional balance quantity will be procured from quarry located at nearby village Kongavanipalem. GVIAL has obtained approval of 8.94 acres of quarry area for meeting the construction material requirement.

2.6.5 Workforce Requirement

At the time of site visit, it was observed that the Project was in pre-construction stage, where construction of boundary wall was initiated (in July). As reported, M/s GVIAL is yet to finalise the EPC contractor. Upon mobilisation of EPC contractor, the entire construction work will be completed in 2.5 years.

Reportedly, the total number of workers to be engaged during peak construction period is expected to be 5500 labourers whereas workforce requirement during operation phase will be around 1000. Local as well as migrant skilled labourers would be involved for the construction work. Reportedly, locals will be preferred for engagement based on skill set and availability of work force. Labour camp facility will be developed for the migrant workers. Considering 50% ratio of local and migrant workforce, it has been estimated that labour camp facility to be developed for 2500-3000 work force.

2.6.6 Labour Camp

Few labour camp facilities will be developed for migrant workers. As reported, labour camp facilities provided to workers as part of the employment contract will be developed with certain minimum specifications in respect of the nature and standard of the accommodation and facilities following International Labour Organization (ILO) guideline as far as possible. The guidelines and recommended facilities like drinking water, separate kitchen, fans, beds, toilets and power supply to be provided to the workers/labours in the labour camp.

Housing space: Adequate housing space for labours should be provided. As per International Labour Organization (ILO) standards, the floor area of workers' sleeping rooms should not be less than 7.5 square meters in rooms accommodating two persons; if a room accommodates more than four persons, the floor area should be at least 3.6 square meters per person. Followings shall be considered:

- Adequate arrangements for comfortable and secure living within the sleeping room
- Arrangements for secured locker etc. for safe keeping of the labours' individual and personal belongings. which can be locked by the occupant to ensure privacy.
- Common Hygienic dining rooms, canteens or mess rooms, should be located away from the sleeping areas.

Potable water: Adequate supply of safe potable water will be ensured for the labour camp. The drinking water provided to the workers will meet drinking water standards.

Sanitation facilities: Proper functional toilets separate for male, and female will be provided. Number of toilet facilities will be provided following CPHEEO guideline of sanitary requirement. The disposal of wastewater should be managed through septic tank and soak pit/Portable STP. Followings will be ensured:

- Proper and adequate drainage system to drain out the wastewater to avoid any kind of contamination or spread of disease thereby.

- There must have arrangements for safeguard of health issues and immediate arrangements for addressing accidental incidents.

2.7 Pollution Sources

In an airport project, pollution vastly occurs during the construction phase in the form of air emissions, noise, vibration, wastewater, muck and debris generation. The operation phase of an airport plant causes pollution due to aircraft emission, aircraft noise, vehicular emissions and solid waste and wastewater generation from terminal building and MRO facilities.

Major construction activities of airport project are levelling of site, construction and erection of main airport structures like terminal buildings, runways, taxi ways, auxiliary buildings etc., and associated equipment in operation. The impacts are on land use, soil, air quality, aquatic Ecology, demography and socio-economics, access roads and public expectations.

During Operation Phase the potential significant impact include the following:

- Noise and vibrations
- Stormwater and wastewater
- Hazardous materials management
- Solid waste
- Air emissions
- Energy and water consumption

The various pollution sources from the Project have been discussed below:

2.7.1 Air Emissions

The major sources of air pollution during construction phase are use of machinery and equipment, vehicular emissions, emissions from crushers, dust emission from Aggregate Processing Plant/Batching Plant. The sources have been described below in detail.

Construction Phase:

Construction Machinery/ Equipment and DG Sets

The machinery and equipment used during the construction activities require large quantities of fuel, mostly diesel. Diesel combustion results in emission of particulate matter (PM), nitrogen oxides, (NOx) and sulphur dioxide (SO_2). However, the impacts are usually short term and limited to construction phase only.

Similarly, the use of DG sets at project site will also result in diesel combustion. Major emissions on account of DG set operation will be PM, SO_2 and NOx.

Aggregate Processing Plant/Batching Plant

Major emissions will be generation of dust comprising mainly of suspended particulate matter (SPM), respirable particulate matter, SO_2 and NOx.

Other Sources

There will be increased vehicular movement for transportation of construction materials to the site. Large quantity of dust is likely to be generated due to the movement of trucks and other heavy vehicles. Therefore, marginal increase in fugitive dust hydrocarbons, SO_2 and NO_x levels are anticipated during construction phase.

Increased dust emissions due to storage and use of construction material like sand and fine aggregates will also occur.

Operation Phase:

The main sources of airport air emissions include combustion exhaust from aircraft during landing and take-off and ground operation, from ground service vehicles, vapours from fuel storage and handling, and emissions from local ground transportation activities servicing the airport.

2.7.2 Noise and Vibrations

The construction activities such as operation of construction machinery, vehicular movement, operation of DG sets is expected to have adverse impacts on the ambient noise levels in the area.

During operation phase the main sources associated with airports include:

- **Aircraft Noise**: The most significant sources of noise and vibrations from airport operations are aircraft during the landing and take-off (LTO) cycles.
- **Ground Noise**: Sources of noise includes variety of ground operations equipment including aircraft taxiing; operation of ground support vehicles (e.g. passenger buses, mobile lounges, fuel trucks, aircraft tugs, aircraft and baggage tractors, and dolly carts); aircraft auxiliary power units (APUs); and aircraft engine testing activities in airports with aircraft maintenance activities. Other indirect sources of noise include ground vehicle traffic from access roads leading to the airport.

2.7.3 Wastewater Generation

Construction Phase

Wastewater is likely to be generated from the following sources:

- **Construction Sites**: Run off from construction site, workshops for machinery maintenance and fleet maintenance.
- **Domestic**: Labour camps, Project Office, etc.

From Construction plants and Workshops

During construction phase, aggregate processing plant and batching plants will be established. In aggregate processing plant, water is required to wash the boulders and to lower the temperature of the crushing edge. Similarly batching plants require water for concrete mixing. The wastewater generated contains high suspended solids. Major pollutants from workshops will be oil and grease.

From Labour Campsites and project Office

Sewage will be generated from the labour campsites and project office. Improper disposal of untreated sewage can result in contamination of water and soil in the area. Also, untreated disposal can lead to various health risks to the workers and local villagers.

It is estimated that approx. 320 KLD of domestic water will be required for the labour camp. The quantity of sewage generated from labour camps will be 280 KLD (considering 80% of sewage generation from the domestic demand). Sewage will be treated in the septic tank and soak pit/portable STP. The treated water will comply with discharge standards.

Operation Phase

Sanitary wastewater from public and employee services and from airplanes

The main users of water include:

- aircraft and vehicle washing
- aircraft potable water supply
- catering facilities
- toilets / laundries / cleaning fluids / and other domestic facilities

It is estimated that approximately 1254 KLD of sanitary wastewater will be generated. Sewage will be treated in the proposed sewage treatment plant (STP) of 1400 KLD capacity. The treated water from the STP will be recycled for flushing, horticulture and HVAC make up water.

Sewage Treatment:

Wastewater generated from hangars, aircraft washings, Cargo and GSE workshop will be passed through Screens, Oil-Water separator and Grit Chamber. Overflow will be sent to STP for further treatment.

STP Scheme: Sewage treatment plant of 1400 KLD capacity will be installed. The treated water from STP will be recycled and used for Flushing/Cooling and landscape. The STP treatment scheme will consists of following treatment units:

- Equalization Tank
- Moving Bed Biofilm Reactor (MBBR)
- Pressure sand filter + Activated carbon filter
- Disinfection (chlorination or UV sterilizer)
- Filter Press

2.7.4 Solid Waste Management

Airports produce a large quantity of wastes from a wide variety of sources including waste food from food establishments, packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers from offices and common passenger areas. Sources of solid waste from airports will be segregated into following types:

- in-flight wastes
- scrap wastes
- catering wastes
- domestic and office wastes
- textile, plastic, rubber and metal from aircraft refurbishment
- Horticulture waste

Solid Waste Management (SWM) System is planned for BIA to ensure hygienic and healthy living / working environment at the airport. Solid Waste Management Plan is aimed at managing the generation, storage, and disposal of municipal solid waste and hazardous waste generated. Solid Waste Management Plan includes detailed program for reduction of waste generation, increase recycling/ reuse of waste and dispose waste through scientific approach. The following tasks are accounted as part of solid waste management methodology:

- Identification of waste generation sources.
- Waste segregation, handling and processing.
- Waste collection, storage and transportation.
- Treatment and disposal of wastes.

Recyclable wastes such as paper, glass, metal, plastics (from domestic and commercial activities) will be recycled through local recycler. Hazardous waste like waste oil and solvents (from maintenance and engineering operations) will be disposed of through CPCB/APPCB approved recycler. Food waste including kitchen wastes and vegetable oils (from restaurants, food courts etc) shall be converted to manure. The green wastes from landscape / gardens shall be used in bio conversion processes.

It is proposed to install a series of collection and deposit systems across the airport, eventually culminating in bulk deposit bins located on the landside at selected locations. From these locations an external agency will collect the bins at periodic intervals using modern mobile collection vans. The recyclable waste will be dispatched to respective recycling agencies, and to a composting facility for treatment of biodegradable waste.

The generation of solid waste and the method of disposal will be as follows:

Table 2-10: Solid Waste Generation and Method of Disposal

Type of waste	Quantity	Method of Disposal
Solid Waste	19.4 MT/day	
Biodegradable Waste	16.3 MT/day	Shall be converted to manure
Recyclable waste	1 TPD	Shall be recycled
Inert waste (street sweeping)	2 TPD	Disposed off in municipal waste disposal site

Commercial Waste	4.2 TPD	Shall be collected in twin bins and will be disposed to nearby municipality waste disposal site.
Waste lubricating Oil	50 LPA	Shall be sent to authorized agencies through APEMCL.
Biomedical Waste	Actuals	Shall be collected and disposed as per Bio-medical waste rules

2.7.5 Storm Water Drainage

Stormwater runoff may include pollutants associated with leaks and spills of oil, diesel, and jet fuels during operation and maintenance of ground service vehicles, and fuel storage and handling activities. Planning of efficient storm water drainage network is one of the most important parts of the overall airport planning.

A suitable storm water drainage system will be designed to meet operational needs and environmental standards. Depending upon the areas to be served, various types of storm water drains will be considered for the entire Project site.

The following E&S aspects will be considered for drainage of the site.

- There is no natural major drains flowing inside or close to the project site so that the development of airport could majorly alter the drainage pattern of the project site. During the development of roads and site preparation the drainage courses/ natural gradient to be properly maintained to drain the runoff water from the airport. Adequate drains will be provided within the airport area to drain out standing water in case of waterlogging. The drainage plan to consider highest rainfall of the area, engineering design with respect to natural gradient of the site, ground water aquifer recharge data, stormwater network and impact on the upstream and downstream areas to avoid flooding and inundation.
- There is a small village located about 500m from the proposed airport site (Gudepuvalasa village on northward) and planned development of plots/ resorts (500m on western side and about 100m on eastern side) which needs to be taken care while developing the airport drainage plan to ensure that the runoff water from the airport does not impact the village/ community.
- Drainage network should be maintained to ensure clear functioning and sufficient water retention capacity to hold the expected waterlogging impacts (in case of extreme/ heavy rainfall).
- The Concession Agreement (CA) stipulates at least 50% of all the storm water run-off generated will be harvested which will be used to recharge the aquifer or used as irrigation water. A rainwater harvesting pond is proposed along the main drain alignment path.

2.7.6 Hazardous Material Management

Airport operations will include the storage and handling of fuels (e.g. jet fuel, diesel, and gasoline) primarily associated with aircraft fuelling activities as well as with ground support vehicles. Major hazardous materials associated with the airport projects includes:

- Aviation Turbine Fuel (ATF)
- HSD for ground service vehicles and DG set
- Hazardous wastes generated at airport premises (engine oil, hydraulic oil, transformer oil, lube oil, gear oil)

Fuels will be stored in storage tanks and conveyed to dispensing locations via piping systems that may be subject to accidental releases during transfer or leaks due to tank and piping containment failure.

The location of fuel facility is crucial, as it influences both incoming supply lines and potential fuel transmission lines from the facility to apron. The fuel farm will be provided with a safety zone according to local regulations. The fuel farm is located at Western precinct with exclusive surface connectivity on both landside and airside. Based on an ultimate fuel storage capacity of 7-days reserve and related ancillary facilities, an area of 43,000 sq.m has been reserved in the master plan.

Mobile dispensers will be used to pump fuel into the aircraft from the hydrants. Parking facilities for fuel dispensers will be provided near the apron.

The plans for the fuel farm will take into account the following infrastructure and operations:

- Offloading facilities for Jet A1 fuel,

- Storage facilities for fuel,
- Bunded areas for fuel tanks,
- Pump station to supply the fuel hydrant system and airside loading racks,
- Fuel Hydrant System,
- Airside loading and off-loading racks,
- Slop tanks for drain from filters and sump drain in storage tanks,
- Fuel sampling system,
- Firefighting strategy,
- Airside fuel operators facilities.

The summary of the estimated peak fuel demand and storage for estimated 7 days storage capacity provided in fuel farm is presented in **Table 2-11**.

Table 2-11: Details of fuel storage facility

Particulars	Details
Storage Capacity	7500 KL (ATF) 999 KL X 6 (Diesel)
Fuel Usage (cum/month)	5000

2.7.7 Energy Conservation Measures and Environmental Sustainability

Airports are significant resource users in terms of energy consumption during the construction and operational phases. The main use of energy in airports include:

- aircraft and vehicles,
- construction activities
- heating, ventilation and air conditioning systems
- lighting, both externally, (runway, airfield and roads) and internally (terminals, offices and other buildings)
- passenger and baggage handling facilities

Energy consumption will be minimized through the usage of following energy efficient materials and systems. The highest level of energy saving potential will be achieved by using of the modern technology. Following energy conservation measures will be adopted:

- Higher insulation levels in walls and roofs;
- High performance glazing;
- Efficient lighting design;
- Efficient HVAC system;
- Demand control ventilation using occupancy sensors;
- Artificial lighting control via daylight sensor; and
- Adoption of high efficiency light fittings.
- Utilization of Solar Energy

2.8 Project Implementation Schedule

The Project will be completed in 30 months from the start date of construction.

3 Environment and Social Regulatory Framework

The policies, regulations and administrative framework within which the Project is to be implemented with respect to environmental management and protection are reviewed in this section. The review includes the Environmental and Social Policies and Regulations of the IFC, NIIF, US DFC and Government of India; the administrative framework of various agencies, such as the Ministry of Environment and Forest, the Pollution Control Boards and other bodies associated with the implementation of the proposed project. This section highlights only the relevant environmental and social policies and regulations which are applicable for this project:

- Applicable local, national, and state level environmental and social (including occupational health and safety, land, labour, public liability and, industrial relationship) laws, regulations, and standards,
- NIIFL Environmental and Social Management Framework,
- IFC Performance Standards, 2012,
- World Bank Group (WBG) General Environmental, Health and Safety (EHS) Guidelines, April 2007,
- WBG EHS Guidelines for Airports, April 2017,
- US DFC Environmental and Social Policy and Procedures (ESPP), January 2020

3.1 Policies and Regulatory Framework of Government of India (GoI)

Constitutional Provisions

The Constitution of India, in Article 48, of Directive Principles of the State, states that “the state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country”. Further Article 51-A (g) of fundamental duties, emphasizes that, “It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures”. These two provisions of the constitution are the guiding principles for the environmental legislation in India.

The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to sustainability and protection of the environment and its various components. The statutory requirements for the proposed project are discussed briefly in the following paragraphs.

The Environment (Protection) Act, 1986

The Environment (Protection) Act, popularly known as EP Act, is an umbrella legislation that supplements existing environmental regulations. Empowered by the EP Act, the Ministry of Environment, Forests and Climate Change (MoEF&CC), GoI has issued the following notifications regulating the siting of industry and operations, procuring clearance to establish industries and development of projects with appropriate Environmental Impact studies, and many other aspects of environment through notifications. The various policies, guidelines, and regulations as may be applicable for the project is discussed under following sub-sections:

3.2 National and Regional Enforcement Authorities

In India the Ministry of Environment, Forests and Climate Change (MoEF&CC) is the apex administrative body for (i) regulating and ensuring environmental protection; (ii) formulating the environmental policy framework in the country; (iii) undertaking conservation & survey of flora, fauna, forests and wildlife; and (iv) planning, promotion, co-ordination and overseeing the implementation of environmental and forestry programmes. Environmental and social aspects of the Airport projects are governed by Ministry of Environment, Forests and Climate Change (MoEF&CC), National Green Tribunal (NGT), Central Pollution Control Board (CPCB), Andhra Pradesh Pollution Control Board (APPCB), Ministry of Civil Aviation (MoCA). Several laws have been framed for protection of environment, social and for Occupational Health & Safety in India by the Central Government. A brief description of the relevant enforcement agencies with respect to the institutional framework is described in ***Table 3-1*** below:

Table 3-1 Enforcement Agencies Relevant to the Project

Sl. No.	Name of the Agency	Description
1.	MoEF&CC	MoEF&CC is the apex body in India which has been formulated to plan, promote, co-ordinate and oversee the implementation of India's environmental and forestry policies and programmes. Various acts like The Environment (Protection) Act 1986, as amended in April 2003, The Air (Prevention and Control of Pollution) Act, 1981, amended in 1987 and The

Sl. No.	Name of the Agency	Description
		Water (Prevention and Control of Pollution) Act, 1974, amended in 1988 have been developed. It is the responsibility of the apex body to ensure the compliance under the acts to maintain stipulated standards and environmental management through various supporting rules promulgated under the Acts.
2.	National Green Tribunal (NGT)	The NGT was established under the National Green Tribunal Act 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources. The Tribunal is mandated to make and endeavour for disposal of applications or appeals finally within 6 months of filing of the same. New Delhi is the Principal Place of Sitting of the Tribunal and Bhopal, Pune, Kolkata and Chennai are the other four place of sitting of the Tribunal.
3.	Central Pollution Control Board (CPCB)	The CPCB was established in September 1974, for the purpose of implementing provisions of the Water (Prevention and Control of Pollution) Act, 1974. The executive responsibilities for the industrial pollution prevention and control are primarily executed by the CPCB at the Central level, which is a statutory body, attached to the MoEF&CC. CPCB works towards control of water, air and noise pollution, land degradation and hazardous substances and waste management.
4.	Andhra Pradesh Pollution Control Board (APPCB)	APPCB is a statutory authority entrusted to implement environmental laws and rules within the jurisdiction of the State. The Board ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State.
5.	Ministry of Labour and Employment	The main responsibility of the Ministry is: • to protect and safeguard the interests of workers; • to create a healthy work environment for higher production and productivity; • to develop and coordinate vocational skill training and employment services; • to promote welfare and providing social security to the labour force.
6.	Ministry of Civil Aviation (MOCA)	The main industry regulator is the Ministry of Civil Aviation (MOCA). MOCA formulates the national policies for all aspects of the industry and the regulations of the Civil Aviation industry in India. It implements and administers the regulations and governing policies through it's supporting regulatory bodies.
7.	Directorate General of Civil Aviation (DGCA)	The prime regulatory responsibility of the DGCA is to develop policies, standards and practices to ensure the safety of all services provided within and in over-flights through Indian airspace. The DGCA leads the coordination of all aspects of operation that have to be harmonized with Defence service operations in India for use of airspace. This applies to airlines, Indian and foreign carriers operating to and from India, airports, Air Navigation Services, coordination with countries whose airspace border on Indian airspace over terrain and international waters.
8.	Bureau of Civil Aviation Security (BCAS)	The BCAS specifies the standards and procedures required to ensure the security of all flights operating at Indian civil airports irrespective of ownership, and at civil enclaves at defence airfields. The BCAS's regulations cover the perimeter of the airport, the operational areas and the passenger and cargo terminals and entry of all personnel and equipment and vehicles into the airport. The force providing airport security

Sl. No.	Name of the Agency	Description
		services, be it the CISF, airline staff and any other appointed staff must meet BCAS standards, procedures and requirements. BCAS essentially follows the actions required to implement ICAO Annex 17, which deals with aviation security (AVSEC) in India. It's functions include inspecting and monitoring the services provided at airports, coordination of all security issues with other ministries and regulatory bodies and international bodies, and all requisite actions to ensure AVSEC at airports and on flights.
9.	Divisional Revenue Office, Vizianagaram	Notification of acquisition of land as per RFCTLARR Act 2013, fixation of compensation, Preparation of R&R scheme and its implementation, resolution of land related grievances and transfer of encumbrance free land to the Authority. 2203.26 acres land for the proposed project is acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra RFCTLARR Rules, 2014. District Revenue department to transfer the land to APADCL after payment of compensation and R&R entitlements. Further, APADCL shall hand over required land for the project to the GVIAL free from any encumbrance as per clause 4.1.2(a) and 10.3.1 of concessionaire agreement. Land related grievances (if any) to be resolved by Divisional Revenue Office, Vizianagaram as per the provision of the act.
10.	Gram Panchayat	Gram Sabha or the Panchayats are the local bodies which have been defined by the 73rd Constitutional Amendment Act, 1992. Panchayats have to be consulted before making the acquisition of land in the Scheduled Areas for development projects and before re-settling or rehabilitating persons affected by such projects in the Scheduled Areas. The responsibilities that have been entrusted upon Panchayats comprises of the preparation of plans for economic development and social justice and the implementation of such schemes for economic development and social justice, as may be assigned to them.
11.	Divisional Forest Office, Vizianagaram	Approvals regarding tree felling and transit permit to be obtained from the State Forest Department. As none of the Project area falls under forest or ESZ, or lies within protected area or wildlife corridor, the wildlife/forest clearance is not applicable to the Project.

3.3 Applicable Environment and Social Laws and Regulations

Table 3-2 summarizes the key regulations that are relevant to the Project across its lifecycle.

Table 3-2: Applicable Environment and Social Laws and Regulations

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
1.	The Water (Prevention & Control of Pollution) Act 1974	Andhra Pradesh Pollution Control Board (APPCB)	As per provisions of Water (Prevention and Control of Pollution) Act, 1974 all new intending projects (Developmental & Industrial) are required to obtain "Consent" from State Pollution Control Board.	**Applicable and Obtained (Appendix E)** As per the APPCB consent policy and categorization of industries for Consent management "**Airports and Commercial Air Strip**" projects are considered as "**Red Category**" Projects. As per the regulatory requirements, obtaining prior consent of the board is mandatory requirement for the project. **Consent to Establish** has been obtained from APPCB for the project through Order **No. 599/APPCB/CTE/RO-VZM/HO/2023 dated 19.05.2023**.
2.	The Air (Prevention & Control of Pollution) Act 1981	Andhra Pradesh Pollution Control Board (APPCB)	As per provisions of Air (Prevention and Control of Pollution) Act, 1981 all new intending projects (Developmental & Industrial) are required to obtain "Consent to Establish" from State Pollution Control Board.	**Applicable and Obtained (Appendix E)** As per the APPCB consent policy and categorization of industries for Consent management "**Airports and Commercial Air Strip**" projects are considered as "**Red Category**" Projects. As per the regulatory requirements, obtaining prior consent of the board is mandatory requirement for the project. **Consent to Establish** has been obtained from APPCB for the project through Order No. **599/APPCB/CTE/RO-VZM/HO/2023 dated 19.05.2023**.
3.	Guidelines/ Criteria for evaluation of proposals/ requests for ground water abstraction (With effect from 24.09.2020)	Central Ground Water Authority	As per CGWA notification number S.O. 3289 (E) dated 24th September 2020 all new/existing industries, industries seeking expansion, infrastructure projects and mining projects abstracting ground water, unless specifically exempted, will be required to seek No Objection Certificate from Central Ground Water Authority or, the concerned State/ UT Ground Water.	**Applicable (if groundwater extraction is proposed)** No Groundwater abstraction is proposed. The project has obtained water supply permission from the **Rural Water Supply and Sanitation (RWS&S), GoAP**. Water demand during construction phase will be managed through tanker water supply/water supply from RWS & S (if granted).
4.	Forests (Conservation) Act, 1980 and Rules 1981	Forest Department	The Forest Conservation Act and Rules mandate projects requiring diversion of forest land for non-forest	**Not Applicable** No forest land diversion is proposed for the project.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
			purposes to seek Forest Clearance from the Ministry of Environment and Forests.	
5.	Tree cutting NOC and Transit Permit	Andhra Pradesh State Forest Department	As per Andhra Pradesh Water, Land &Trees Act 2002. (GO MS No.87, dt: 29-11-2017) permission for cutting of certain types of trees located in the project site to be obtained.	**Applicable** Approval of the Forest Department is required for felling of trees in the project area. Procedure for tree cutting permission is Tree cutting permission is governed by the latest GO MS No.87, dt: 29-11-2017.
6.	Environmental Impact Assessment (EIA) Notification 2006	MoEF&CC	The EIA Notification, as amended in December 2009 by MoEF&CC, mandates that all airport projects are categorized as Category A and project should obtain Prior Environmental Clearance from MoEFCC before start of any construction activity.	**Applicable and Obtained (Appendix D)** Environment clearance issued earlier to M/s Bhogapuram International Airport Corporation Limited vide letter F. No. 10-21/2016-IA.III dated 14.08.2017 and has now been transferred to M/s GMR Visakhapatnam International airport Limited vide letter dated 24.03.2023.
7.	Environment Protection Act, 1986 and as amended till date	CPCB & APPCB	Permissible limits for ambient air quality, water quality, noise limits have been laid down by CPCB under EP Act, 1986 which requires to be complied with.	**Applicable** Permissible limits for ambient air quality, water quality, noise limits are required to be complied with.
8.	Noise (Regulation and Control) Rules 2000 amended in 2010	APPCB	The Rules stipulate ambient noise limits during daytime and night-time for industrial, commercial, residential, and ecologically sensitive areas. The rules apply both during the construction and operation of the project. Violation of the standards for assessing the noise quality due to the project will lead to penalty as under the EPA Act 1986.	**Applicable** Permissible limits for noise are required to be complied with.
9.	Solid Waste Management Rules 2016,	Local Authority	As per the provisions of the rules, it is the duty of the waste generator to ensure proper collection, segregation, storage and disposal of waste.	**Applicable** The proposed project is envisaged to generate different categories of non-hazardous wastes such as packaging waste, metal scrap and other solid wastes. Solid waste should be managed as per the provisions of SWM Rule, 2016.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
10.	Construction and Demolition Waste Management Rules, 2016	Local Authority	As per the provisions of the rules every waste generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated. It is to ensure that project shall keep the construction and demolition waste within the premise or get the waste deposited at collection center or handover it to the authorized processing facilities; and ensure that there is no littering or deposition of construction and demolition waste in a manner, which causes obstruction to the traffic or the public or drains.	**Applicable** The proposed project activity is envisaged to generate construction i.e. Asphaltic concrete paving, concrete, concrete reinforcing steel, Brick, Concrete masonry units, etc., during construction of the project. Thus, the provision of this regulation will be applicable forthe project. If waste generation is more than 20 tons/day or 300 tons/month project should get appropriate approvals from the urban local body before starting construction or demolition work.
11.	Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016.	APPCB	The rule outlines the responsibilities of the generator, transporter, and recycler/re-processor of the hazardous wastes for handling and management in a manner that is safe and environmentally sound. Project proponent needs to obtain authorization from State Pollution Control Board for generation, handling storage and transport of hazardous waste.	**Applicable (to be obtained for Construction and Operation Phase)** The project is expected to generate hazardous waste in the form of waste oil from DG sets, engine oils, oil-soaked cotton waste from maintenance activities, etc. during construction phase hazardous waste in the form of waste oil, paint drums, drums containing hazardous chemicals and solvents, etc. are also expected. Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016 to be obtained.
12.	Environment (Protection) Rules 1986 and its amendment	MoEF&CC	The DG sets to be installed should comply with maximum permissible noise levels and noise control measures for diesel generators as specified in the Act.	**Applicable** The project is envisaged to generate dusts, fumes, gaseous emissions, solid and hazardous wastes, noise emissions during both construction and operation of the project. Thus, as per regulatory requirement, these potential pollution sources shall require to be maintained within emissions and discharge norms set out by the regulatory authority.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
13.	Wildlife (Protection) Act 1972, Wildlife (protection) Amendment Act 2002 and 2003 amendment.	Chief Conservator Wildlife, NBWL/State Forest Department and MoEF&CC	The Act provides for the protection of wild animals, birds, and plants; and for matters connected therewith or ancillary or incidental there to. The application of the Order of the Honourable Supreme Court in WP 460 of 2004 dated 04.12.2006 in the matter of Goa Foundation v. Union of India and other wherein the Honourable Supreme Court has directed that all projects which require environmental clearance and are located within the distance of 10Km of National Park and Sanctuaries must be placed before the standing Committee of the National Board for Wildlife constituted under the Wildlife (Protection) Act, 1972.	**Not Applicable** There is no notified eco sensitive area within 10 km of the project site.
14.	The Petroleum Act 1934, as amended in August 1976 The Petroleum Rules 1976, as amended in March 2002. Explosives Act 1884 Explosive Rules, 2008	PESO (Chief Controller of Explosives)	As per Section 3 of The Petroleum Act 1934 and Rule 116 of The Petroleum Rules 1976, project will be required to obtain a license from PESO, if the quantity of the fuel stored (petroleum class B) exceeds 25,00 litres and/ or is stored in a receptacle exceeding one thousand litres in capacity.	**Applicable (to be obtained for Construction and Operation Phase)** PESO license would be applicable to the project for the storage of ATF and HSD. Project involves use of explosives for blasting operations for extraction of boulders from quarry. The project is required to obtained blasting permission from PESO.
15.	Central Motor Vehicle Act 1988	Motor Vehicle Department	To check vehicular air and noise pollution.	**Applicable.** This rule will be applicable to vehicles deployed for construction activities and construction Machinery.
16.	License under Factories Act, 1948	Department of Factories, Andhra Pradesh	As per the section 6 of The Factories Act, 194, GVIAL would have to obtain registration of the power plant if 10 or more workers are engaged then act would be applicable from the State Government or Chief Inspectorate of Factories, Andhra Pradesh.	**Applicable (to be obtained in Operation Phase)**
17.	The Right to Fair Compensation and	Local Administration	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act	**Applicable**

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
	Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	District Collector Revenue Officer	(RTFCTLARR Act), stipulates mandatory consent of at least 70% of affected people for acquiring land for Public Private Partnership (PPP) projects and 80% for acquiring land for private companies. It also requires that payment of compensation for the owners of the acquired land will be four times the market value in rural areas and twice in urban areas. It also stipulates that the land cannot be vacated until the entire compensation is awarded to the affected parties. The law has the provision that the companies can lease the land instead of purchasing it. Besides, the private companies will have to provide for rehabilitation and resettlement if land acquired through private negotiations is more than 50 acres and 100 acres in urban and rural areas, respectively.	The land was procured as per RFCTLARR act 2013 and Andhra Pradesh RFCTLARR Rules, 2014. The private land is acquired from 1465 landowners from 7 villages. Total 405 families are displaced due to the acquisition of land from 4 village habitations. Refer Appendix M and N for details and supporting documents.
18.	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006 & rules 2007	Ministry of Tribal Affairs Tribal Welfare Department	The act basically vests the forest rights and occupation in forest land in forest dwellers (ST and other traditional forest dwellers) who have been residing in forests for generations but whose rights could not be recorded.	**Not applicable** As reported by the GVIAL, the land acquired for the Project does not comprise of any tribal land and this was further confirmed by the RDO-Vizianagaram during the consultation meeting. Though Vizianagaram district falls under Schedule V areas as defined in the Indian Constitution under Article 342 of the same but Bhogapuram Mandal (where the Project is located) does not falls under the schedule V area. Mo forest Land acquisition is prosed for the project.
19.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Department of Labour, Government of and Andhra Pradesh	This Act provides for safety, health, and welfare measures of construction workers in every establishment which employs or employed during the preceding year ten or more such workers. These measures include fixing hours for normal working day, weekly paid rest day, wages for overtime, provision of basic welfare amenities like drinking water, latrines, urinals, crèches, first aid, canteens, and temporary	**Applicable (to be obtained for Construction Phase)** Section 7 of the Act mandates the registration of establishments. GVIAL should ensure that contractor/ sub-contractors have a valid registration under the Building and Other Construction Works Act and Contract Labour (Regulation and Abolition) Act, 1970.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
			living quarters within or near the work site. Every employer of an establishment employing 10 or more building workers in any building or other construction work must register the establishment within a period of sixty days from commencement of the work	
20.	Public Liability Insurance Act, 1991			**Applicable** The operation and maintenance of the proposed project facility is envisaged to involve generation and handling of hazardous and non-hazardous wastes (used oil, empty chemical containers, empty chlorine tonners, etc.) as well as hazardous chemical as storage of chlorine tonners for chlorine-based disinfection process for treated water. As per MSIHC Rules, 1989 chlorine is classified as hazardous chemicals. Thus, this act and its rules are applicable as hazardous chemical handling and storage is involved.
21.	Workmen's Compensation Act, 1923 & Rules 1924	Department of Labour, Government of and Andhra Pradesh	The Act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.	**Applicable** Project proponent should ensure that in case of any accident/ injury/ loss of life, the workmen should be paid a minimum compensation as calculated under this act both during construction and operation phase of the project. The reporting of accidents needs to be done in prescribed forms as per the act and the incident / accident register needs to be maintained accordingly. The Act also gives a framework for calculating amount of compensation and wages.
22.	The Contract Labour (Regulation and Abolition) Act, 1970 as amended in 2017	Department of Labour, Government of and Andhra Pradesh	The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. As per Section 12 of the Contract Labour (Regulation and Abolition) Act, 1970 a contractor executing any contract work by engaging 50	**Applicable (to be obtained for Construction and Operation Phase)** As per Section 12 of the Contract Labour (Regulation and Abolition) Act, 1970 a contractor executing any contract work by engaging 20 or more contract labourers has to obtain a license under the Act.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
			or more contract labourers has to obtain a license under the Act. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.	Section 16,17,18,19,20 and 21 of the said Act mandates the provision of the principal employer to ensure that all the contracted workers are provided with condition of services, rate of wages, holidays, hours of work as stipulated in the act and rules
23.	The Inter-State Migrant Workmen (Regulation of Employment and conditions of service) Act, 1979	Department of Labour, Government of and Andhra Pradesh	Principal Employer registration for engaging migrant labour is required for direct/indirect labour who may be employed by the project from outside of the state.	**Applicable (to be obtained for Construction and Operation Phase)** Section 4 of the Act mandates that the Principal Employer registration should be obtained for engaging migrant labour through third party.
24.	Minimum Wages Act, 1948	Department of Labour, Government of and Andhra Pradesh	Section 12 of the Minimum Wages Act, 1948: The employer shall pay to every employee engaged in a scheduled employment under him wages at a rate not less than the minimum rate of wages fixed by the appropriate Government Authority for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed. Every employer shall be responsible for the payment to persons employed by him of all wages required to be paid under this Act.	**Applicable** The Project, contractor and sub-contractor should comply with this requirement.
25.	The Child Labour (Prohibition and Regulation) Act, 1986	Department of Labour, Government of and Andhra Pradesh	Section 3 under the Child Labour (Prohibition and Regulation) Act, 1986 (CLA, 1986) including amendment in 2016. No child below the age of 14 years shall be employed in any establishment mentioned in Schedule Part A and Part B of the CLA, 1986.	**Applicable** The EP contractor and GVIAL should ensure that no child labour is engaged at site for operation works either directly or by the sub-contractors.

Sl. No.	Applicable Legislation	Agency Responsible	Overview	Applicability to the Project
26.	Bonded Labour (Abolition) Act 1976	Department of Labour, Government of and Andhra Pradesh	Rule 4 of the Bonded Labour System (Abolition) Act, 1976 specifies "After the commencement of this Act, no person shall- make any advance under, or in pursuance of, the bonded labour system, or compel any person to render any bonded labour or other form of forced labour."	**Applicable** The project, contractor and sub-contractor should comply with this requirement.
27.	Equal Remuneration Act 1976	Department of Labour, Government of and Andhra Pradesh	It is the duty of an employer to pay equal remuneration to men and women workers for same work or work of a similar nature.	**Applicable** The project, contractor and sub-contractor should comply with this requirement
28.	Maternity Benefit Act, 1961	Department of Labour, Government of and Andhra Pradesh	• Subject to the provisions of this Act, every woman shall be entitled to, and her employer shall be liable for, the payment of maternity benefit as per the provision of the act.	**Applicable** The project, contractor and sub-contractor should comply with this requirement

3.4 Other Approvals Pertaining to the Project

Status of key local approvals for the construction work is listed in **Table 3-3**.

Table 3-3: Status of Key Local Approvals

Sl. No.	Key E&S Approvals	Issuing Authority	Status
1.	Concession Agreement	APADACL	Signed on 12.06.2020
2.	Site Clearance / in Principal Approval	Ministry of Civil Aviation (MOCA), GoI	Site Clearance has been obtained from MOCA through letter No. AV.20015/111/2015-AD dated 11.11.2020 (**Appendix F**).
3.	Closure of Existing Civil Enclave at Vizag Naval Airbase	Ministry of Civil Aviation (MOCA), GoI	NOC for closure of existing Civil Enclave at Vizag Naval Airbase has been granted through letter no AV-29012/62/2021-AD dated 13.09.2022 (**Appendix G**).
4.	Defence Clearance	Ministry of Defence, GoI	Defence Clearance obtained through letter no. 2(12)/2015/D(Air-II) dated 15.12.2015. the validity of NOC was extended upto 14.12.2027 (**Appendix H**).
5.	BCAS Clearance	Clearance from BCAS for providing civil aviation security for BIA	Agreement executed on 06.04.2023 (**Appendix I**).
6.	Supply of water	Rural Water Supply and Sanitation (RWS&S), GoAP	GO (G. O. Rt. No. 13 dated 23.02.2023) issued for provision of 5 MLD water from Taraka Rama Teertha Sagar project (**Appendix J**).
7.	Power Availability	APTRANSCO	GO (G. O. Rt. No. 13 dated 23.02.2023) issued for provision of Power upto Airport Boundary (**Appendix J**).
8.	MOU between MoCA and GVIAL for certain aeronautical services support	MoCA	Agreement signed on 16th May, 2023 (**Appendix H**).
9.	Permission for extraction of boulders from quarry	GoAP	Approval of Director Mines, Vijayawada (Under Process).
10.	Cutting of trees	DFO	Tree cutting permission will be required if there are cutting of following trees viz. sandal wood, teak, rosewood.
11.	Master Plan	BCAS & DGCA	To be Obtained
12.	Operation of Airport	DGCA	To be Obtained
13.	Operation of Crusher, batching plant, Asphalt plant	APPCB	To be obtained before establishment of the plants
14.	Security	Agreement for Provision of Security by the concerned agency (CISF / State Govt)	To be Obtained
15.	Customs	Clearance from Department of Revenue Ministry of Finance	To be Obtained
16.	Immigration	Clearance from Ministry of Home Affairs for provision of Immigration services	To be Obtained

Sl. No.	Key E&S Approvals	Issuing Authority	Status
17.	Airport Meteorology Services	Agreement with IMD for provision of meteorological Services	To be Obtained
18.	Health Services	Agreement / MOU with Ministry of Health & Family Welfare for provision of APHO	To be Obtained
19.	Plant Protection and Quarantine	Agreement with Directorate of Plant Protection and Quarantine & Storage – Ministry of Agriculture	To be Obtained
20.	Animal Quarantine	Agreement with Department of Animal Husbandry, Dairying & Fisheries for provision of required services by the Department	To be Obtained
21.	Fire Services / NOC	NOC from State Fire Services Dept.	To be Obtained
22.	Authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Amendment Rules, 2016	APPCB	To be obtained
23.	License from PESO (Chief Controller of Explosives)	PESO (Chief Controller of Explosives)	To be obtained
24.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Department of Labour, GoAP	To be obtained
25.	The Contract Labour (Regulation and Abolition) Act, 1970 as amended in 2017	Department of Labour, GoAP	To be obtained
26.	The Inter-State Migrant Workmen (Regulation of Employment and conditions of service) Act, 1979	Department of Labour, GoAP	To be obtained
27.	License under Factories Act, 1948		To be obtained (during Operation Phase)

3.4.1 External Factors Review

The review of publicly available information on environment and social aspects related to Project was conducted to know the past litigations. A number of newspaper articles[20][21][22][23] were published between 2015 and 2022 on matter of land acquisition, protest by local people and farmer on land acquisition, challenging the procedure adopted for environment clearance in National Green Tribunal (NGT)[24]. Initially (in 2015) an estimated 5311.8 acres of land was proposed to be acquired for the Project and later the same was reduced. A number of meetings were conducted between APADC, State Government and Project Affected People and finally 2203.26 acres was acquired.

In 2017, a case was filed in NGT (Appeal No.18) on ground of challenging the decision of the Expert Appraisal Committee (EAC) and findings of the EIA Report. After multiple hearing the case was closed by NGT with verdict that the EC procedure adopted by the Project was found to be satisfactory. If the amount of water requirement for the Project is goes up, the project proponent will inform the MOEF&CC by amending the water requirement and secure appropriate approvals towards the drawl of water.

3.5 Applicable International Standards and Guidelines

3.5.1 IFC Performance Standards

The performance standards stipulate that any project shall meet the following requirements throughout the life of an investment by IFC or other relevant financial institution: -

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety, and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage

These Performance Standards and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts. The applicability of the Performance Standards is discussed in ***Table 3-4***.

[20] https://timesofindia.indiatimes.com/city/visakhapatnam/bhogapuram-airport-project-flies-into-trouble/articleshow/46871712.cms
[21] https://www.thehindu.com/news/national/andhra-pradesh/legal-hurdles-for-bhogapuram-airport-cleared-as-hc-dismisses-all-writ-petitions-related-to-land-acquisition/article66096456.ece
[22] https://www.thehindu.com/news/national/andhra-pradesh/andhra-pradesh-naidu-laid-stone-for-bhogapuram-airport-without-completing-land-acquisition-and-with-an-eye-on-elections-alleges-minister/article66804342.ece
[23] https://www.deccanchronicle.com/nation/in-other-news/040523/bhogapuram-airport-over-2300-acres-against-12000-of-td-botsa.html
[24] https://greentribunal.gov.in/sites/default/files/news_updates/Counter%20filed%20by%20R4%20in%20Appeal%20No%2018%20of%202017(SZ).pdf

Table 3-4: Applicability of IFC Performance Standards

Sl. No.	IFC PS	Overview	Applicability to the Project
1.	PS 1: Assessment and Management of Environmental and Social Risks and Impacts	This PS aims to assesses the existing social and environmental management systems of a company and to identify the gaps with respect to their functioning, existence and implementation of any Environmental and Social Management Plan (ESMP) and procedures, a defined EHS Policy, organization chart with defined roles and responsibilities, risk identification and management procedures as well as processes like stakeholder engagement and grievance management.	**Applicable** This IFC-PS is applicable to the project as there are aspects such as air pollutant emissions, wastewater generation, waste generation (including hazardous wastes) etc. associated with project related activities. The risks and adverse impacts associated with these aspects have to be managed through a defined management plan (ESMP) and related policies and procedures.
2.	PS 2: Labour and Working Conditions	This PS is guided by a number of international conventions and instruments on labour and workers' rights. It recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of fundamental rights of workers. The PS covers following themes: human resource policy and management, workers' organization, non-discrimination and equal opportunity, retrenchment, protecting the workforce and occupational health and safety. It applies to workers directly engaged by the client (direct workers), workers engaged through third parties to perform work related to core business processes of the project for a substantial duration (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).	**Applicable.** This PS helps to assess the status of the employees and workers of project as well as any contractors working under the project vis-à-vis the applicable national legislations and international guidelines pertaining to labour welfare and rights and health and safety conditions of workers. As planned during construction phase peak workforce to be employed will be around 5500 whereas workforce during operation phase of the project will be 1000. Therefore, guidelines and standards related to PS 2 to be followed.
3.	PS 3: Resource Efficiency and Pollution Prevention	PS-3 covers the use resources and materials as inputs and wastes that could affect human health. The objective of PS-3 is to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; to promote more sustainable use of resources, including energy and water, and to reduce project related GHG emissions. Key themes covered under PS-3 are pollution prevention, resource conservation and energy efficiency, wastes, hazardous materials, emergency preparedness and response, greenhouse emissions, pesticide use and management.	**Applicable** Construction activities will typically include land clearing for site preparation and transmission and distribution routes; excavation, and filling; transportation of supply materials and fuels; construction of foundations involving excavations and placement of concrete; operating cranes for unloading and installation of equipment; construction and installation of associated infrastructure; etc. Environmental issues associated with airport project include: • Noise and vibrations • Stormwater and wastewater

Sl. No.	IFC PS	Overview	Applicability to the Project
			• Hazardous materials management • Solid waste • Air emissions • Energy and water consumption. This PS will assess how to minimize environmental, social and OHS impacts, etc.
4.	PS 4: Community Health, Safety and Security	This PS-4 requires due diligence to anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances. It also requires ensuring that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the affected Communities. Key areas of compliance screened under PS-4 includes infrastructure/equipment safety, hazardous material safety, natural resource issues, exposure to disease, emergency preparedness and response, and security personnel.	**Applicable** PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. One of the most significant risks for local communities due to operation of the airport include though highly infrequent, but potentially catastrophic, failure of aircraft during the landing and take-off (LTO) cycle. Other community, health, safety related impacts may include: • Strikes with birds, or stray dogs wandering the runways. • Airport operators should prepare necessary emergency preparedness and response plans. • Issues associated with airport security.
5.	IFC PS 5: Land Acquisition and Involuntary Resettlement	PS-5 requires project proponents to anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use. The key themes covered under this are: compensation and benefits for displaced persons, consultation and grievance mechanism, resettlement planning and implementation, physical displacement, economic displacement. The PS-5 also prescribes private sector responsibility to supplement government actions and bridge the gap between governments assigned entitlements and procedures and the requirements of PS-5.	**Applicable** A total of 2203.26 acres of land was acquired for the development of Project consisting of 1453.71 acres private land (Zeroyiti land), 505.42 acres assigned land and 244.13 acres government land. The land was acquired by GoAP through compulsory government driven process and compensation was paid to people as per provisions of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014. As the land acquisition resulted into physical and/or economic displacement, and the land was acquired through expropriation or other compulsory procedures in accordance with the legal system of the country, hence the provision of PS is applicable to this Project.

Sl. No.	IFC PS	Overview	Applicability to the Project
			As landlessness is likely to be envisaged, but the quantum is not assessed due to unavailability of data, the Project may require preparing a supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and take corrective action as necessary. The Project is required to implement LRP to assess the loss of livelihood for the lost land among the impacted families and restoration plan for implementation.
6.	IFC PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	The requirements of this Performance Standard are applied to projects (i) located in modified, natural, and critical habitats; (ii) that potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or (iii) that include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry). PS-6 screens relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. The key themes covered under PS-6 are natural habitat, critical habitat, legally protected areas, international introduction of alien species, and living natural resources (natural and plantation forest, aquatic resources etc.) are sustainably managed.	**Applicable** PS 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This standard is aimed to promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities. The objectives of PS 6 are: • To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities. The Project site, as well as the area of influence contain natural and near-natural habitats, besides modified habitats. The project site and the area of influence of the project provide important ecosystem services to the local community, including priority provisioning services in the form of water resources and pasture for livestock. The proposed project infrastructure and activities, such as removal of vegetation, levelling of land, laying of access roads, vehicular movement, artificial illumination and construction of airport and its associated facilities, are expected to cause loss or degradation of habitats and ecosystem services, as well as, fragmentation of habitats, and possibly, promote further spread of already introduced invasive alien species. As per PS 6 guidance, the presence of

Sl. No.	IFC PS	Overview	Applicability to the Project
			biodiversity values of significant conservation values was observed in the study area. Therefore, PS 6 is applicable to this project.
7.	PS 7: Indigenous Peoples	This Performance Standard applies to communities or groups of Indigenous Peoples who maintain a collective attachment, i.e., whose identity as a group or community is linked, to distinct habitats or ancestral territories and the natural resources therein. PS-7 endeavour to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. Key themes covered under PS-7 are avoidance of adverse impacts, consultation and informed participation, impacts on traditional or customary lands under use, relocation of IPs from traditional or customary lands, and cultural resources.	**Not applicable** As reported by the GVIAL, the land acquired for the Project does not comprise of any tribal land and this was further confirmed by the RDO-Vizianagaram during the consultation meeting. Though Vizianagaram district falls under Schedule V areas as defined in the Indian Constitution under Article 342 of the same but Bhogapuram Mandal (where the Project is located) does not falls under the schedule V area. According to the 2011 census and the review of secondary data shows that A. Ravivalasa, Gudepuvalasa, Kancheru villages has nil ST population, whereas Savaravilli,(0.35%) , Kavuluvada (0.05%), Ravada (1.67%) and Munjeru (0.03%) has limited ST population as compared to Vizianagaram district (10.05%) and Andhra Pradesh State (7%).
8.	PS 8: Cultural Heritage	For the purposes of PS-8, cultural heritage refers to (i) tangible forms of cultural heritage; (ii) unique natural features or tangible objects that embody cultural values; and (iii) certain instances of intangible forms of culture that are proposed to be used for commercial purposes. The requirements of PS-8 apply to cultural heritage regardless of whether it has been legally protected or previously disturbed.	**Not Applicable** Review of Google Earth Map and the site reconnaissance did not point towards the presence of any significant cultural heritage site within the vicinity of Project. Hence, the provisions of PS 8 is not applicable.

3.5.2 IFC EHS Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). Following EHS Guidelines were referred for this ESIA study:

- WBG General EHS Guidelines, 2007; and
- IFC EHS Guidelines for Airports, 2017

The key EHS requirements for the project have been discussed in **Table 3-5.**

Table 3-5: EHS guidelines for Airport project

Environmental Attributes	Guidelines
Noise and Vibration	• To plan site for airport location and orientation of routes to avoid noise impacts. • To minimize potential noise from approaching and departing aircraft for noise-sensitive areas. • To identify and implement noise prevention and control strategies in noise abatement zones
Air Emissions	• To optimize ground service infrastructure to reduce aircraft and ground vehicle movements on taxiways and idling at the gate; • To Improve ground service vehicle fleets to control air pollution; • To minimize fugitive air emissions from jet kerosene and other fuel storage and handling.
Wastewater	• To ensure collection and proper treatment for aircraft and airport sanitary sewage;
Hazardous Materials	• To develop spill prevention and control plans, and emergency preparedness and response plans. • To conduct fire training on impermeable surfaces. • Water containing fire extinguishing agents and non-combusted flammable materials should be treated prior to discharge to surface water.
Waste Management	• Minimizing generation of solid waste • To segregate compostable and other food waste for recycling as agricultural fertilizer and animal feed • To segregate recyclable waste like newspapers / papers, plastic, metallic containers, and used pillows, etc.
Occupational Health and Safety	• Occupational health and safety impacts associated with the project primarily include the following: ✓ Noise ✓ Physical hazards ✓ Chemical Hazards
Community Health & Safety	Potential community health and safety impacts include: ✓ Wildlife Strikes ✓ Operational Safety Management ✓ Airport security

3.5.3 NIIFL E&S Management Policy

The NIIFL's ESMF comprises of the following key elements:

- Environmental and Social (E&S) Management Policy,
- E&S Management Principles,
- E&S Management Procedures and Guidelines,

The key requirements of NIIFL's E&S policy include the following:

- NIIFL E&S Management Principles,
- Screening and Categorization of projects/ investments,

- E&S Due Diligence (ESDD),
- Monitoring and Evaluation,
- E&S Management Organization,
- Information Sharing,
- NIIFL sub-funds managed by third-party managers,
- NIIFL Roles and Responsibilities,
- Supporting documents for Policy implementation.

As part of NIIFL's E&S Management Principles, the Project or business activity appraisal process includes ESIA and ESMP studies. Every investment done by Fund Management is expected to meet the requirements of NIIFL's E&S Management Principles through a mutually agreed E&S Action Plan (ESAP) between the Fund Management and Investment Proponent /Sponsor. Details of NIIFL E & S Management Policy requirements are provided in the **Table 3-6.**

Table 3-6: Applicability of NIIFL E&S Management Policy

NIIF E&S Principles	Description	Objectives and applicability of the project
Principle 1	Environmental & Social Risk Assessment and Management Systems.	**Applicable** This principle essentially mandates that every project or business activity funded by NIIFL or by third party managers of its sub-funds irrespective of its categorization under NIIFL's E&S Management Policy will institute and operate an appropriate Environmental and Social risk identification, assessment and Management System (ESMS) that addresses all the requirements specified in NIIFL's E&S Management Principles 2 through 4. GVIAL shall be required to implement ESMS for E&S risk assessment practices. The ESMS will be inclusive of all environments, health, social policies, procedures, etc.
Principle 2	Environmental Risks and Management	**Applicable** This principle will cover all matters relating to identification and assessment of risks and impacts on environmental resources that will be caused by the development of the Project or business activity to be funded and management strategies to be formulated to mitigate the risks and impacts. The project activities during construction phase and operation phase will cause pollution and therefore GVIAL shall be required to minimize pollution related impacts through adoption of monitoring, mitigation and management plans.
Principle 3	Human Resources Management	**Applicable** This principle will cover all matters relating to engagement of human resources through the Project life cycle. The principle will cover all aspects of human resources engagement including but not limited to direct employment, contractual employment, employment offered though third party or petty contractors, occupational health and safety aspects in the workplace, working conditions and terms of employment including equal opportunities, grievance mechanism, prohibition of child or forced or bonded labour practices. The project will have to develop a human resource policy and ensure non-discrimination and equal opportunity, protection of workforce and occupational health and safety.
Principle 4	Social Risks and Management	**Applicable** This Principle will cover all matters relating to identification and assessment of risks and impacts on social aspects that will be caused by the

NIIF E&S Principles	Description	Objectives and applicability of the project
		development of the Project or business activity to be funded and management strategies to be formulated to mitigate the risks and impacts. This principle will cover all risks and impacts on social sector including involuntary land acquisition; physical and economic displacement of project affected peoples (PAPs); vulnerable PAPs; scheduled tribes and cultural heritage resources relevant to local communities. The total land acquired for the development of airport is 2203.26 acres, which includes 1453.71 acres of private land, 505.42 acres assigned land and 244.13 acres of government land. The private land is acquired from 1465 landowners from 7 villages. Total of 405 families were displaced. The land acquisition resulted in livelihood impacts particularly among vulnerable PAPs such as SCs, WHH, Elderly people above 65 and landless labourers. Therefore, the Principle 4 will be applicable for the project.

3.5.4 US DFC E&S Policy and Procedures

The U.S. International Development Finance Corporation (DFC) is America's development bank. USDFC partners with the private sector to finance infrastructure projects. USDFC investments are adhering to high standards and respect the environment, human rights, and worker rights. The Environmental and Social Policies and Procedures ("ESPP") addresses DFC's commitments regarding the environmental and social dimensions of sustainable development and provides applicants notice of the general environmental and social requirements that are applied in evaluating prospective projects and monitoring ongoing supported projects. The ESPP implements applicable environmental and social requirements and procedures contained in U.S. law and, the IFC Performance Standards on social and environmental sustainability and industry sector guidelines.

USDFC advocates for screening and categorisation of projects (1) to define the area of influence of the project for the purposes of environmental and social review as well as public consultation; (2) to identify the nature and magnitude of environmental and social risks and impacts, including those project impacts that could preclude support; (3) to identify issues to be investigated in detail in the environmental and social review process; and (4) to determine requirements for documentation, consultation, disclosure, notification and third party audits. All projects and subprojects are categorized as Category A, B, C or D based on environmental and social factors. While the categorisation is similar to IFC project categorisation, the Category D is reserved for initial approval of guaranties to Financial Intermediaries, which will make investments in or provide financing to projects or enterprises (subprojects).

As per USDFC requirements, the project needs to identify (i) all E&S risks and issues through PS 2 to 8, (ii) identification of all factors that define the Project's area of influence; and (iii) identification of groups and communities that may be directly or indirectly affected by the Project and (iv) evidence of meaningful consultation with project affected people within the defined area of influence, and (v) provide mitigation in accordance with a mitigation hierarchy through corrective measures.

USDFC undertakes detailed, tailored environmental and social reviews for certain sectors and types of projects in response to USDFC policies and practices.

3.6 Applicable International Conventions

Environmental problems which migrate beyond the jurisdiction (Trans-boundary) require power to control such issues through international co-operation by either becoming a Contracting Party (CP) i. e. ratifying treaties or as a Signatory by officially signing the treaties and agreeing to carry out provisions of various treaties on environment and social safeguards. The relevant international conventions are as provided in ***Table 3-7***.

Table 3-7 Relevant International Conventions

Sl. No.	International Conventions	Salient Features	Applicability and Guidelines
1.	Kyoto Protocol	The Kyoto protocol was signed by India in August 2002 and ratified in February 2005. The convention pertains to the United Nations framework on Climate Change.	**Greenhouse-gas emission:** Client and contractor should make efforts to reduce all

Sl. No.	International Conventions	Salient Features	Applicability and Guidelines
		The 3rd Conference of the Parties to the Framework Convention on Climate Change (FCCC) in Kyoto in December 1997 introduced the Clean Development Mechanism (CDM) as a new concept for voluntary greenhouse-gas emission reduction agreements between industrialized and developing countries on the project level.	emissions from project related activities.
2.	Montreal Protocol on Substances That Deplete the Ozone Layer (and subsequent Amendments)	India signed the Montreal Protocol along with its London Amendment on 17-9-1992 and also ratified the Copenhagen, Montreal and Beijing Amendments on 3rd March 2003.	**Ozone depleting substances (ODS)** should be avoided for refrigeration, air-conditioning as ratified under the agreement.
3.	International Labour Organization conventions	India has also ratified many of the International Labour Organization conventions that are relevant to the Project including: C1 Hours of Work (Industry) Convention, 1919 (14:07:1921, ratified); C5 Minimum Age (Industry) Convention, 1919 (09:09:1955, ratified): C11 Right of Association (Agriculture) Convention, 1921 (11:05:1923, ratified): C14 Weekly Rest (Industry) Convention, 1921 (11:05:1923, ratified); C29 Forced Labour Convention, 1930 (30:11:1954, ratified) & C105 Abolition of Forced Labour Convention, 1957 (18:05:2000, ratified); C100 Equal Remuneration Convention, 1951 (25:09:1958, ratified); C107 Indigenous and Tribal Populations Convention, 1957 C111 discrimination (Employment and Occupation) Convention, 1958 (03:06:1960, ratified)	**Labour working conditions, accommodation and wages:** Client and contractor should follow all applicable national and state regulations related to labour working conditions, accommodation, wages and benefits.
4.	UN Guiding principles on Business and Human Right	The United Nations (UN) Guiding Principles on Business and Human Rights (GPs), which were endorsed by the Human Rights Council (HRC) in June 2011, are built on three pillars: states' duty to protect human rights, corporate responsibility to respect human rights, and access to effective remedies. All three pillars of the GPs – especially Pillar 1 and Pillar 3 – require states to take a number of measures to ensure that business enterprises do not violate human rights and that effective remedies are available in cases of violation. The UN Working Group on the issue of human rights and transnational corporations and other business enterprises (UNWG) 'strongly encourages all states to develop, enact and update' a national action plan (NAP) on business and human rights (BHR) as part of states' responsibility to disseminate and implement the GPs. In June 2014, the HRC passed a resolution calling upon states to develop NAPs. As of 29 February 2016, ten states have drawn up NAPs of which India was a party wherein it reaffirms India's commitments towards realization of human	

Sl. No.	International Conventions	Salient Features	Applicability and Guidelines
		rights and promotion of socially responsible businesses in the country.	
5.	Convention Concerning the Protection of World Cultural and Natural Heritage, 1972 (UNESCO World Heritage Convention) (WHC).	India has been a State Party to the WHC since 1977. The WHC aims to identify and protect the world's natural and cultural heritage considered to be of outstanding universal value. State Parties to the WHC are expected to identify and nominate properties on their national territory to be considered for inscription on the World Heritage List, giving details of how a property is protected and providing a management plan for its upkeep. States Parties are also expected to protect the World Heritage values of the properties inscribed.	Disturbance to Cultural and Natural Heritage The project boundary is located well beyond 100 to 300 m from any ancient monuments and archaeological sites and remains declared as per Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010. In case of discovery of any ancient monuments and archaeological sites and remains or in case of any land acquisition impacting any religious structures, all required precautions should be taken by client and contractor so that impacts are minimized / removed.
6.	Convention on Biological Diversity, 1992 (CBD or Rio Convention)	India is a party to CBD since 1994. The objectives of the CBD are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from commercial and other utilization of genetic resources. The agreement covers all ecosystems, species, and genetic resources.	
7.	Convention on the Conservation of Migratory Species of Wild Animals, 1983 (CMS or “Bonn Convention”)	India is a Party to CMS since 1983. CMS is an intergovernmental treaty aimed at conservation and sustainable use of migratory animals and their habitats. It brings together Range States through which migratory animals pass and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. Parties strive towards protecting migratory species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.	
8.	Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 (Ramsar Convention)	India is a Contracting Party to the Ramsar Convention since 1982. It is an intergovernmental treaty that provides a framework for the conservation and wise use of wetlands and their resources. It includes all lakes and rivers, underground aquifers, swamps and marshes, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, mangroves and other coastal areas, coral reefs, and also human-made sites, such as fishponds, rice paddies, reservoirs and salt pans. Contracting Parties commit to work towards the wise use of all their wetlands, designate suitable wetlands for the list of Wetlands of International Importance (the “Ramsar List”) and ensure their effective management, as well as cooperate internationally on transboundary wetlands, shared wetland systems and shared species	

Sl. No.	International Conventions	Salient Features	Applicability and Guidelines
9.	Convention on International Trade in Endangered Species of Wild Flora and Fauna, 1975 (CITES)	India is a Party to CITES since 1976. It is an international agreement between governments aimed at ensuring that international trade in specimens of wild animals and plants does not threaten the survival of such species. Each CITES Party is expected to adapt its domestic legislation to ensure that the CITES framework is implemented at the national level.	
10.	Convention Concerning the Protection of World Cultural and Natural Heritage, 1972 (UNESCO World Heritage Convention) (WHC).	India has been a State Party to the WHC since 1977. The WHC aims to identify and protect the world's natural and cultural heritage considered to be of outstanding universal value. State Parties to the WHC are expected to identify and nominate properties on their national territory to be considered for inscription on the World Heritage List, giving details of how a property is protected and providing a management plan for its upkeep. States Parties are also expected to protect the World Heritage values of the properties inscribed.	
11.	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure	The Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals & Pesticides in international Trade was adopted by India at the Conference of Plenipotentiaries at Rotterdam in 1998.	

3.7 Categorisation of Project

3.7.1 Project Categorization as per EIA Notification 2006

Environmental Impact Assessment (EIA) Notification S.O.1533 (E), dated 14th September 2006, issued under Environment (Protection) Act 1986, has made it mandatory to obtain environmental clearance for scheduled development projects. The notification has classified projects under two categories 'A' & 'B'. Category A projects (including expansion and modernization of existing projects) require clearance from MoEF&CC, Govt. of India (GoI) and for category B from State Environmental Impact Assessment Authority (SEIAA), constituted by Government of India.

The EIA Notification, as amended in December 2009 by MoEF&CC, mandates that all airport projects are categorized as **Category A** in the notification, including expansion and modernization of existing projects or activities. All airport projects shall require prior environmental clearance from the Central Government in the MoEF&CC on the recommendations of an Expert Appraisal Committee (EAC) constituted by the MoEF&CC.

3.7.2 Categorization as per IFC PS

As part of its review of a project's expected social and environmental impacts, IFC uses a system of social and environmental categorization. This categorization is used to reflect the size of impacts understood because of the client's social and environmental assessment and to specify IFC's institutional requirements.

The categories used by the IFC are:

1. ***Category A Projects***: Projects with potential significant adverse social or environmental risks or/and impacts that are diverse, irreversible or unprecedented.
2. ***Category B Projects***: Projects with potential limited adverse social or environmental risks or/and impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
3. ***Category C Projects***: Projects with minimal or no adverse social or environmental risks or/and impacts, including certain financial intermediary (FI) projects with minimal or no adverse risks; and
4. ***Category FI Projects***: All FI projects excluding those that are Category C projects.

IFC, therefore, categorizes the project primarily according to the significance and nature of its impacts. IFC defines the project's area of influence as the primary project site(s) and related facilities that the client (including its contractors) develops or controls; associated facilities that are not funded as part of the project (funding may be provided separately by a client or a third party including the government), and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project; areas potentially impacted by cumulative impacts from further planned development of the project; and areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.

Applying the criteria stipulated by the IFC Policy on Environmental and Social Sustainability for environmental and social categorization of projects, the proposed Bhogapuram International Airport Project may be assigned as '***Category A***' as there will be significant environmental and social impacts, which are diverse, irreversible in nature. The risks and impacts can be mitigated by adopting suitable mitigating measures proposed for the Project.

3.7.3 Categorization as per NIIFL Environmental and Social Management Framework

The categories used by the NIIF are:

1. **Category A**: Projects or business activities with significant adverse environmental or social risks and/or impacts that are direct or indirect, diverse, across different locations, persistent over a period, irreversible, cumulative, or unprecedented.
2. **Category B**: Projects or business activities with limited adverse environmental or social risks and/or impacts that are direct or indirect, markedly site-specific, manageable over a period, largely reversible, and readily addressed through mitigation measures.
3. **Category C**: Projects or business activities with minimal adverse environmental or social risks and/or impacts.
4. **Category FI**: NIIFL investments in sub-funds that will be managed by financial intermediaries. This category is further divided into:
    - FI–A: when a NIIFL sub-fund's investments fall under Category A.
    - FI–B: when a NIIFL sub-fund's investments fall under Category B.
    - FI–C: when a NIIFL sub-fund's investments fall under Category C.

Applying the criteria stipulated by NIIF environmental and social management framework, the proposed Bhogapuram International Airport Project may be assigned as '***Category A***'.

3.7.4 Categorization as per US DFC Environmental and Social Policy and Procedures

All projects and Subprojects are categorized as Category A, B, C or D based on environmental and social factors:

1. **Category A:** Projects that may have significant adverse environmental and/or social impacts that are irreversible, sensitive, diverse, or unprecedented in the absence of adequate mitigation measures.
2. **Category B**: Projects that have limited adverse environmental and/or social impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
3. **Category C**: Projects that have minimal adverse environmental or social impacts.
4. **Category D**: Subprojects, originated by the Financial Intermediaries for activities within Categories A, B or C.
5. **Special Consideration projects:** Projects having heightened adverse project related social risks associated with the involvement of or impact on Project Affected People including Workers.

Applying the above-mentioned criteria, the proposed Project may be assigned as '**Category A**'. Rationale for the above categorization is as below:

Table 3-8 Project Categorisation

Environment and Ecological Sensitivity	Social Sensitivity	Overall Categorisation
1. The project is entirely greenfield having a relatively large size of land. 2. There will be irreversible change of existing land use due to the construction of the project. The project will require 2203 acres of land. 3. Approximately 2203 acres of natural, near-natural or modified habitat area expected to be cleared of its existing vegetation and occupied by project infrastructure. 4. There are diverse impacts anticipated from the project (like noise and vibration, handling of Hazardous material, generation of solid waste, wastewater, energy consumption) which requires adequate mitigation and management measures.	1. Of the total 2203 acres of land acquired, about 1455 acres of private land is acquired through land acquisition involving expropriation. 2. Total 1465 landowners from 07 villages namely Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru were impacted due to the acquisition of land. 3. Physical displacement of 405 families from 4 villages/ hamlets namely Rellipeta, Bollinkalapalem, Mudasarlapeta and Maradapalem. Of which about 65 are project displaced families (PDFs) are from Scheduled Caste (SC) community from Rellipeta hamlet. 4. Acquisition of land envisage to have a livelihood impacts particularly vulnerable project affected person (PAPs) such as SCs, women headed household (WHH), Elderly (above 65), landless etc.	Based on the preliminary assessment undertaken, the Project is categorised as '**Category A**'.

3.8 Applicable Environmental Standards

3.8.1 Ambient Air Quality

National Ambient Air Quality Standards (NAAQS), as notified by MoEF&CC and WHO air quality guideline are given in **Table 3-9.** As per the WB/IFC General EHS guidelines, ambient air quality results need to be compared with the relevant ambient air quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO air quality guidelines or other internationally recognized sources. Since, India has its own national ambient air quality standards, these local standards are considered as the applicable standard for the project.

Table 3-9: National Ambient Air Quality Standards

Pollutant	Time Weighted Average	NAAQS		WHO (2021)
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Govt.)	
Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20	-
	24 Hours**	80	80	40
Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30	10
	24 Hours**	80	80	25

Pollutant	Time Weighted Average	NAAQS		WHO (2021)
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Govt.)	
Particulate Matter (size less than 10 µm) or PM_{10}, µg/m^3	Annual*	60	60	15
	24 Hours**	100	100	45
Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$, µg/m^3	Annual*	40	40	5
	24 Hours**	60	60	15
Carbon Monoxide (CO), mg/m^3	8 Hours**	2	2	4#
	1 Hour**	4	4	
Ozone (O_3), mg/m^3	8 Hours**	100	100	100
	1 Hour**	180	180	

**Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval*

***24 hourly or 8 hourly or 1 hourly value as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.*

 # 24 hour average value

3.8.2 Ambient Noise Standards

Ambient noise standards notified by the MoEF&CC and IFC are as presented in **Table 3-10** and **Table 3-11**, respectively.

Table 3-10: Ambient Noise Standards as per CPCB

Type of Airport	Day time, (dB(A)) 06:00-22:00	Night Time, (dB(A)) 22:00- 06:00
Busy Airport#	70	65
All other Airports excluding proposed airports	65	60

#: civil airport which has more than 50,000 aircraft movements per year.

Note: These standards will not be applicable to a civil airport which has less than 15,000 aircraft movement annually

The noise standards within the overall boundary of airports shall be applicable as Industrial Areas i.e. day time 75 dB (A) Leq and night time 70 db (A) Leq as per the Noise (Regulation and Control) Rules 2000 and shall be measured at different points of airport boundary and then averaged.

Table 3-11: Ambient Noise Standards as per IFC-WHO

Category of Area	Day time, (dB(A)) 07:00-22:00	Night Time, (dB(A)) 22:00- 07:00
Industrial Area	70	70
Commercial Area	70	70
Residential Area	55	45
Silence Zone*	55	45

**Silence zone is defined as area up to 100 m around premises of hospitals, educational institutions and courts. Use of vehicle horns, loudspeakers and bursting of crackers are banned in these zones.*

3.8.3 Work Zone Noise Standards

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act (Refer **Table 3-12**).

Table 3-12: Standards for Occupational Noise Exposure

Total Time of Exposure per Day in Hours (Continuous or Short-term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110
¼	115
Never	>115

No exposure in excess of 115 dB (A) is to be permitted.

For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

3.8.4 Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in **Table 3-13**.

Table 3-13: Primary Water Quality Criteria for Designated Best Use Classes

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wildlife and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25°C micro mhos/cm Max.2250 • Sodium absorption Ratio Max. 26 • Boron Max. 2mg/l
	Below-E	• Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

3.8.5 Coastal Water Quality Standards

Primary water quality criteria for five designated best use are as follows:

SW-1: Salt Pans, Shell Fishing, Mariculture and Ecologically Sensitive Zones

SW-II: Bathing, Contact Water Sports & Commercial Fishing

SW-III: Industrial Cooling, Recreation and Aesthetic

SW-IV: Harbor

SW- V: Navigation and Controlled Waste Disposal

Table 3-14: Coastal Water Quality Criteria

PARAMETER	SW I	SW II	SW III	SW IV	SW V
pH	6.5-8.5	6.5-8.5	6.5-8.5	6-9	6-9
DO, mg/l	5 or 60% Saturation	4 or 50% saturation	3 or 40% saturation	3 or 40% saturation	3 or 40% saturation
Colour/Odour	No offensive	No offensive	No offensive	No offensive	-
Floating matter	Nothing obnoxious	Nothing obnoxious	Nothing obnoxious	-	-
SS or Turbidity	None from sewage or Effluent	30 NTU	30 NTU	-	-
Oil & Grease	0.1 mg/l	-	-	-	-
Heavy Metals Hg Pb Cs	0.001 0.001 0.01	-	-	-	-
Fecal Coliform	-	100/100 ml	500/100ml	500/100ml	500/100ml
BOD, mg/l	-	3	-	5	-
Dissolved Iron, mg/l	-	-	< 0.5	-	-
Dissolved Mn, mg/l	-	-	< 0.5	-	-

3.8.6 Discharge Standards

As per the IFC EHS guidelines, the treated sewage discharge is required to meet the following guidelines.

Table 3-15: Treated sewage discharge guidelines as per IFC

Sl. No.	Parameter	MoEF&CC Standards	IFC Standards
1.	pH	6.5-9	6-9
2.	BOD (mg/l)	20 (Metros and State Capitals) 30 (other regions)	30mg/l
3.	COD (mg/l)		125 mg/l
4.	Total Nitrogen (mg/l)		125 mg/l
5.	Oil and Grease (mg/l)		10 mg/l
6.	Total Suspended Solids (mg/l)	<50 (Metros and State Capitals) <100 (other regions)	50 mg/l
7.	Total coliform bacteria (MPN /100 ml)		400 MPN/100 ml
8.	Faecal Coliform (MPN /100 ml)	< 1000	

4 Environmental and Socio-Economic Baseline

This section describes the environmental, social and ecological baseline condition prevailing in the study area. The study area includes all the components of the projects as discussed in Chapter 2. Data on prevailing baseline conditions of Physical environment, biological environment and socio-economic environment were collected from the study area.

4.1 Study Area/Area of Influence

The **IFC Performance Standards** require project proponents to identify and manage environmental and social risks and impacts within their Area of Influence. The AoI is defined in IFC Performance Standard 1 as:

The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project;(ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.

Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Direct Area of Influence

The areas which may be directly or indirectly impacted by the project during the project life cycle constitute the direct area of influence. This also includes areas that will be impacted by the construction of roads, health and safety impacts and construction camps including inflow of workers in the area due to job opportunities that might emerge due to the project.

Indirect Area of Influence

The Indirect Area of Influence includes areas with a wider radius (10 km) of the Project site which may be indirectly impacted to a lesser extent. The Direct and Indirect Area of Influence are collectively termed as Study Area.

As per **MoEF&CC EIA notification guideline**, primary data through measurements and field surveys and secondary data from secondary sources are to be collected in the study area within 10 km radius from Aerodrome Reference Point (ARP). However, for information with respect to ecology and biodiversity secondary data should be collected from 15 km aerial distance from ARP.

4.2 Environmental Attributes

The study area for the ESIA study has been considered as 10 km from the site boundary. Attributes for environmental monitoring includes physical environment comprising air, noise, surface water, groundwater and soil, biological environment and socio-economic environment. Information on baseline environmental and socio-economic condition was gathered through primary survey as well as publicly available secondary information. Baseline environmental monitoring for the physical attributes like air, water, soil, noise, surface water and ground water quality in the study area was assessed through primarily monitoring conducted through NABL accredited and MoEF&CC recognised laboratory M/s Shree Krishna Analytical Services Pvt Ltd, New Delhi. Primary survey as well as baseline environmental monitoring was conducted during August 16-21, 2023. Primary surveys for biotic environment focused to understand and record the biological environment prevailing in the area and the same was verified by the forest officials and against published information and literature. The socioeconomic environment has been studied through consultations with various stakeholders within the site. Additionally, socioeconomic data have been obtained from the Census 2011 of India reports.

Secondary information on geology, hydrology, prevailing natural hazards like floods, cyclones, etc. have been collected from literature reviews and authenticated information made available by government departments. Attributes of environmental monitoring is described in **Table 4-1.**

Table 4-1: Attributes of Baseline Environmental monitoring

Sl. No.	Attributes	Parameters	No. of Samples (Sources)
1.	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NO_X, CO, O_3, Ni, As, Benezene, Ba(P), Methane	9 locations (Primary monitoring)
2.	Noise levels	Noise levels in dB(A)	10 locations (Primary monitoring)
3.	Meteorology	Wind speed and direction, temperature, relative humidity and rainfall	IMD Climatological Table (1981-2010), IMD, GoI (Vishakhapatnam; 31.0 km from the site) (secondary Source)
4.	Ground Water	Physical, Chemical and Bacteriological parameters	5 groundwater (Primary monitoring)
5.	Surface Water	Physical, Chemical and Bacteriological parameters	5 samples including one marine water sample
6.	Soil	Physical, Chemical	6 locations (Primary Monitoring)
7.	Ecology	Existing terrestrial, aquatic flora and fauna and avifauna within 10-km radius circle.	Primary inventory through site survey and publicly available secondary data
8.	Land use	Existing land use for different categories	Based on latest satellite imagery data
9.	Socio-Economic aspects	Socio-economic and demographic characteristics, worker characteristics	Primary consultation and survey and Census of India 2011 (secondary sources)
10.	Hydrology	Drainage area and pattern, nature of streams, aquifer characteristics, recharge and discharge areas	Ground water brochure of Vizianagaram and Vishakhapatnam, CGWB (Secondary Sources)

4.3 Baseline Conditions

4.3.1 Climate and Meteorology

Being close to coastal area, the climate of the district is characterized by high humidity all the year round. There are three clear distinct seasons can be observed in the district viz. Summer, Rainy and Winter. The summer season is from March to the middle of June. This is followed by the South-West monsoon season, which lasts up to about the 2nd week of October and the period from mid-October to the end of November constitutes the post monsoon or retreating monsoon season. December to February is the winter season.

Available information on meteorology for the area was compiled from climatological data published by IMD, GoI. The climatological information for the site was obtained from IMD station in Vishakhapatnam (old name is Waltair) which is about 31 km from the site boundary and can be considered as representative of the meteorological condition of the site. The long-term meteorological data, IMD (Vishakhapatnam (Waltair)) is presented in **Table 4-2.**

Table 4-2: Long-term Meteorological Data, IMD (Vishakhapatnam (Waltair))

Sl. No	Month	Temperature (°C)		Relative Humidity		Direction	Total Rainfall (mm)	Mean Wind Speed (m/s)
		Daily Max	Daily Min	RH 0830	RH1730			
1.	January	27.7	20.7	72	70	NE	11.1	6.7
2.	February	29.2	22.3	73	72	SW	10.5	8.4
3.	March	30.8	24.6	72	75	SW	13	11.4
4.	April	31.7	26.4	72	77	SW	26.2	14.5
5.	May	32.9	27.6	73	77	SW	70.5	13.7
6.	June	32.7	27.5	75	76	SW	117	12.8
7.	July	31.2	26.3	79	78	SW	133.3	12
8.	August	31.3	26.1	79	79	SW	163.6	11.1
9.	September	31.3	26	79	80	SW	191.1	8.8

Sl. No	Month	Temperature (°C)		Relative Humidity		Direction	Total Rainfall (mm)	Mean Wind Speed (m/s)
		Daily Max	Daily Min	RH 0830	RH1730			
10.	October	31	25	75	74	NE	258.1	7.3
11.	November	29.7	23.2	67	68	NE	115.5	8
12.	December	28.2	21.1	66	65	NE	8.8	7.3
13.	Average	30.6	24.7				1118.7	10.2

**Source: Climatological Tables 1981-2010, Indian Meteorological Dept., Govt. of India

Temperature Profile: There is not much variation in the day and night temperature. The average daily maximum temperature is 30.6° C whereas average daily minimum temperature is 24.7° C. However, there is marked seasonal variation in temperature. During summer months maximum temperature is 32.9 ºC whereas minimum temperature during January is 20.7 ºC. The temperature profile of the area is shown in **Figure 4-1**.

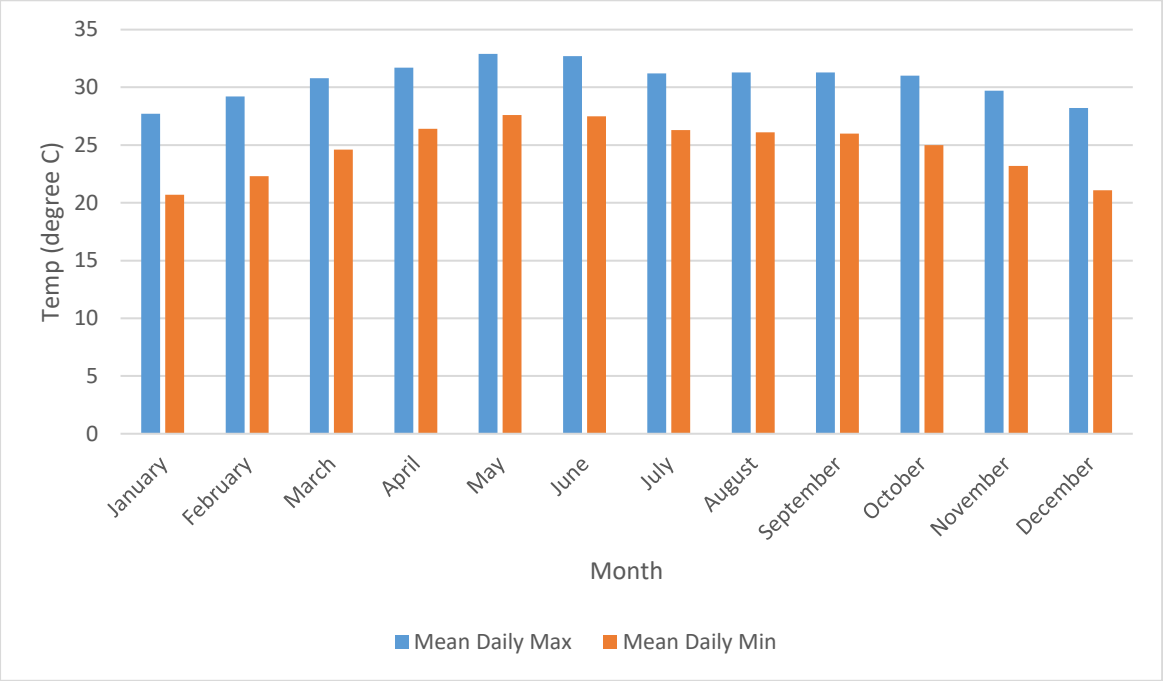


Figure 4-1: Temperature Profile of the Area

Source: *IMD Climatological Table, Vishakhapatnam (Waltair) Station (Based on 1981- 2010 observations)*

Relative Humidity: Being close to Bay of Bengal, the area experiences high humidity round the year. There is not much variation in the morning and evening relative humidity. Maximum relative humidity (80%) is observed in the month of September whereas lowest relative humidity is recorded in the month of December (66%) (**Figure 4-2**).

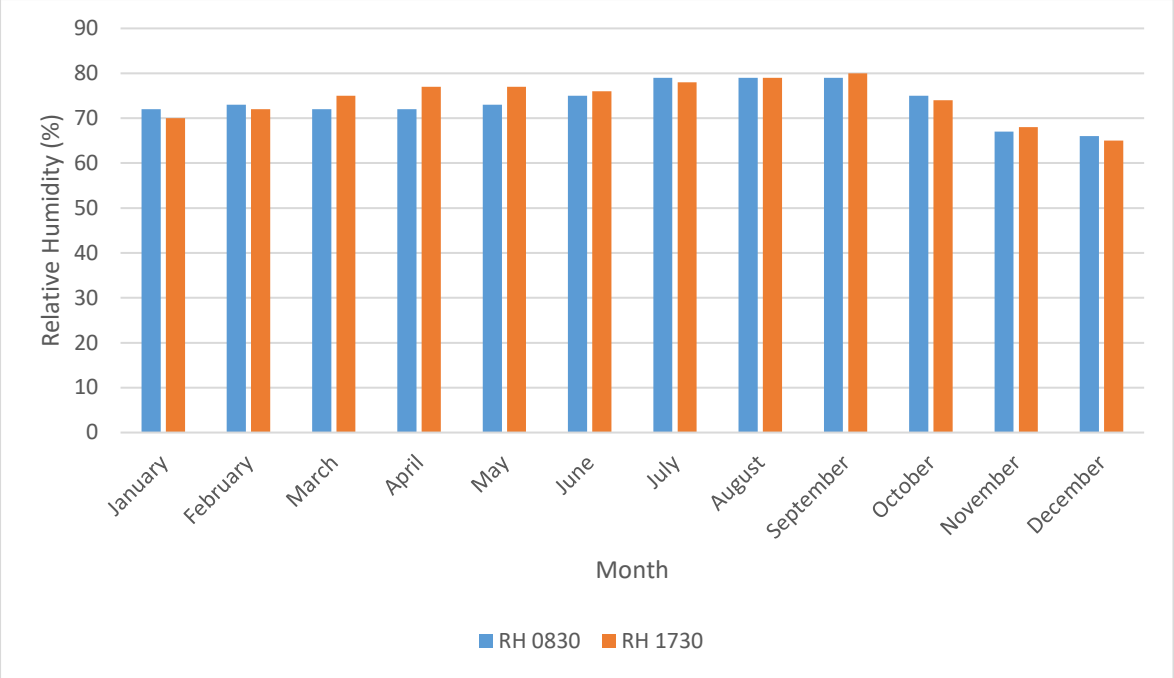


Figure 4-2: Relative Humidity Profile of the Area

Source: *IMD Climatological Table, Vishakhapatnam (Waltair) Station (Based on 1981- 2010 observations)*

Rainfall: The area receives a good amount of rainfall. The total rainfall in the district is 1118.8 mm only. The area experience almost six months of rainfall. The area receives rainfall from south-west monsoon (June to September) as well as during retrieving north east monsoon (October-November). The normal rainfall during South-west monsoon months, June to September amounts to 54% of the annual rainfall and that during North East monsoon months of October to December constitutes 33% of the annual rainfall. The area receives maximum amount of rainfall in the month of October. Monthly variation of rainfall pattern is shown in **Figure 4-3.**

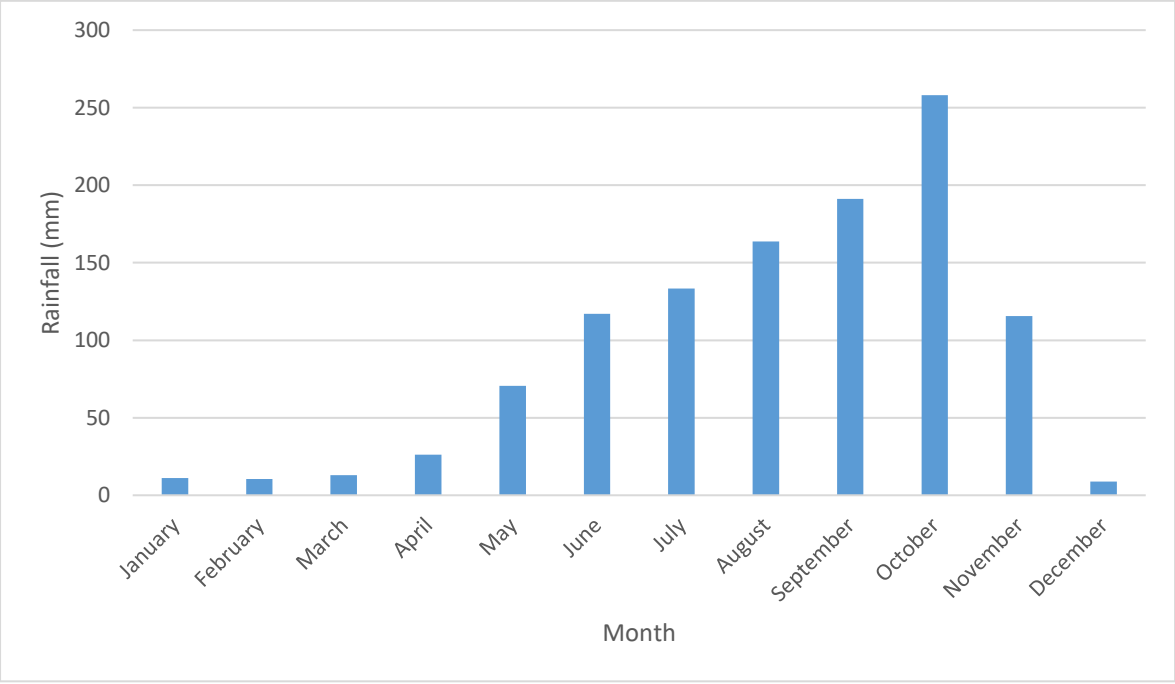


Figure 4-3: Rainfall Pattern of the Area

Source: *IMD Climatological Table, Vishakhapatnam (Waltair) Station (Based on 1981- 2010 observations)*

Wind direction and Wind speed

Hour: 0300 UTC (*Based on 1973- 2000 observations)*

Annual wind rose prepared from daily surface wind data recorded at Waltair Vishakhapatnam Indicates that predominant wind direction is southwest (SW) followed by the winds from northeast (NE). During morning time, annual strongest wind speeds (greater than 9 mps) generally come from the north northeast (NNE) or southwest (SW) direction whereas during evening time they are from north (N), north northeast (NNE), northeast (NE) and southwest (SW) directions. During evening time, winds seldom come from north-westerly direction. The annual average wind-rose diagram as well as monthly variation of wind speed and direction is shown in **Figure 4-5**. Calm wind condition prevalent around 16.5% of time over a year. The average wind speed observed for the area is 10.2 kmph whereas highest wind speed is observed during April and reaches about 14.5 kmph. The yearly variation of average wind speed is shown in **Figure 4-4.**

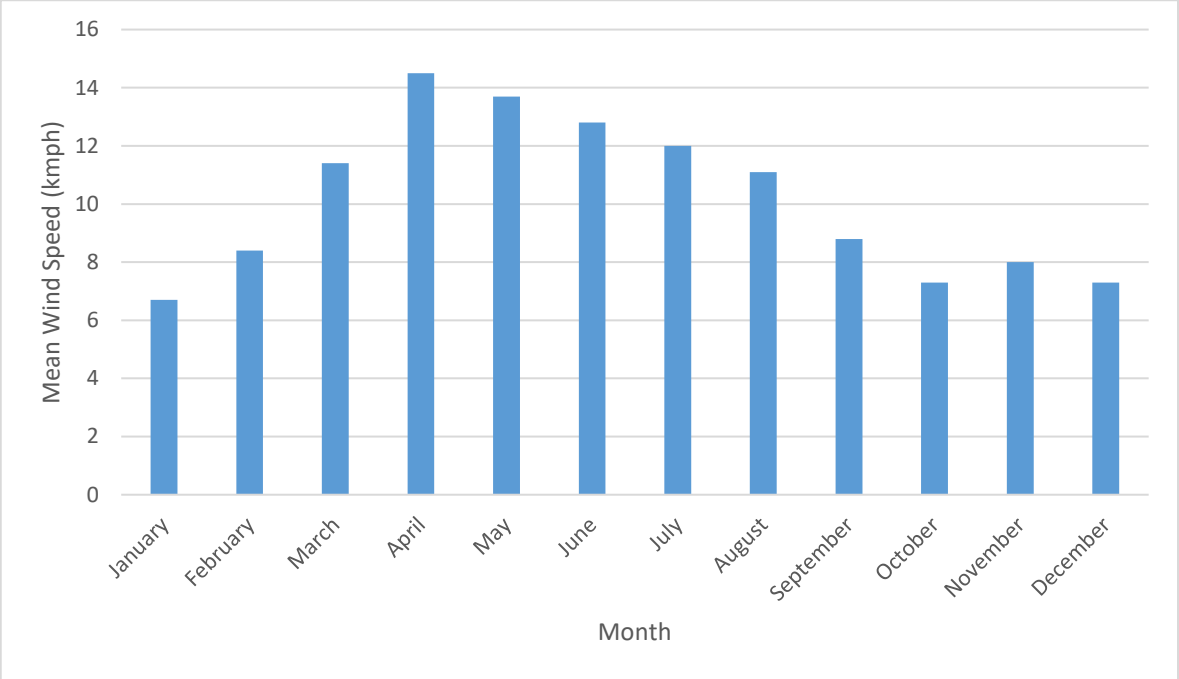
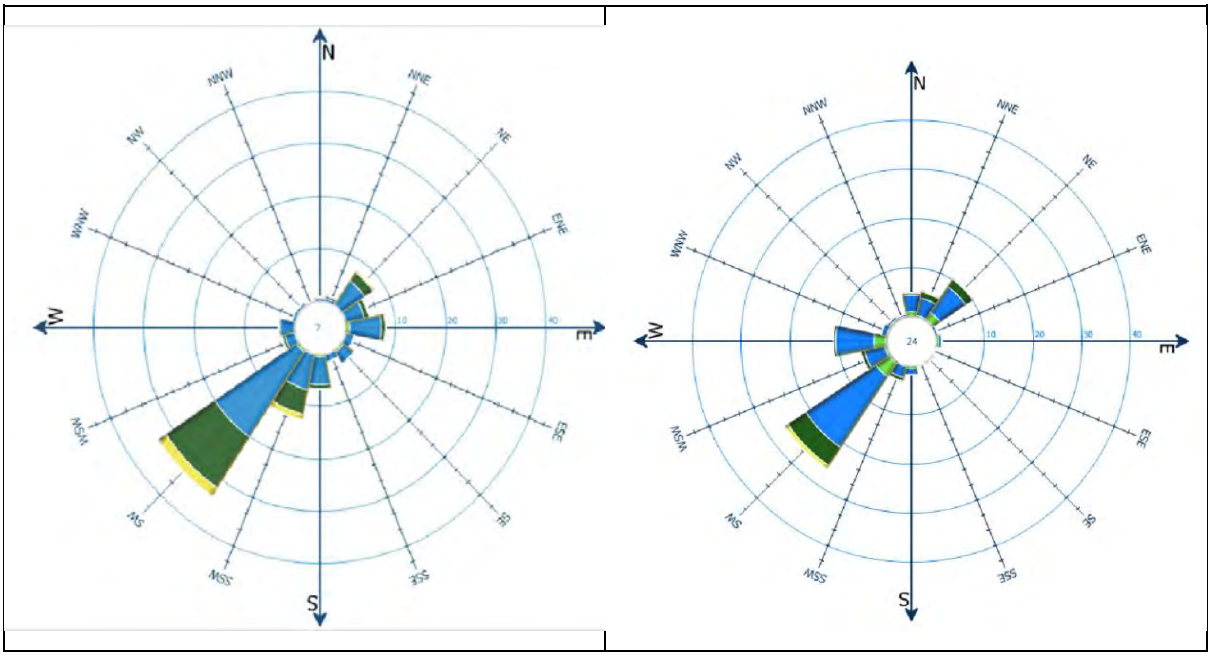
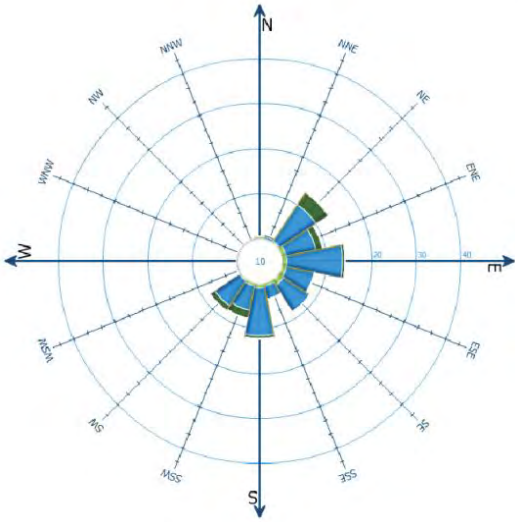


Figure 4-4: Monthly variation of mean wind speed

Source: *IMD Climatological Table, Vishakhapatnam (Waltair) Station (Based on 1981- 2010 observations)*



JANUARY



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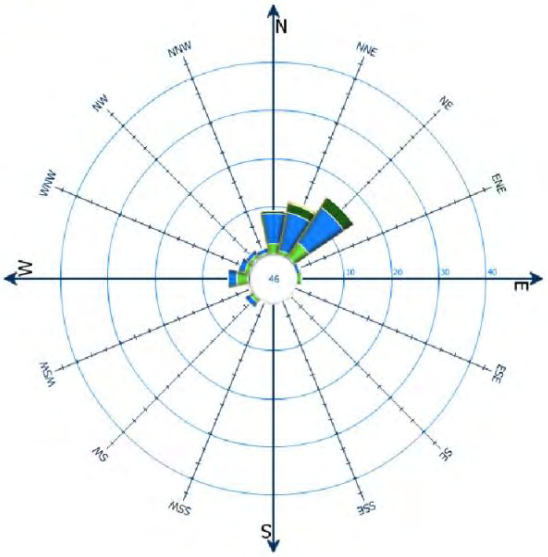
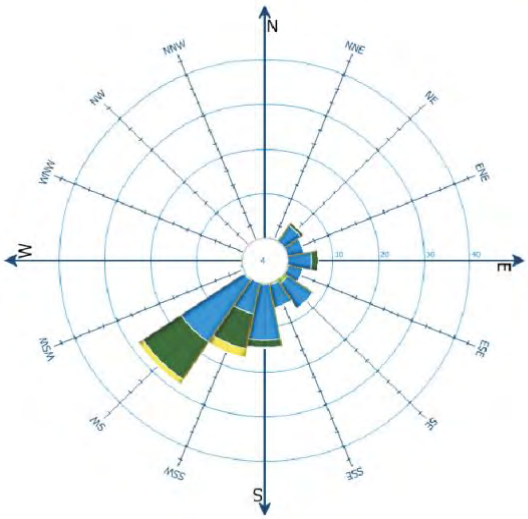


FEBRUARY



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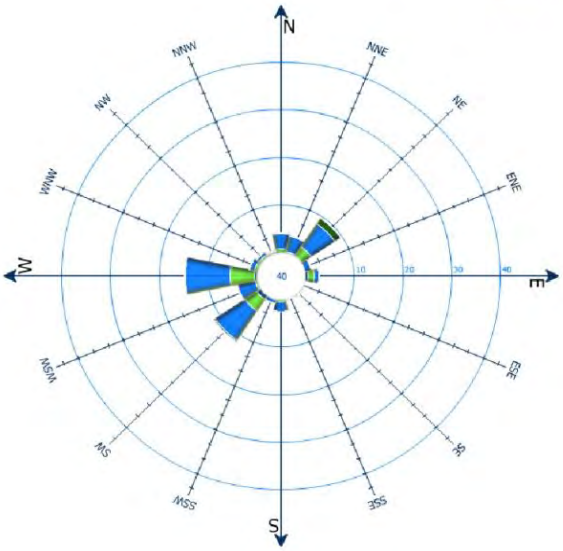
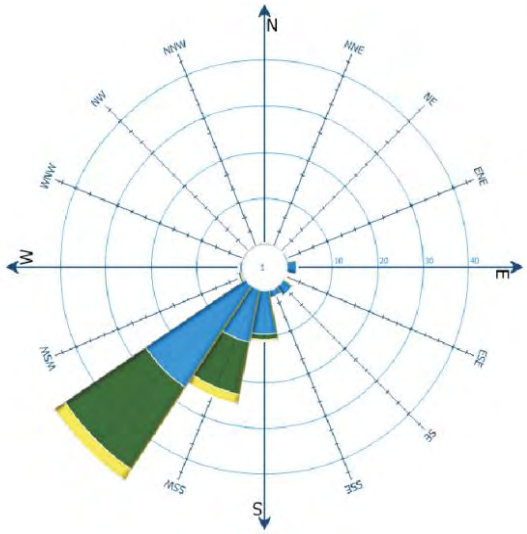


MARCH



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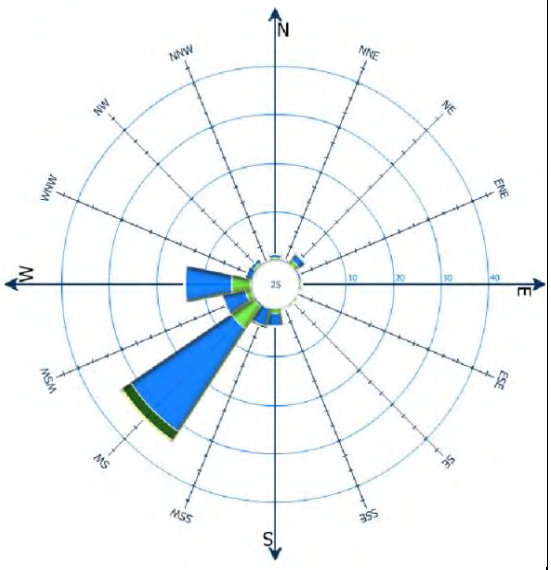
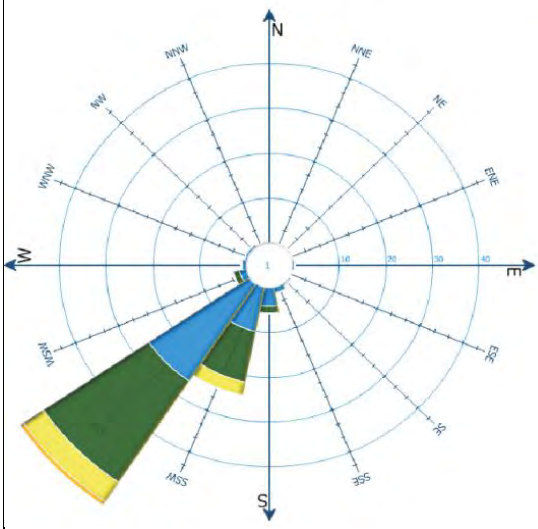


APRIL



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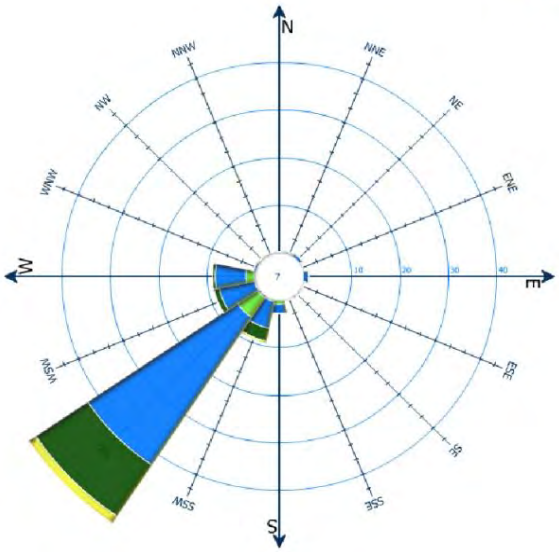

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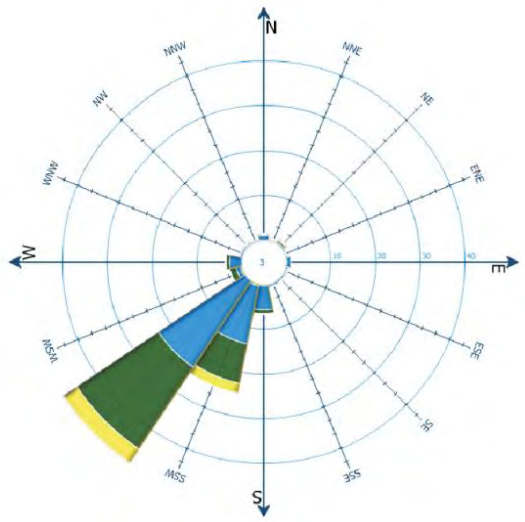

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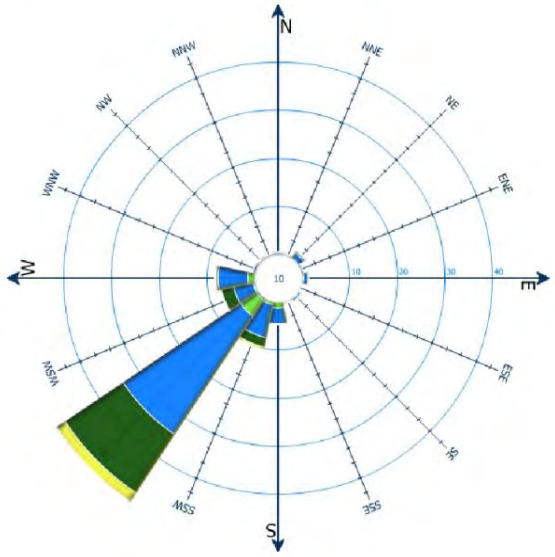

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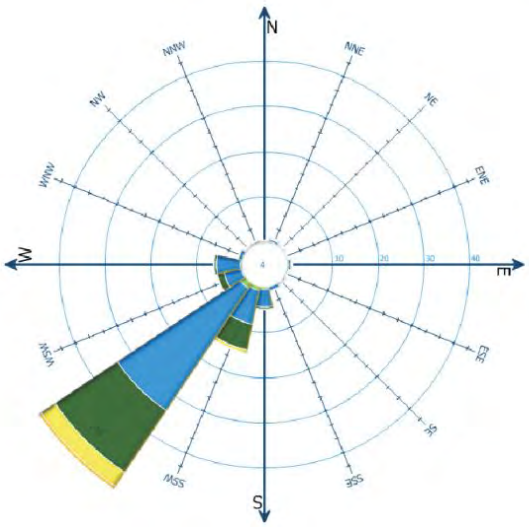

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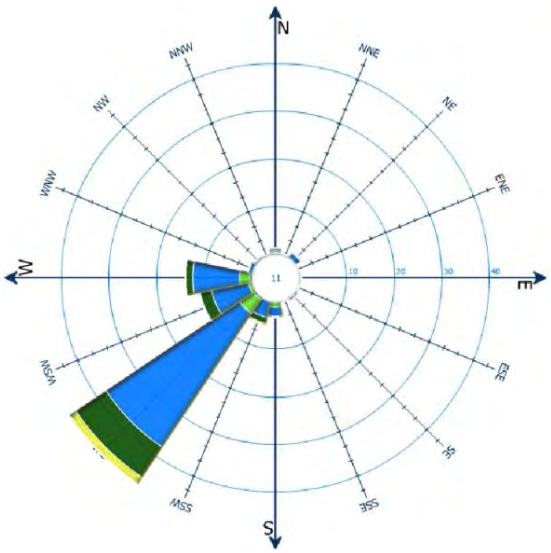

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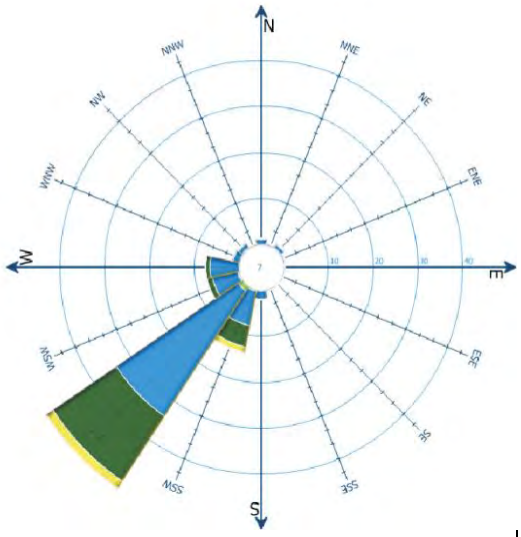

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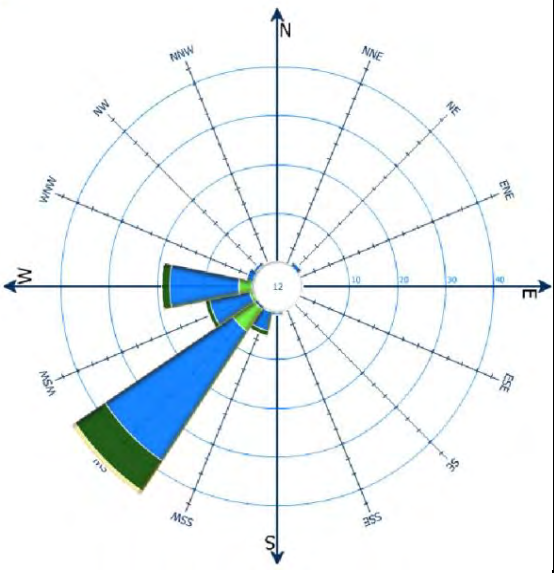

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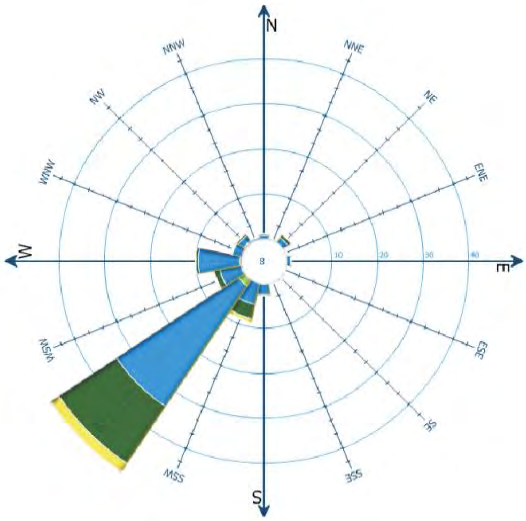

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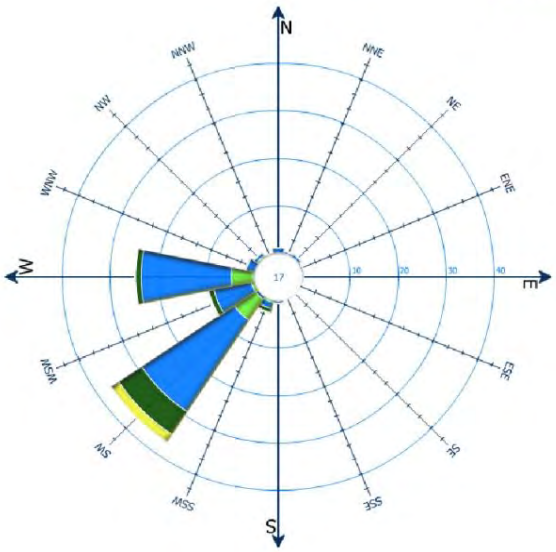

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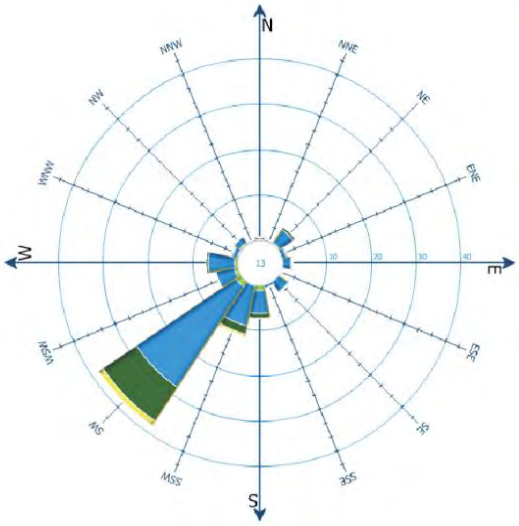

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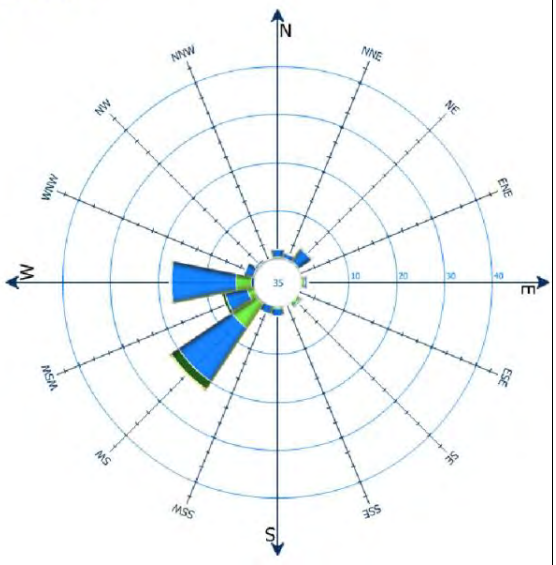

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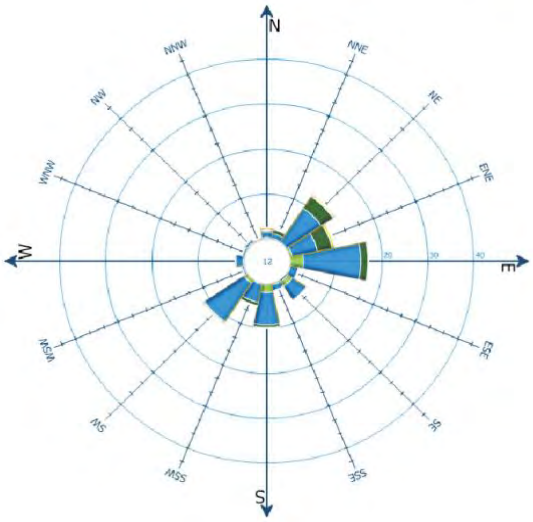

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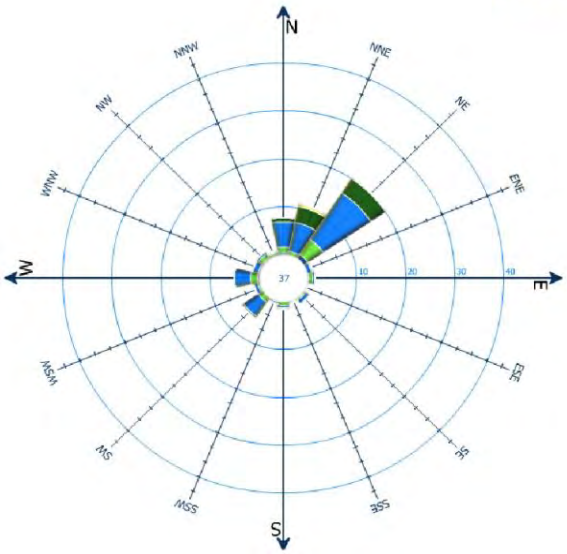


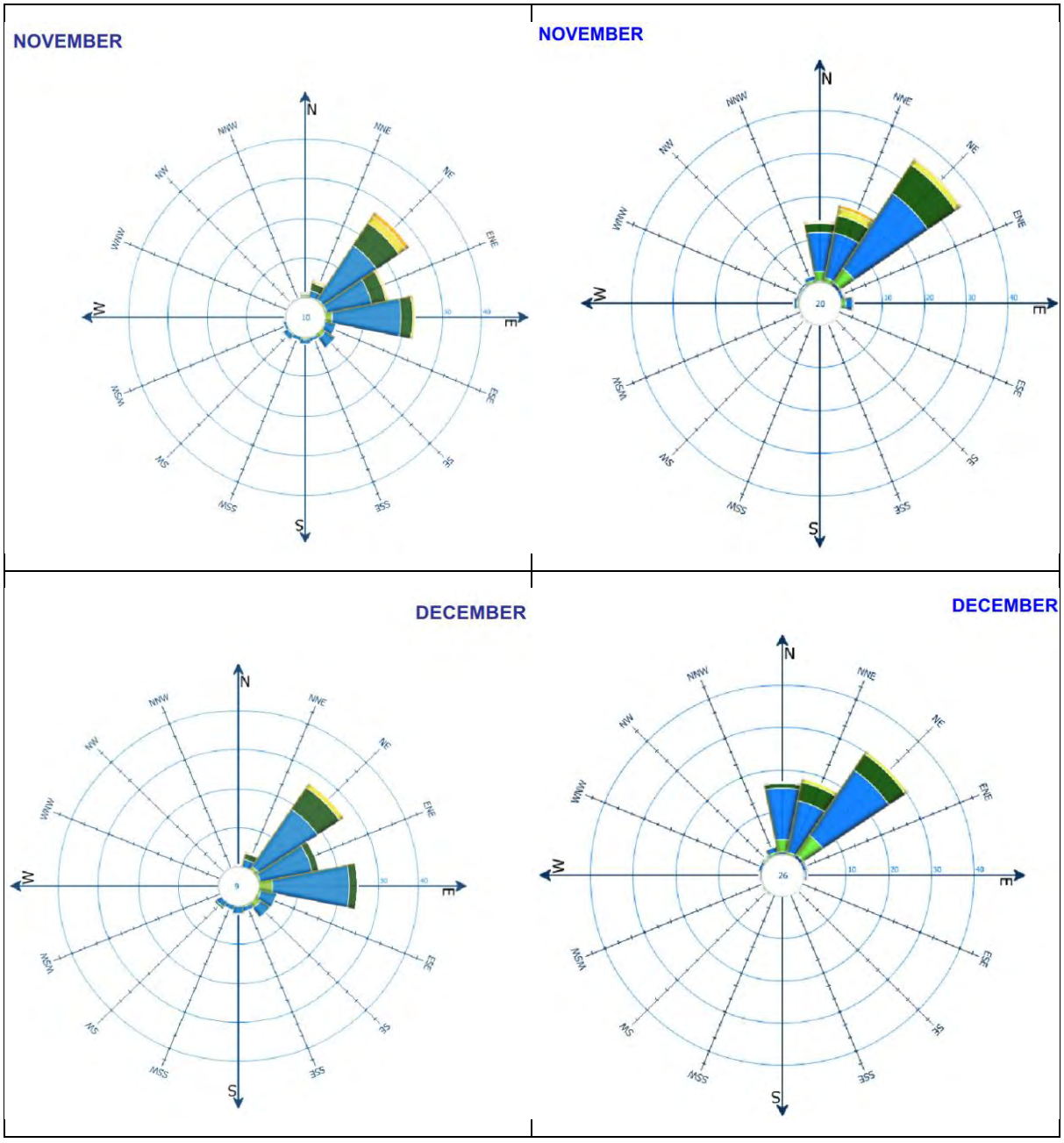


Figure 4-5: Wind Rose Pattern during 12 UTC (Left) (period 1980-2000) and 0300 UTC (Right) (*1973- 2000 observations)*

Source: *Atlas of Wind roses, IMD, New Delhi Visakhapatnam (Waltair) Station (Based on 1973- 2000 observations)*

4.3.2 Physiography

Vizianagaram district is one of the Northern Coastal districts of Andhra Pradesh. The district is lying between the Eastern Ghats and Bay of Bengal. The district is bounded on the east by the Bay of Bengal, on the northeast by Srikakulam district, on the Northwest by Orissa state and on the south by Visakhapatnam district. Geomorphologically, the district can be broadly divided into 4 distinct units viz.; structural hills, pediplains, alluvial plains and coastal plains. The western and northern parts of Vizianagaram district are occupied by structural hills and also, they occur in isolated patches. The pediplains occupy larger parts of the district. Alluvial plains and coastal plains are observed on eastern side of the district.

4.3.3 Geology

The major geological formations in the Vizianagaram district are Khondalite (44%) and Granite gneiss (39%). The Khondalite group mainly include quartzite, talc-granulite and talc-silicate. The Migmatite group include porphyroblastic hypersthene-biotite gneiss, hypersthene-quartz-feldspar augen gneiss, cordierite-hypesthene

gneisses with biotite and granitoid gneiss. The Upper Gondwanas and Tertiaries are represented by sandstones and shales, but these formations are not exposed in the study area as laterite occur as capping on the Khondalite. The alluvium occurs along the river courses consisting of sandy clay, sands and gravel.

4.3.4 Soil

The district is characterized by 5 types of soils viz. (i) red loamy soil ii) red sandy soil iii) Lateritic soil iv) Deltaic alluvial soil and 5) coastal sandy soil. The main soils in the district are Red soils, Sandy Loams and Sandy Clay and they constitute 96% of the total area. Alluvium soils are observed along the valleys. Red loamy soil is seen around west of Vizianagaram, whereas Lateritic soil covers a small area around Chipurupalle. Deltaic alluvial soil is seen in the north-eastern boundary and coastal sandy soil occurs as a narrow strip along the coast near Konada.

4.3.5 Topography

The topography in the study area is undulating and the ground levels vary from 0 m near sea cost to 250 m above mean sea level (MSL) near hillocks on southern site of the project boundary. The average site elevation in the study area varies from 20 m to 70 m. The site has Bay of Bengal on the East side which is about 1 km from the boundary and National Highway 16 (NH 16) at about 1.5 km from boundary on the West side. The natural surface consists of red soil and sandy loams. In the government land Cashew, Coconut and mango orchards are observed. The map showing digital elevation model (DEM) of the area is presented in **Figure 4-6.**

4.3.6 Drainage

The district is drained by the rivers of Nagavali, Gosthani, Suvarnamukhi, Champavathi, Vegavathi and Gomukhi which pass through plain and hilly regions whereas the study area is drained by Gosthani and Champavathi river. The Gosthani river has its origin in the Ananthagiri forest area of Srungavarapukota whereas Champavathi river takes its origin in the Eastern Ghats in Srikakulam district and after flowing through Saluru area it enters Vizianagaram mandal. The river finally falls into Bay of Mengal at Konada village in Pusapatirega mandal of the district. The drainage map of the study area is depicted in **Figure 4-7.**

4.3.7 Status of Shoreline Change in Vizianagaram District

Vizianagaram district is a part of the Northern Coastal plains of Andhra Pradesh. South-East boundary of the district is bound by Bay of Bengal. The district has coastline of about 32.78 km.

The shoreline changes are attributed as erosion, where the shoreline shift landwards or accretion where the shoreline shift seawards. Inventory related to coastal erosion are a pre-requisite in understanding the coastal dynamics of the region. A systematic and repetitive inventory and monitoring of shoreline change are prerequisite for planning measures along the coastal region. National Centre for Coastal Research, (NCCR) study the shoreline changes along Indian coast using satellite and field surveyed data.

The shoreline change estimation for Vizianagaram coast finds that about 42.6% of the coast has stable form while 45.3% of the coastlines were under erosion, and the remaining 12.0% region is experiencing accretion (**Table 4-3**). The project area in shoreline change map is shown in **Figure 4-8.**

Table 4-3: Status of Shoreline Changes along Vizianagaram Coast

Classification of coast	Extent (km)	% of Coast
Erosion	14.86	45.3
Stable	13.98	42.6
Accretion	3.94	12.0
Length of coastline	32.78	

Source: *Ministry of Earth Science, GoI (09.02.23)*

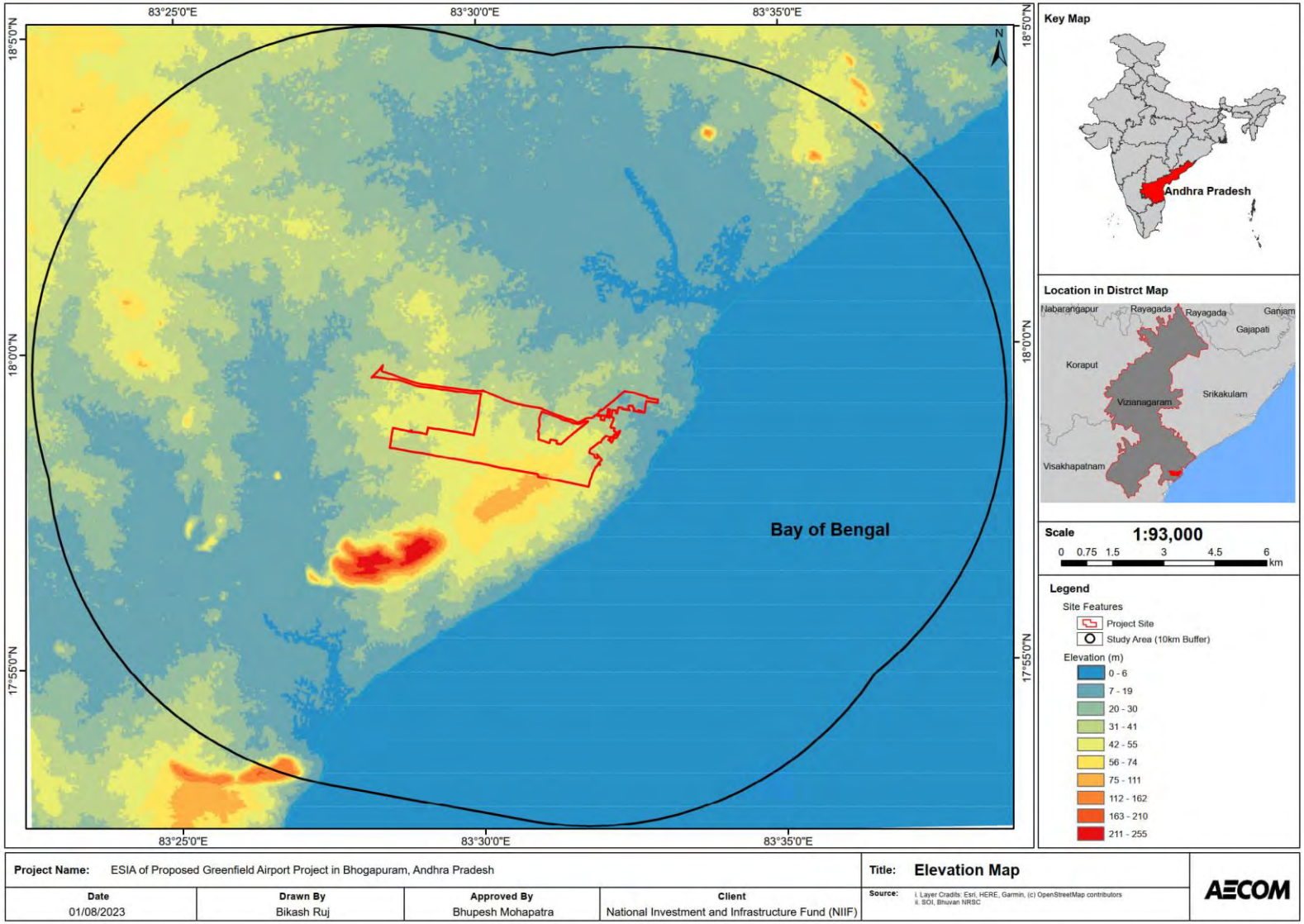


Figure 4-6: Digital Elevation Model (DEM) map of the Site area

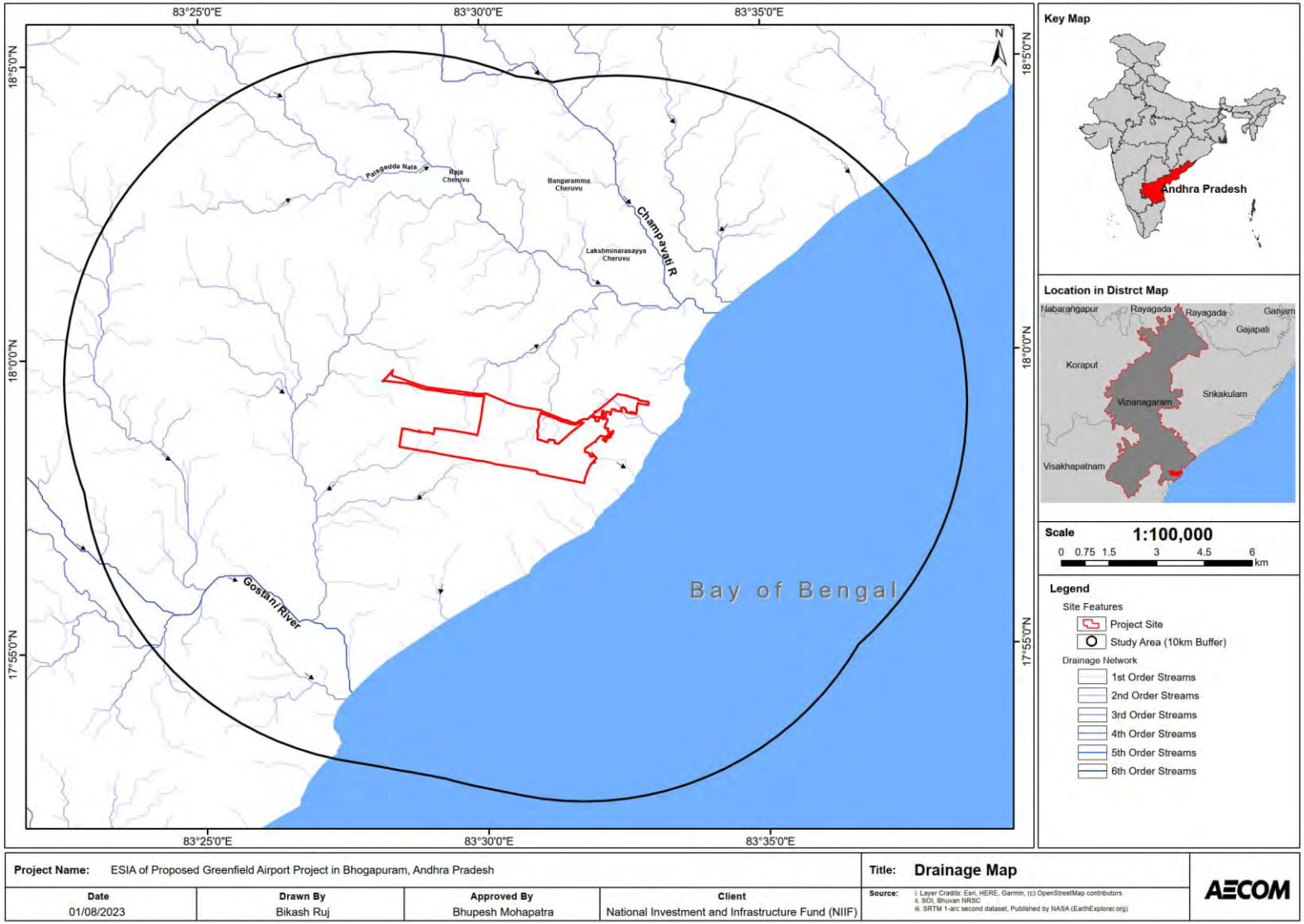


Figure 4-7: Drainage map of the Study Area

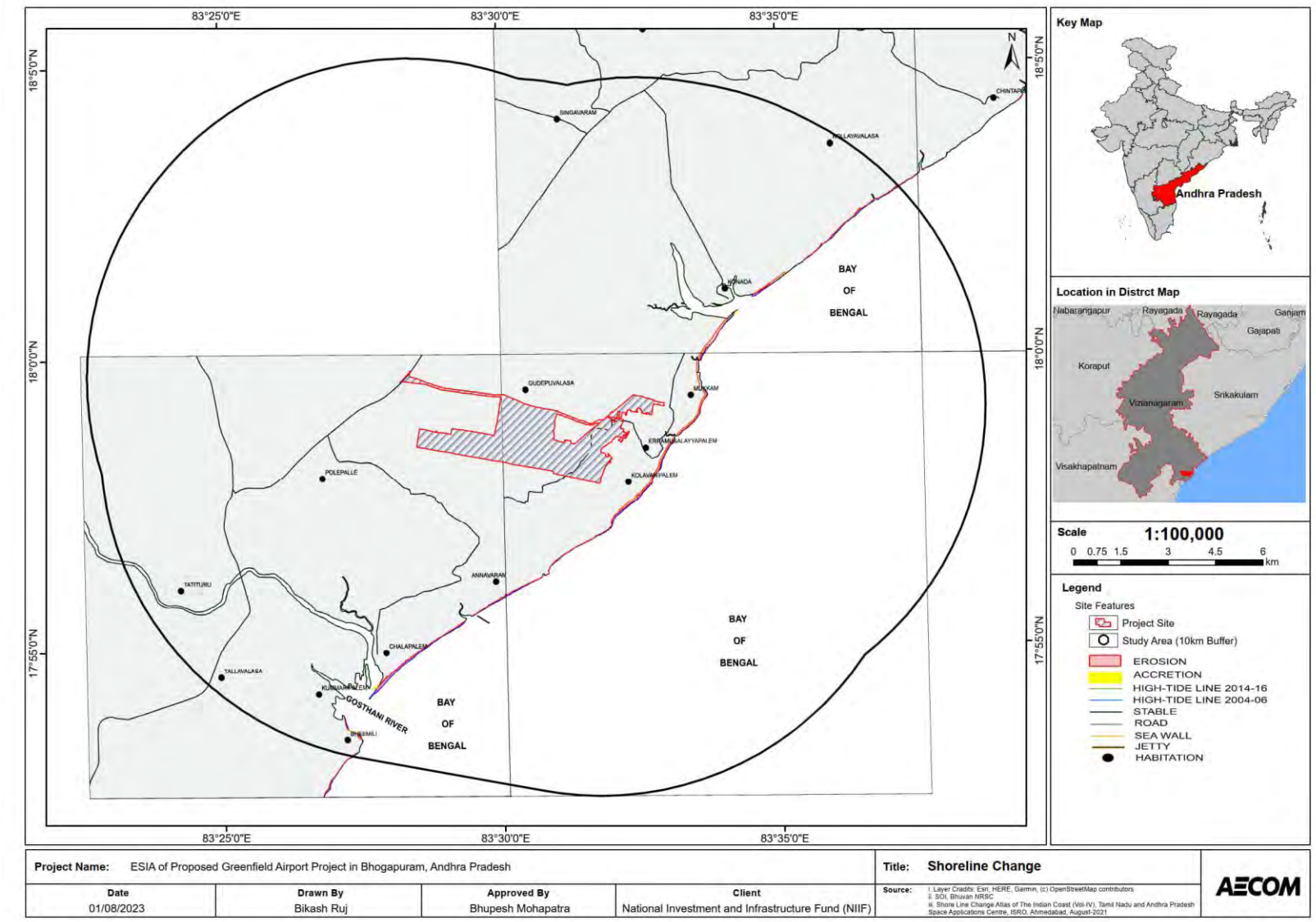


Figure 4-8: Map Showing Project Area in Shore Line Changes Map of Vizianagaram District

4.3.8 Land Use Land Cover

The land-use and land-cover of the study area (10 km) were guided by National Remote Sensing Centre (NRSC) (http://bhuvan.nrsc.gov.in), latest satellite imagery and Survey of India (SOI) topo sheet of the area. About 41% of the study area has agriculture whereas the next major land use category is waterbody which occupy about 38% of the area. About 10% of the area has wasteland. Settlements are very low in the area. Built up area in the study area is only 4%. Forest land covers about 4% of the study area. Land Use and land cover pattern of the study area is shown in **Figure 4-9**. The land use/land cover map of the study area is depicted in **Figure 4-10.**

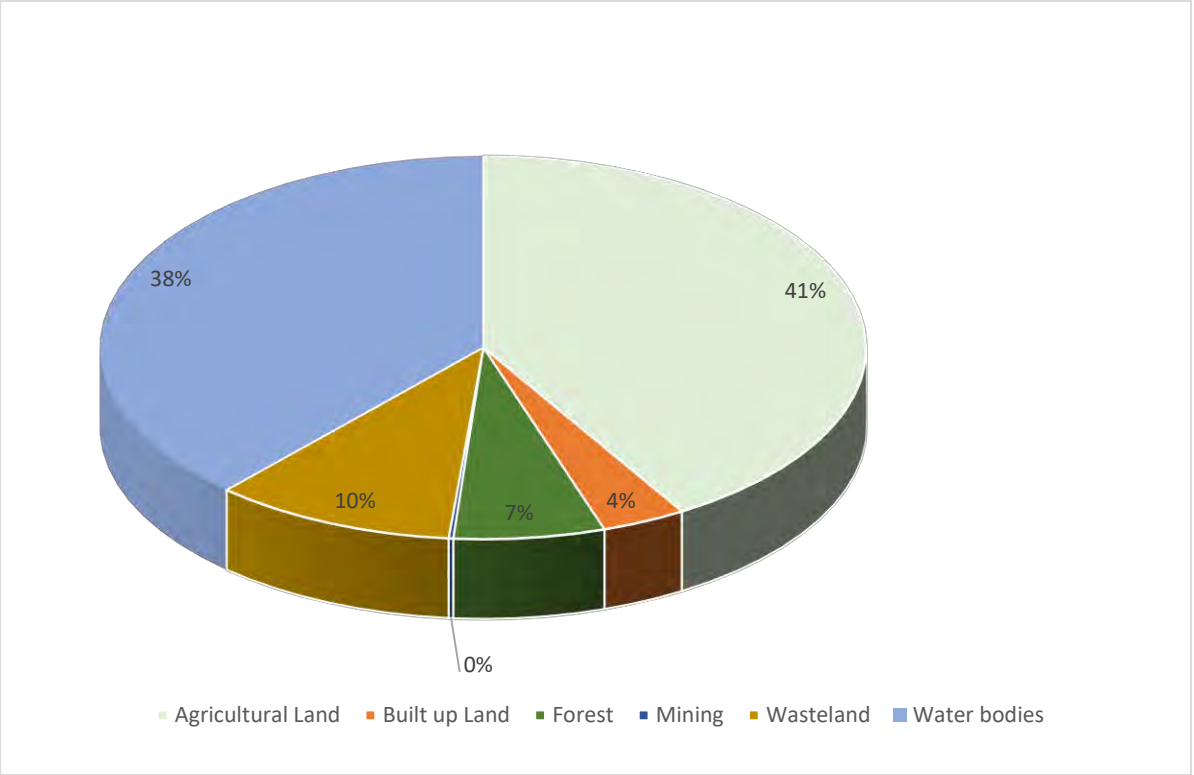


Figure 4-9: Chart showing Major Land Use and Land Cover Pattern in the Study Area

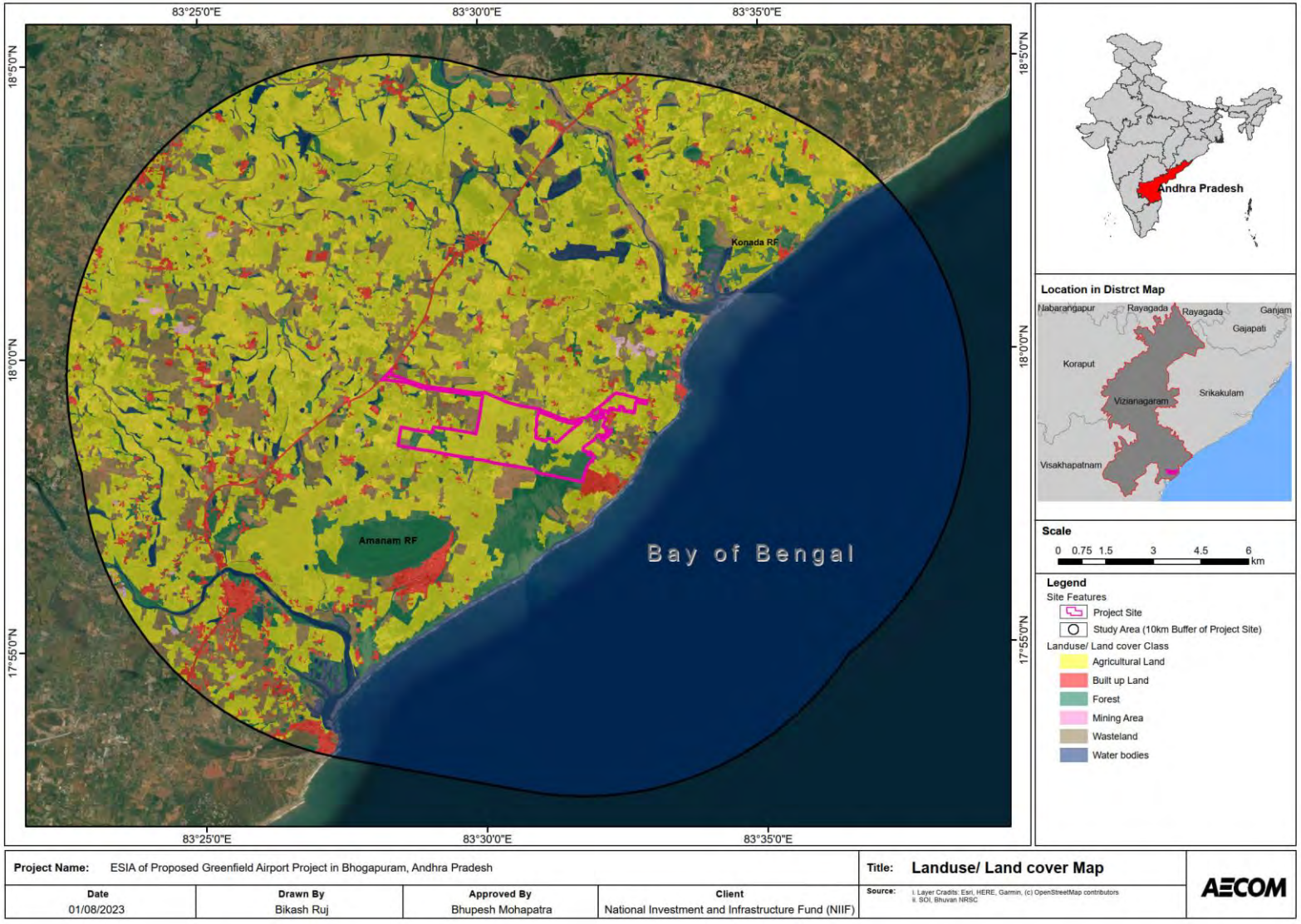


Figure 4-10: Map showing LULC of the Study Area

4.3.9 Hydrogeology

The Project site lies in the border of border of Visakhapatnam and Vizianagaram district. Therefore, the study area covers both Visakhapatnam and Vizianagaram district.

Ground water occurs in unconfined conditions and also in semi-confined/confined conditions. The ground water flows from the weathered zone into the fracture zone in hard rock area, whereas in alluvial/soft rock formations ground water flows follows simply reciprocate to topography.

Groundwater Profile of Vizianagaram District:

During pre-monsoon season majority of the water levels during this season are in the range of 5.0 to 10 m covering 68% of the area, followed by 2.0 to 5.0 m bgl (26%) and >10 m bgl (5%). The water levels > 10 m bgl occupy in parts of Salur, Pachipenta, Bhogapuram and Kothavalasa mandals.

During post-monsoon season majority of the water levels during this season are in the range of 2.0 to 5.0 m covering 73% of the area, followed by 5.0 to 10 m bgl (15%), < 2.0 m bgl (11%). The water levels > 10 m bgl occupy about 2 % of the area falling in parts of Salur and Kothavalasa mandal. The shallow water level < 2.0 m bgl occupy in parts of S.Kota, Gantyada, Vizianagaram, Nellimerla, Pusapatirega, Bobbili, Bandangi, Ballijipeta, Makkuva and Parvatipuram mandals .

The annual extractable ground water resource has been estimated as 2256.35 MCM; gross ground water draft for all uses is 427.21 MCM only. All 34 mandals are categorized as Safe in the district. The Mandal wise stage of ground water development varies from 2.8 % (Gummalakshmipuram) to 53.4% (Pusapatirega).

Groundwater Profile of Visakhapatnam District:

During pre-monsoon season majority of the water levels during this season are in the range of 5-10 m covering 65% of the area, followed by 10-20 m bgl (15%) and 2-5 m bgl (10%). Shallow water levels <2 m.bgl occupy about 5% of the area falling in parts of coastal parts of Visakhapatnam.

During post monsoon season majority of the water levels during this season are in the range of 5-10 m covering 45% of the area, followed by 2-5 m bgl (40%) and 10-20 m bgl (5%). Deep water levels in the range of >20 m bgl occupy about 2% of the area falling mostly in parts of Devarapalli mandal. Shallow water level <2 m.bgl occupy 8% of the area in small parts of Visakhapatnam urban areas.

The annual extractable ground water resource has been estimated as 939.6 MCM; gross ground water draft for all uses is 255.8 MCM only. All 43 mandals are categorized as Safe in the district. The Mandal wise stage of ground water development varies from 9% (Ananthagiri mandal) to 53% (Munagapaka mandal).

The depth to water level during pre-monsoon (April) and post-monsoon (November) is depicted in **Figure 4-11**.

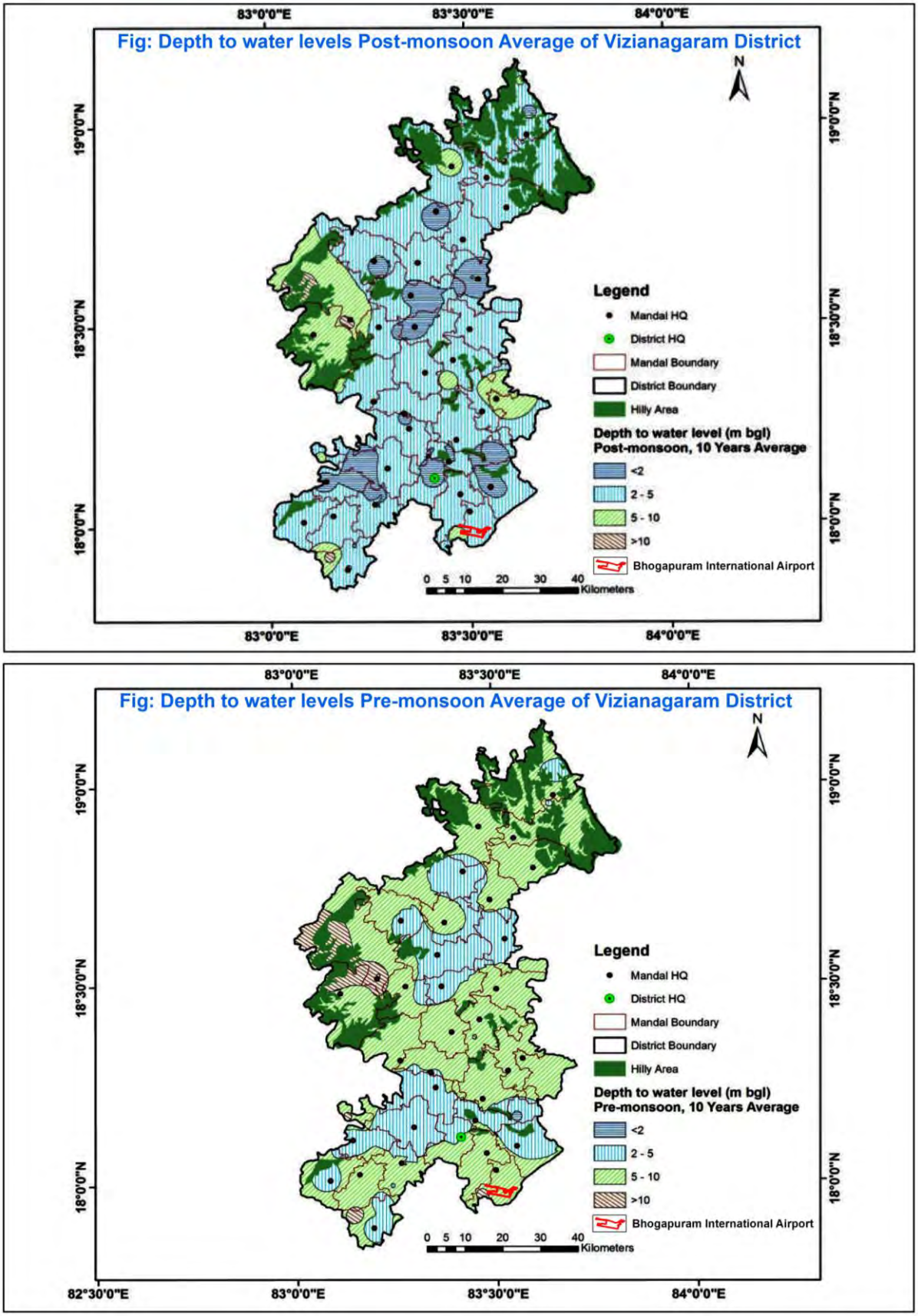


Figure 4-11: Depth of Water Level in Vizianagaram District during Pre-Monsoon (above) and post-Monsoon (below) (Source: District Groundwater Brochure, CGWB, Vizianagaram District)

4.3.10 Natural Disasters

The state of Andhra Pradesh in particular is one of the multi-hazard prone districts in India. The district geographically can be divided into two natural divisions as plain and hilly regions. The climate of the district is Characterized by high humidity, all the year round with oppressive summer and good seasonal rainfall. The Climate of the hill parts of the district is different from that of the plains. Since hilly regions receive heavier rainfall, they are cooler than the plains. The most important natural hazard in the district is cyclone. The project area superimposed in natural hazard maps are discussed in subsequent sections.

4.3.11 Earthquake

As per the earthquake hazard map, published by the **Building Materials and Technology Promotion Council (BMTPC), Government of India**, the study area falls in Zone II category in terms of earthquake. Zone II represents the low earthquake prone area (Refer **Figure 4-12**).

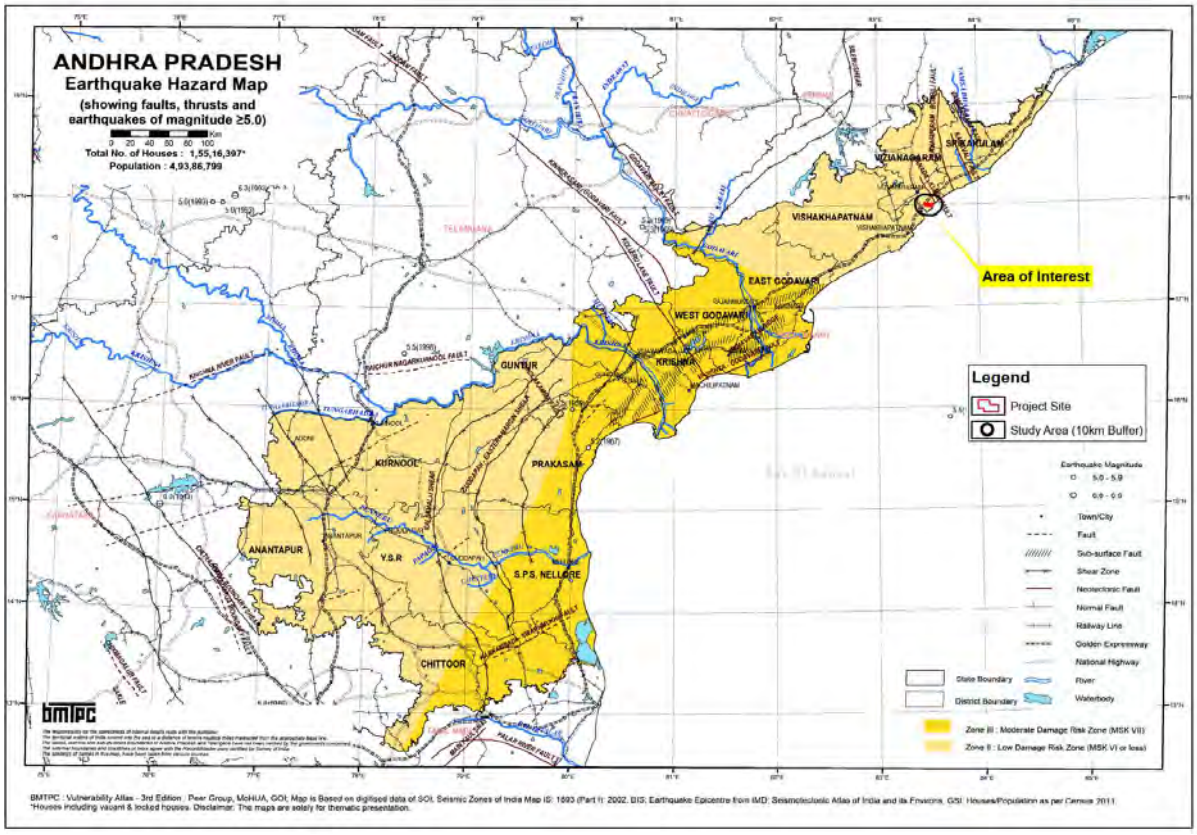


Figure 4-12: Project Area Superimposed in Earthquake Hazard Map

4.3.12 Flood

The study area is away from flood prone areas. The Project areas superimposed in flood hazard map is shown in **Figure 4-13.**

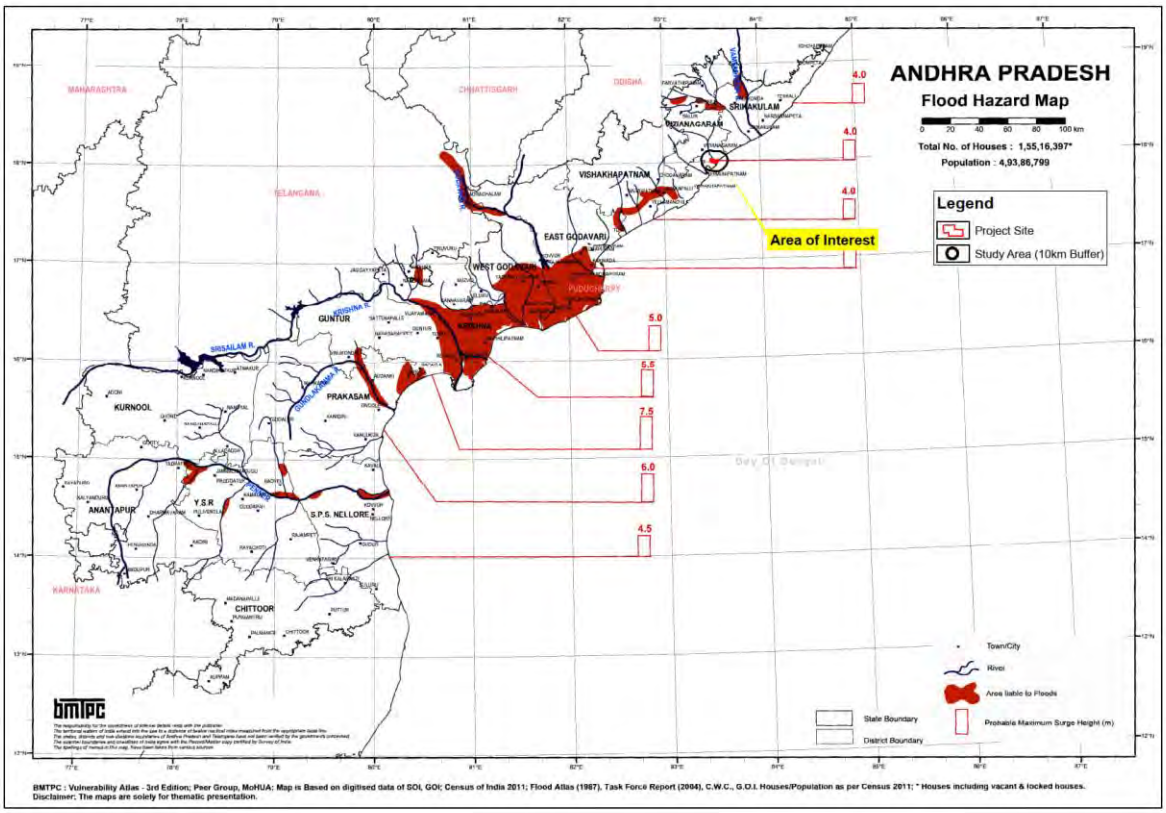


Figure 4-13: Project Area Superimposed in Flood Hazard Map

4.3.13 Cyclone

According to the BMTPC cyclone zonation map of India the project area falls in **very high damage risk zone**. The Project areas superimposed in flood hazard map is shown in **Figure 4-14**.

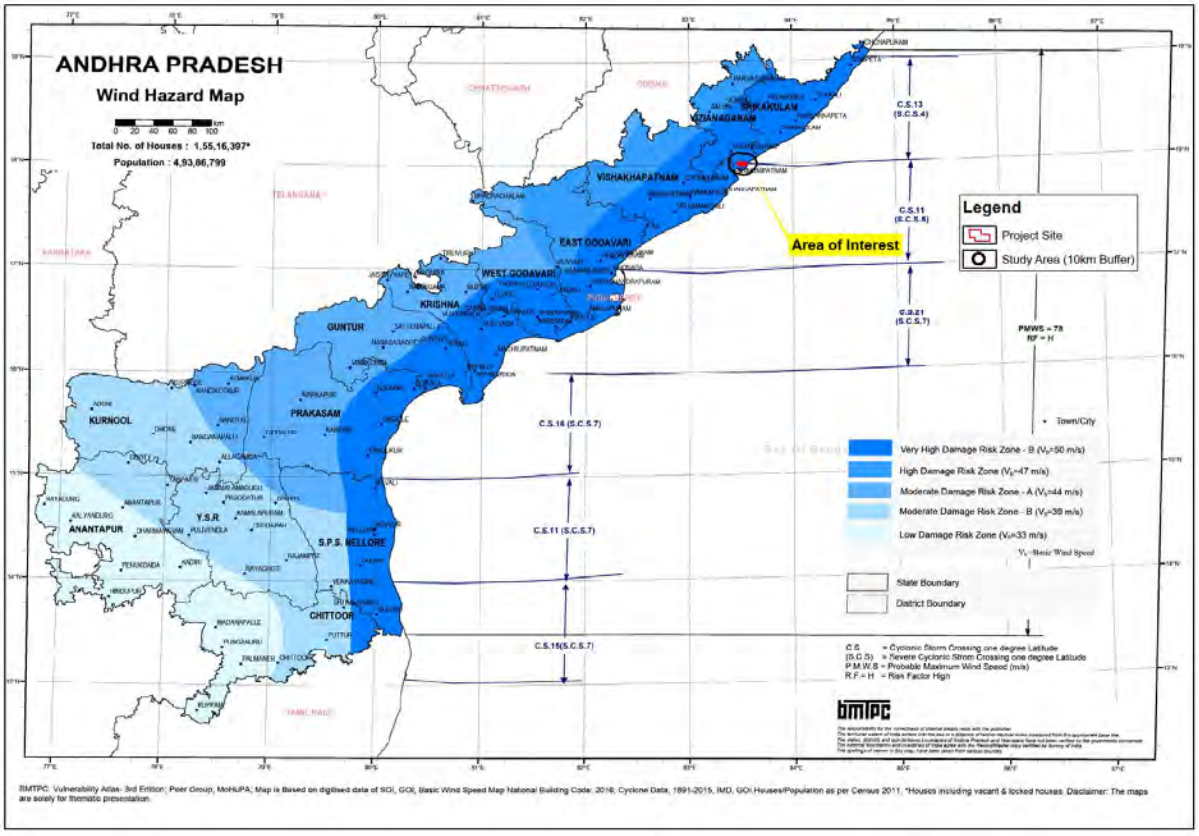


Figure 4-14: Project Area Superimposed in Wind Hazard Map

4.4 Environmental Monitoring

Environmental monitoring was undertaken for ambient air quality, ambient noise levels, surface water, ground water quality, and Soil quality. Monitoring was conducted through a NABL accredited and MoEF&CC recognised laboratory M/s Shree Krishna Analytical Services Pvt Ltd, New Delhi. The baseline environmental monitoring was conducted during August 16-21, 2023. The sampling and analysis for baseline environmental monitoring was done following IS/CPCB guidelines. The frequency for ambient air quality monitoring was for twice a week while other attributes for baseline environmental quality monitoring viz. noise, surface water, ground water and soil were for once for the season. The details of the monitoring locations are depicted below in **Table 4-4**. Map showing environmental monitoring locations are shown in **Figure 4-15.**

Table 4-4: Baseline Environmental Monitoring Locations

Env. Aspects	Location	Latitude & Longitude	Distance (km)	Direction	Rationale
Ambient air quality (AAQ)	Project Site (AAQ 1)	17°58'16.750"N & 83°30'27.223"E		On site	Project site
	Kancheru (AAQ 2)	17°58'12.154"N & 83°32'38.454"E	0.97	South-East	Location in upwind side
	Dibbalapalem School (AAQ 3)	17°57'35.439"N & 83°31'45.833"E	0.38	South-East	Nearest sensitive receptor to the runway
	M.P.U.P.School, Gudepuvalasa (AAQ 4)	17°59'25.892"N & 83°30'14.360"E	0.30	North-West	Sensitive receptor towards downwind side
	M.P.P.School, Devudumetta (AAQ 5)	17°59'9.059"N & 83°31'16.455"E	0.36	North-East	Sensitive receptor towards downwind side
	Manjeru (AAQ6)	18°0'50.389"N & 83°31'15.929"E	3.33	North North-East	Location towards downwind side
	Bhogapuram (AAQ 7)	18°1'54.068"N & 83°29'54.033"E	4.71	North North-West	Location towards downwind side
	Ravada (AAQ 8)	17°58'12.705"N & 83°27'36.286"E	1.62	West South-West	Receptor nearest to the runway

Env. Aspects	Location	Latitude & Longitude	Distance (km)	Direction	Rationale
	Nandikapeta (AAQ 9)	17°59'45.448"N & 83°28'27.208"E	0.15	North West	Kerbsite
Noise	Along Runway (N 1)	17°57'51.472"N & 83°31'44.730"E	0.00	On site	Project Site (Runway- Zone of Max Impact)
	Along Runway (N 2)	17°58'30.402"N & 83°28'32.606"E	0.00	On site	Project Site (Runway- Zone of Max Impact)
	Dibbalapalem School (N3)	17°57'33.359"N & 83°31'42.319"E	0.43	South East	Receptor to the runway
	Near Avanthi's research & technological academy, Basavapalem (N 4)	17°58'3.686"N & 83°28'48.896"E	0.61	West South-West	Nearest sensitive receptor to the runway
	M.P.P.School, Devudumetta (N 5)	17°59'10.770"N & 83°31'19.730"E	0.43	North East	Nearest sensitive receptor to the runway
	Reddy Kancheru (N 6)	17°58'50.511"N & 83°32'16.670"E	0.15	East	Village near proposed residential facility
	M.P.U.P.School, Gudepuvalasa (N 7)	17°59'25.109"N & 83°30'20.160"E	0.33	North West	Sensitive receptor near peripheral road
	Patnavanipalem (N8)	17°59'30.390"N & 83°28'30.223"E	0.07	North West	Sensitive receptor near kerbsite
	Near Gum City School, Amatam Ravivalasa (N 9)	17°59'45.423"N & 83°28'27.120"E	0.15	North West	Sensitive receptor near kerbsite
	Near Sunray Beach Resorts (N10)	17°57'46.51"N, & 83°32'34.17"E	1.5	East	Proposed turtle nesting area
Surface Water (SW)	Bay of Bengal (SW 1)	17°57'41.683"N & 83°32'54.305"E	1.86	South East	Marine sample
	Champavathi River (SW 2)	18°1'17.615"N & 83°33'15.721"E	3.92	North East	River sample
	Gosthani River (SW 3)	17°55'11.320"N & 83°27'34.148"E	6.90	South West	River sample
	Near Akkivaram (SW 4)	18°0'55.128"N & 83°27'46.563"E	2.39	North West	Pond
	Near Zila High School, Konada (SW5)	18°1'15.999"N & 83°33'49.316"E	4.23	North East	Backwater (Near Konada Beach
Ground Water (GW)	Bhogapuram village (GW 1)	18° 1' 44.849" N & 83° 29' 27.426" E	4.67	North	North Direction
	Kavulavada (GW 2)	17°57' 55.001" N & 83° 29' 34.881" E	0.5	south	South Direction
	Kancheru village (GW 3)	17°58' 13.484" N & 83° 32' 40.877" E	1.6	East	East Direction
	Sarvavilli (GW 4)	17° 59' 12.664" N 83° 27' 38.508" E	4.0	West	West Direction
	Reddy Kancheru (GW 5)	17° 58' 50.005" N 83° 32' 15.290" E	0.15	East	East Direction (Near proposed Residential Purpose)
Soil Quality (SQ)	Project Site (SQ 1)	17°58'39.916"N & 83°30'34.630"E	0.00	On site	On site
	Near Eppllipeta (SQ 2)	18°0'34.352"N & 83°32'14.636"E	2.34	North East	North East direction
	Near DSN Hostel (SQ 3)	17°57'3.594"N & 83°29'31.859"E	2.19	South West	South West direction
	Near Amatam Ravivalasa (SQ 4)	18°0'20.490"N & 83°27'48.981"E	1.51	North West	North West direction

Env. Aspects	Location	Latitude & Longitude	Distance (km)	Direction	Rationale
	Near Kotha Kopperla (SQ 5)	18° 3'30.691"N & 83°32'9.801"E	7.73	North North-East	North North-East direction
	Near Geddapeta (SQ 6)	18°0'33.572"N & 83°23'17.535"E	8.85	West North-West	West North-West direction

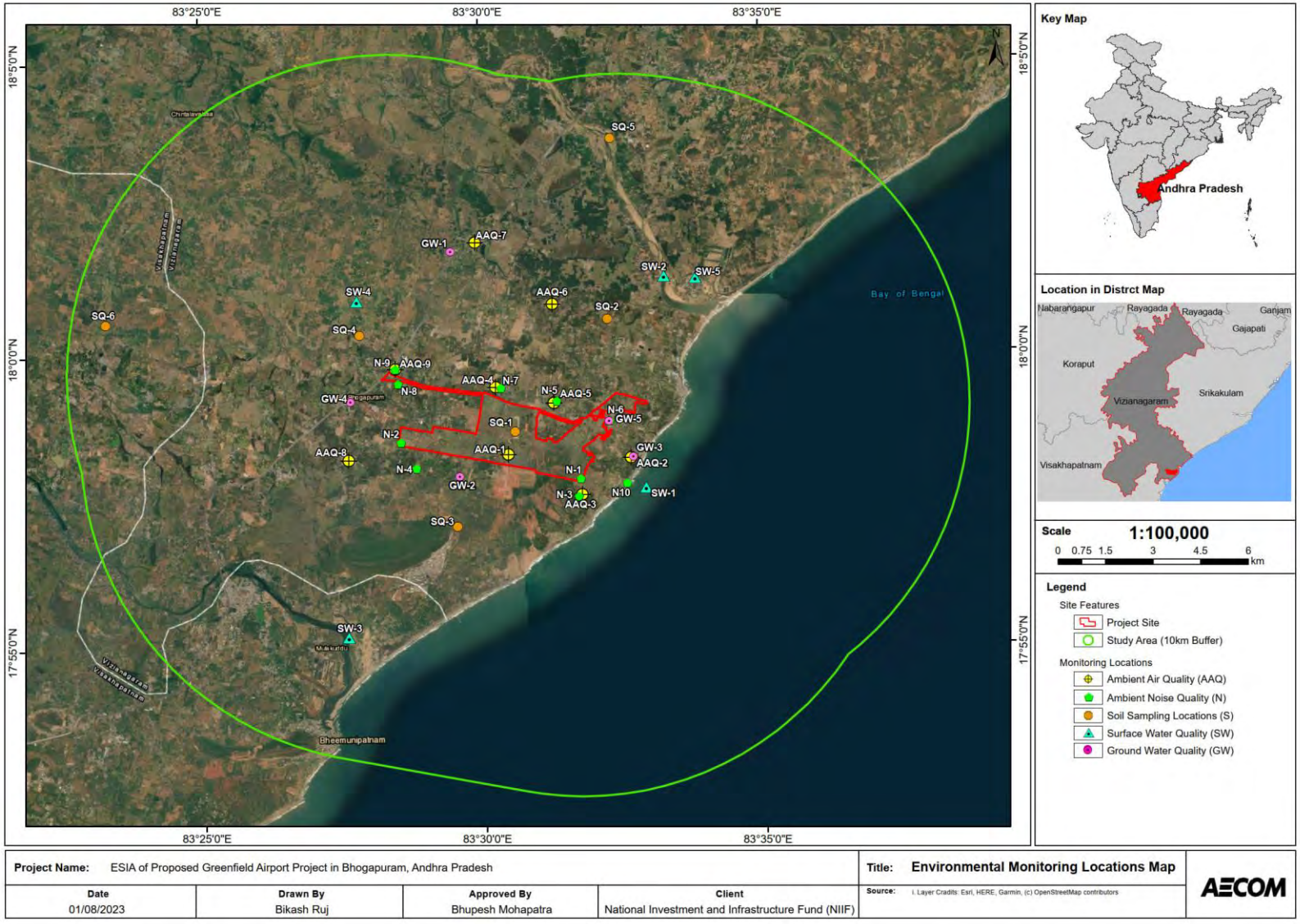


Figure 4-15: Baseline Environmental Monitoring Map

4.4.1 Ambient Air Quality

Ambient air quality monitoring was conducted for nine (9) locations. Sampling and analysis were done as per the standard method prescribed by CPCB /IS-5182. Monitoring stations were selected based on their proximity to settlements, topography, and predominant wind direction. Details of selected ambient air quality environmental monitoring locations and the rationale for selection as described above in **Table 4-4.**

Interpretation of Air Quality Results

On comparison of the ambient air quality values with national ambient air quality standards (NAAQS), the recorded concentration values for all the pollutants were observed to be within the limits of the NAAQS. The study area is primarily in a rural set up with there is no major permanent source of air pollution except road traffic and agriculture activities. The range of particulate matter (PM_{10}) concentration was observed to vary from 59 µg/m^3 to 87.9 µg/m^3 whereas average PM_{10} concentration was observed to be 72.9 µg/m^3 . Fine particulate matter ($PM_{2.5}$) concentration was observed to vary from 40.8 to 53.1 µg/m^3 whereas average $PM_{2.5}$ concentration was observed to be 46.2 µg/m^3. All the gaseous pollutant concentration levels were well below the NAAQS. Maximum load of particulate matter and gaseous pollutant concentration was observed in the monitoring location at Manjeru village and Bhogapuram village.

The air quality comparison graph between observed value and standard value for PM_{10}, $PM_{2.5}$, SO_x, NOx, CO and O_3 are shown in **Table 4-5** and **Figure 4-16.**

Table 4-5: Ambient Air Quality Monitoring Results

Locations/ Parameters	Particulate Matter ($PM_{2.5}$); µg/m^3	Particulate Matter (PM_{10}); µg/m^3	Carbon Monoxide (CO)- mg/m^3	Sulphur Dioxide (SO_2); µg/m^3	Nitrogen Dioxide (NO_2); µg/m^3	Ozone (O_3) µg/m^3	Ammonia (NH_3) µg/m^3	Lead (Pb) ug/m^3
AAQ-1	40.85	70.7	BDL (MDL-1)	6.65	11.05	14.8	8.3	BDL (MDL-0.2)
AAQ-2	45.9	70.85	BDL (MDL-1)	7.8	15.05	19	9.35	BDL (MDL-0.2)
AAQ-3	51.8	78.3	BDL (MDL-1)	8.8	19.1	21.8	8.35	BDL (MDL-0.2)
AAQ-4	41.74	64.15	BDL (MDL-1)	7.65	12.15	10.5	6.2	BDL (MDL-0.2)
AAQ-5	47.85	73	BDL (MDL-1)	8.65	15	17	7.3	BDL (MDL-0.2)
AAQ-6	51.9	87.85	BDL (MDL-1)	10.55	22.2	18.2	9.2	BDL (MDL-0.2)
AAQ-7	53.1	82.85	BDL (MDL-1)	9.35	18.8	14.95	15.2	BDL (MDL-0.2)
AAQ-8	41.2	69.35	BDL (MDL-1)	6.3	11.7	10.3	7.9	BDL (MDL-0.2)
AAQ-9	41.05	59.35	BDL (MDL-1)	5.15	10.15	7.8	6.4	BDL (MDL-0.2)
Min	**40.85**	**59.35**	**0**	**5.15**	**10.15**	**7.8**	**6.2**	**--**
Max	**53.1**	**87.9**	**0.0**	**10.6**	**22.2**	**21.8**	**15.2**	**--**
Avg.	**46.2**	**72.9**		**7.9**	**15.0**	**14.9**	**8.7**	**--**
NAAQS	**60**	**100**	**2**	**80**	**80**	**100**	**400**	

Source: Primary environment monitoring by SKAS laboratory, August 2023

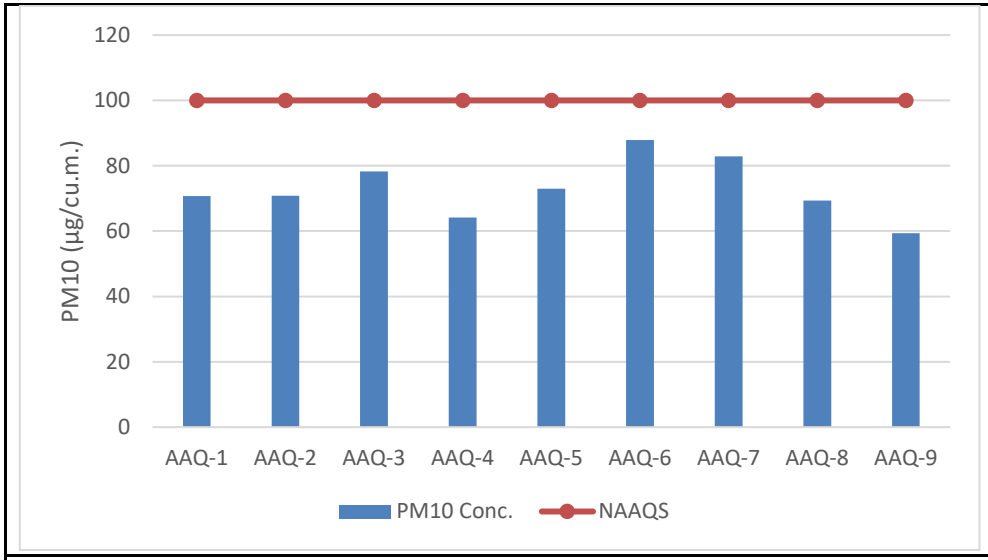


Fig: PM_{10} concentration in the study area

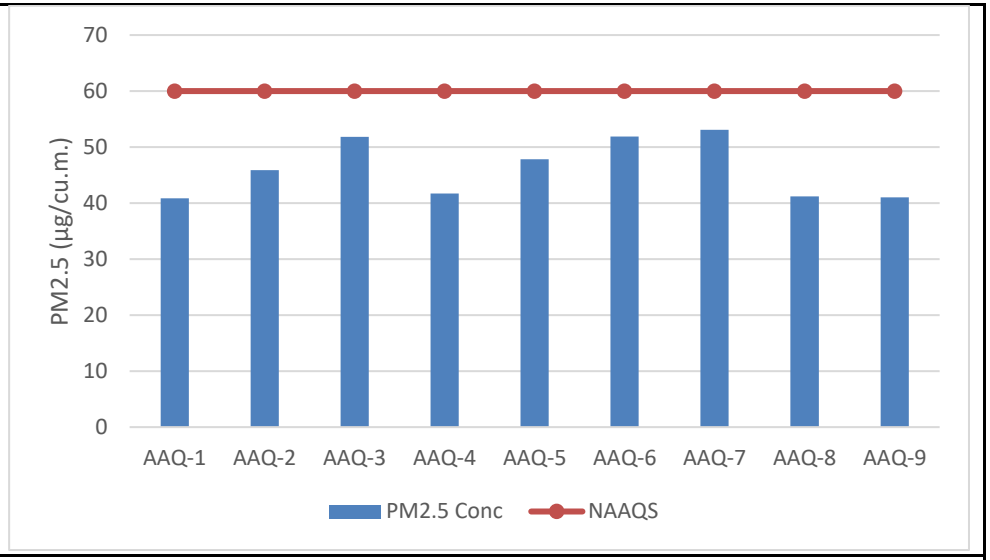


Fig: $PM_{2.5}$ concentration in the study area

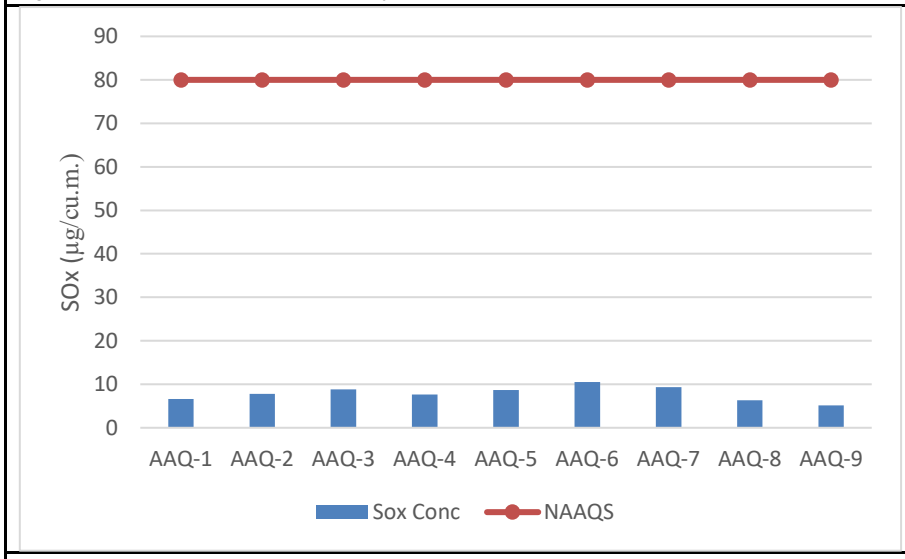


Fig: SO_2 concentration in the study area

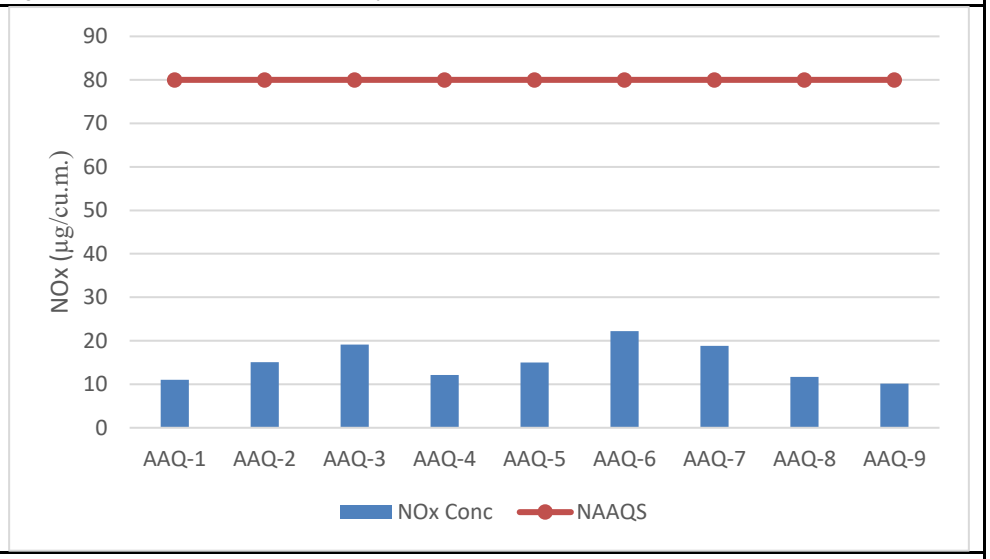


Fig: NO_2 concentration in the study area

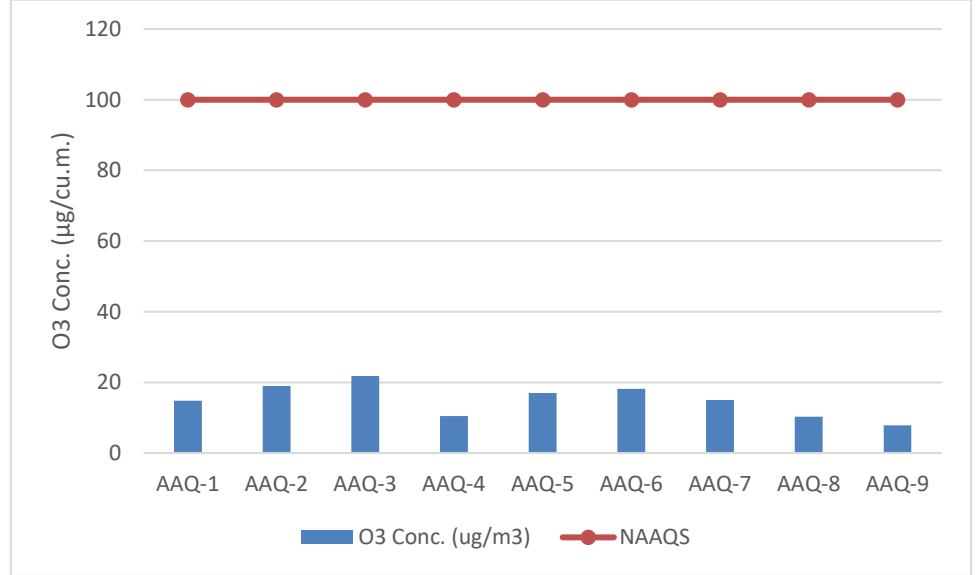


Fig: O_3 concentration in study area

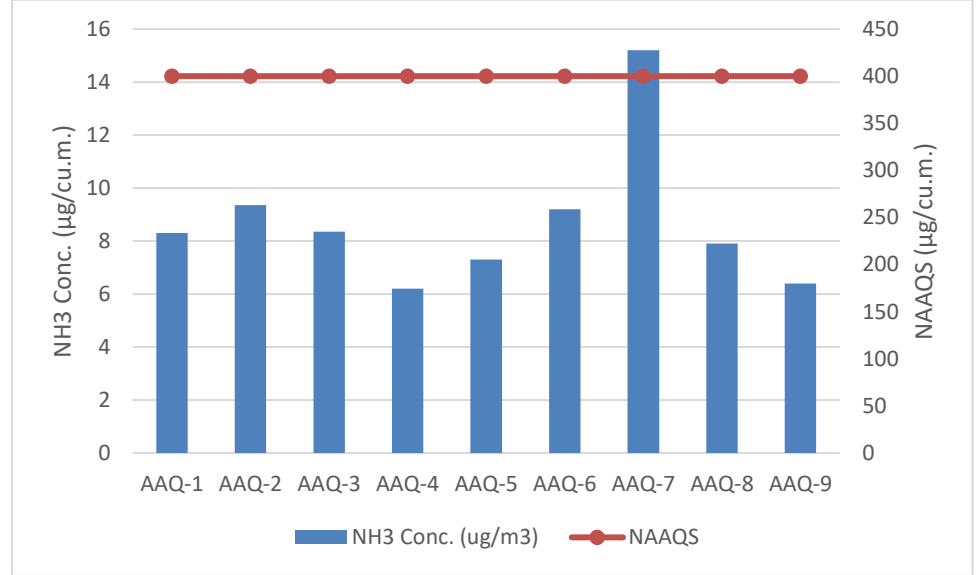


Fig: Ammonia concentration in study area

Figure 4-16: Graphical Representation of Ambient Air Quality with Respect to Standards

4.4.2 Ambient Noise Quality

The ambient noise monitoring was conducted at seven locations in the study area. The noise monitoring network was established based on the understanding of the project activities and professional judgment.

Sound pressure level (SPL) measurements in dB(A) were recorded for every hour continuously for 24 hours for the aforesaid monitoring stations and equivalent noise levels in the form of Leq day and Leq night. The results so obtained were compared with the standard specified in Noise Standards. The summary of noise quality results is presented in **Table 4-6.**

Table 4-6: Noise Quality Monitoring Results

Sl. No.	Parameters	Noise Levels, dB (A)									
		N-1	N-2	N-3	N-4	N-5	N-6	N-7	N-8	N-9	N-10
1.	Leq day	48.9	45.5	48.9	46.5	49.1	46.9	46.9	48.5	49.8	48.5
	CPCB Std.	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**
	IFC Std.	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**	**55**
2.	Leq Night	38.9	37.9	39.3	38.5	39.1	38.2	38.2	41.8	42.5	40.5
	CPCB Std.	**65**	**65**	**65**	**65**	**65**	**65**	**65**	**65**	**65**	**65**
	IFC Std.	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**	**45**

Source: Primary environment monitoring by SKAS laboratory, August 2023

Interpretation of Noise Quality Results

CPCB has noise standard for airport noise zone apart from ambient noise standards. Noise levels were compared with airport noise standard for “Busy Airports” (civil airport having more than 50,000 aircraft movements per year).

However, IFC has noise standards for following two categories of landuse viz. (i) Residential, institutional, educational and (ii) Industrial, Commercial. Noise levels of the study area were compared with the Residential, institutional, educational standard.

Noise levels recorded at different places in the study area were observed to be within the IFC and CPCB standards. The graph showing noise quality comparison between observed value and standard value are shown in **Figure 4-17.**

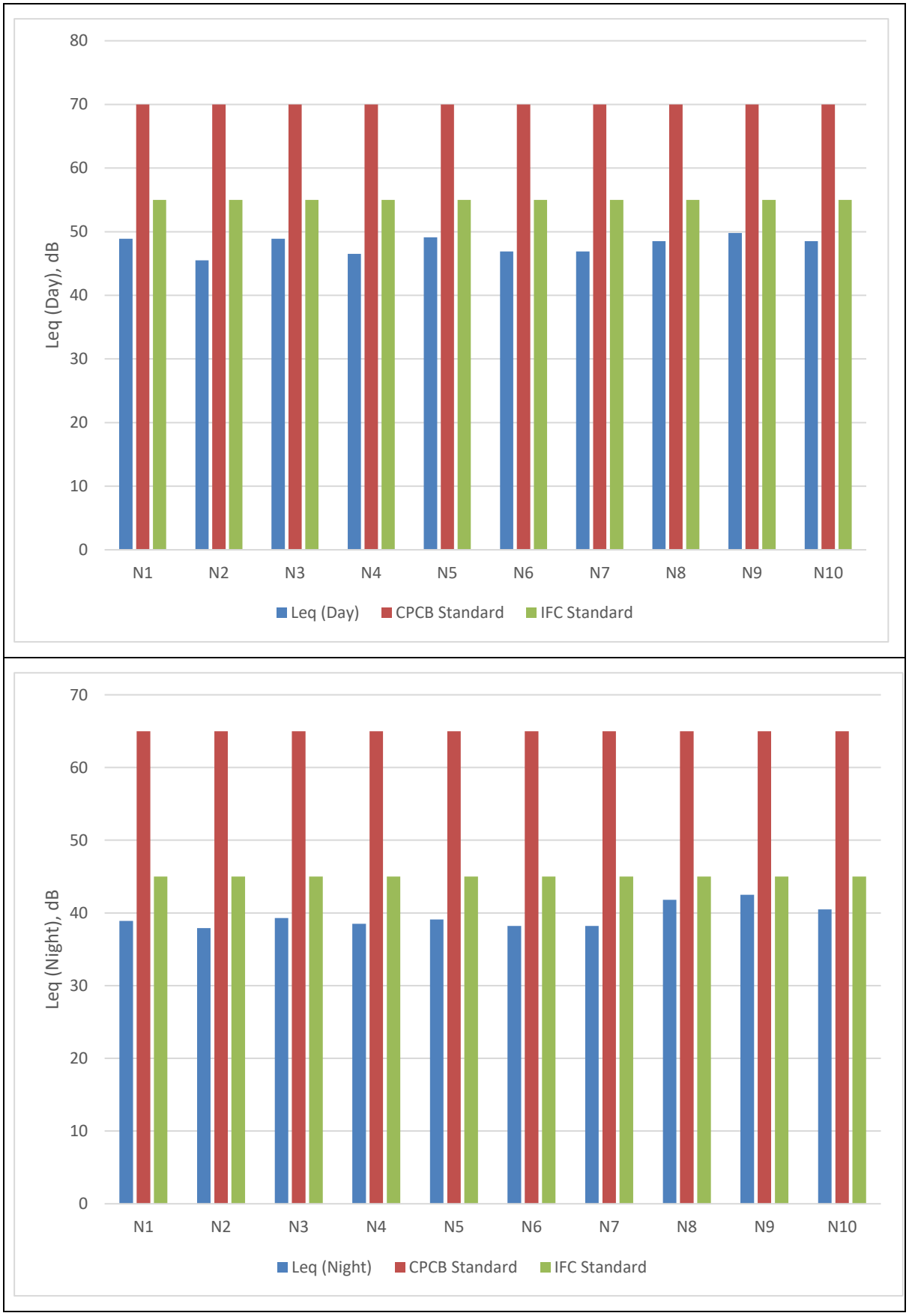


Figure 4-17: Graphical Representation of Noise Quality with Respect to Standards

4.4.3 Surface water Quality

The surface water sample was collected from five locations from the study area. The analysis was done as per standard methods prescribed by IS:2296 Class C and CPCB standards. The details of selected monitoring location as mentioned above in **Table 4-4**. Surface water quality monitoring results are mentioned in **Table 4-7**.

Table 4-7: Surface water quality monitoring results

S.No	Parameters	IS:2296 Class-C	Units	SW-1 (Sea water)	SW-2 (River)	SW-3 (River)	SW-4 (Pond)	SW-5 (Back water)
1.	Temperature	Minimum	C	26.2	25.5	25.1	26.9	26.4
2.	Color	300	Hazen	BDL(MDL-0.5)	BDL(MDL-0.5)	BDL(MDL-0.5)	80	BDL(MDL-0.5)
3.	Odour			Agreeable	Agreeable	Agreeable	Dis-Agreeable	Agreeable
4.	pH	6.5-8.5	-	7.84	6.84	7.86	8.12	8.19
5.	Turbidity		NTU	BDL(MDL-1)	2	4	26	2
6.	Total Dissolved Solid (TDS)	1500	mg/l	26100	3462	846	1206	9472
7.	Total Suspended Solid (TSS)	5	mg/l	BDL (MDL-5)	BDL (MDL-5)	6.9	44.5	BDL (MDL-5)
8.	Total Alkalinity (as CaCO3)		mg/l	112	182	102	221	266
9.	Total Hardness (as CaCO3)		mg/l	6350	512	284	312	1620
10.	Dissolved Oxygen (DO)		mg/l	9.5	8.5	6.6	0.2	7.6
11.	COD		mg/l	BDL (MDL-6)	BDL (MDL-6)	12	152	BDL (MDL-6)
12.	BOD	3	mg/l	BDL (MDL-1)	BDL (MDL-1)	1.6	44	BDL (MDL-1)
13.	Chlorides (as Cl)	600	mg/l	16455	1544	314	398	4556
14.	Sulphate (as SO_4)	400	mg/l	486	145	98	142	452
15.	Sulphide		mg/l	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	0.54	BDL(MDL-0.05)
16.	Fluoride (as F)	1.5	mg/l	0.69	0.55	0.62	0.74	0.84
17.	Nitrate(as NO3)	50	mg/l	26.6	18.5	14.2	24.6	22.2
18.	Ammoniacal Nitrogen		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	16.9	BDL(MDL-0.1)
19.	Iron (as Fe)	50	mg/l	0.35	0.27	0.16	0.54	0.36
20.	Manganese (as Mn)		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	0.11	0.12
21.	Cadmium (as Cd)	0.01	mg/l	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)
22.	Silver (as Ag)		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)

S.No	Parameters	IS:2296 Class-C	Units	SW-1 (Sea water)	SW-2 (River)	SW-3 (River)	SW-4 (Pond)	SW-5 (Back water)
23.	Lead (as Pb)	0.1	mg/l	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
24.	Zinc (as Zn)	15	mg/l	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	0.16	BDL(MDL-0.01)
25.	Aluminum (as Al)		mg/l	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)
26.	Nickel (as Ni)		mg/l	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
27.	Total Chromium (as Cr)	0.05	mg/l	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)
28.	Copper (as Cu)		mg/l	0.06	0.05	0.05	0.08	0.11
29.	Total Arsenic (as As)	0.2	mg/l	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)
30.	Cyanide (as CN)		mg/l	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
31.	Magnesium-(Mg)		mg/l	555.86	48.48	31.35	35.72	191.97
32.	Boron (as B)		mg/l	0.21	0.1500	0.1100	0.1300	0.1900
33.	Chromium (as Cr+6)		mg/l	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)
34.	Barium (as B)		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
35.	Calcium(as Ca^{2+})		mg/l	1625	125	62	66	332
36.	Mercury (as Hg)		mg/l	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)
37.	Anionic Detergents		mg/l	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
38.	PAH		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
39.	Oil & Grease	0.1	mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
40.	Phosphorus (as PO_4)		mg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	16.50	BDL(MDL-0.1)
41.	BTEX			BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
42.	Total Petroleum Hydrocarbon		mg/l	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
43.	2,4-Dichlorophenoxyacetic acid		µg/l	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
44.	DDT(o,p and p,p-isomers of DDT.DDE and DDD)		µg/l	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)

S.No	Parameters	IS:2296 Class-C	Units	SW-1 (Sea water)	SW-2 (River)	SW-3 (River)	SW-4 (Pond)	SW-5 (Back water)
45.	Endosulphan(alpha, beta and sulphate)		µg/l	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
46.	Ethion		µg/l	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
47.	Isoproturon		µg/l	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)
48.	Malathion		µg/l	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)
49.	Monocrotophos		µg/l	BDL (MDL-1)	BDL (MDL-1)	BDL (MDL-1)	BDL (MDL-1)	BDL (MDL-1)
50.	Phorate		µg/l	BDL (MDL-2)	BDL(MDL-2)	BDL (MDL-2)	BDL(MDL-2)	BDL (MDL-2)
51.	Total Coliform	5000	MPN/100 ML	BDL (MDL-2)	BDL(MDL-2)	BDL (MDL-2)	25300	1120
52.	Fecal Coliform		MPN/100 ML	BDL (MDL-2)	BDL(MDL-2)	BDL(MDL-2)	3200	120

Source: Primary environment monitoring by SKAS laboratory, August 2023

Interpretation of Surface Water Quality Results (Except SW 1 and SW 5)

Surface water quality characteristics were assessed against IS 2296 class C specification for the samples SW-2, SW-3 and SW-4. Interpretation for SW-1 and SW-5 has been described in subsequent section being coastal water. Water quality was observed to be slightly alkaline having high TDS value. TDS value in the sample collected from Champavathi was observed to be higher than the standards. Higher TDS may be due to influence of saline ingress from tidal backwater. Dissolved oxygen value was observed to be low in the water sample collected from the village Akkivaram. BOD and COD content was also observed to be higher in the sample.

4.4.4 Groundwater Quality

To study the ground water quality in the study area seven ground water samples from different places were collected and analysed. Analysis was done as per standard methods prescribed by IS 3025 and results are presented in **Table 4-8.**

Table 4-8: Groundwater Quality Monitoring Results

Sl. No	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	GW-4	GW-5
			Desirable limits	Max Permissible Limits					
1.	Colour	Hazen	5	15	BDL(MDL-0.5)	BDL(MDL-0.5)	BDL(MDL-0.5)	BDL(MDL-0.5)	BDL(MDL-0.5)
2.	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3.	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4.	pH	-	6.5-8.5	No Relaxation	8.05	8.03	8.35	8.41	8.21
5.	Total Hardness (as $CaCO_3$)	mg/l	200	600	572	420	288	244	648
6.	Iron (as Fe)	mg/l	1	No Relaxation	0.26	0.21	0.12	0.09	0.23

Sl. No	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	GW-4	GW-5
			Desirable limits	Max Permissible Limits					
7.	Chlorides (as Cl)	mg/l	250	1000	508	415	212	124	416
8.	Fluoride (as F)	mg/l	1	1.5	1.11	0.95	0.62	0.56	0.95
9.	TDS	mg/l	500	2000	1794	1584	908	764	1542
10.	Calcium(as Ca^{2+})	mg/l	75	200	112.5	84.5	66	44.6	122
11.	Magnesium (as Mg^{2+})	mg/l	30	100	70.65	50.73	29.89	32.20	83.35
12.	Sulphate (as SO_4)	mg/l	200	400	149	144	88	65.5	168
13.	Nitrate(as NO_3)	mg/l	45	No Relaxation	15.5	11.2	9.5	6.5	16.5
14.	Chromium (as Cr)	mg/l	0.05	No Relaxation	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)	BDL(MDL-0.03)
15.	Alkalinity as $CaCO_3$	mg/l	200	600	572	498	342	382	468
16.	Aluminium (as Al)	mg/l	0.03	0.2	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)	BDL(MDL-0.02)
17.	Copper (as Cu)	mg/l	0.05	1.5	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
18.	Manganese (as Mn)	mg/l	0.1	0.3	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
19.	Zinc (as Zn)	mg/l	5	15	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
20.	Ammonia (as NH_3-N)	mg/l	0.5	No relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
21.	Anionic detergents (as MBAS)	mg/l	0.2	1	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
22.	Boron (as B)	mg/l	0.5	1	0.12	0.13	0.11	0.13	0.19
23.	Mineral oil	mg/l	0.5	No relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
24.	Phenolic compounds (as C_6H_5OH)	mg/l	0.001	0.002	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)
25.	Cadmium (as Cd)	mg/l	0.003	No relaxation	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)	BDL(MDL-0.002)
26.	Cyanide (as CN)	mg/l	0.05	No relaxation	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
27.	Lead (as Pb)	mg/l	0.01	No relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
28.	Mercury (as Hg)	mg/l	0.001	No relaxation	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)	BDL(MDL-0.001)
29.	Nickel (as Ni)	mg/l	0.02	No relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)

Sl. No	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	GW-4	GW-5
			Desirable limits	Max Permissible Limits					
30.	Sulphide(H2S)	mg/l	0.05	No relaxation	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
31.	Total arsenic (as As),	mg/l	0.01	No relaxation	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)	BDL(MDL-0.005)
32.	Barium	mg/l	0.7	No relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
33.	Chloramines (as Cl_2)	mg/l	4	No relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
34.	Silver(as Ag)	mg/l	0.1	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
35.	Molybdenum (as Mo)	mg/l	0.07	No Relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
36.	Polynuclear Aromatic Hydrocarbons(as PAH)	mg/l	0.0001	No Relaxation	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)
37.	Polychlorinated biphenyls	mg/l	0.0001	No Relaxation	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)	BDL(MDL-0.0001)
38.	TRIHALOMETHANES								
a	Bromoform	mg/l	0.1	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
b	Dibromochloromethane	mg/l	0.1	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
c	Bromodichloromethane	mg/l	0.06	No Relaxation	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)	BDL(MDL-0.05)
d	Chloroform	mg/l	0.2	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
39.	PESTICIDE RESIDUES								
40.	Alachor	µg/l	20	No Relaxation	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
41.	Atrazine	µg/l	20	No Relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
42.	Aldrin/Dialdrin	µg/l	0.03	No Relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
43.	Alpha HCH	µg/l	0.01	No Relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
44.	Beta HCH	µg/l	0.04	No Relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)
45.	Butachlor	µg/l	125	No Relaxation	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)
46.	Chlorpyriphos	µ g/l	30	No Relaxation	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
47.	Delta HCH	µg/l	0.04	No Relaxation	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)	BDL(MDL-0.01)

Sl. No	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	GW-4	GW-5
			Desirable limits	Max Permissible Limits					
48.	2,4-Dichlorophenoxy acetic acid	µg/l	30	No Relaxation	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
49.	DDT(o,p and p,p-isomers of DDT.DDE and DDD)	µg/l	1	No Relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
50.	Endosuiphan(alpha, beta and sulphate)	µg/l	0.4	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
51.	Ethion	µg/l	3	No Relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
52.	Gamma HCH(Lindane)	µg/l	2	No Relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
53.	Isoproturon	µg/l	9	No Relaxation	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)	BDL(MDL-5)
54.	Malathion	µg/l	190	No Relaxation	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)	BDL(MDL-100)
55.	Methyl Parathion	µg/l	0.3	No Relaxation	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)	BDL(MDL-0.1)
56.	Monocrotophos	µg/l	1	No Relaxation	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
57.	Phorate	µg/l	2	No Relaxation	BDL(MDL-2)	BDL(MDL-2)	BDL(MDL-2)	BDL(MDL-2)	BDL(MDL-2)
	MICROBIOLOGICAL PARAMETER								
58	Total Coliform	IS:15185:2016	Should be absent/ 100 ml		Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml
59	E.coli	IS:15185:2016	Should be absent/ 100 ml		Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml	Absent/100ml

Source: Primary environment monitoring by SKAS laboratory, August 2023

Interpretation of Ground Water Quality Results

Ground water samples were collected and analysed from the five locations. The ground water sample collected from all the points were observed to be complying with the standards as per IS10550 except TDS values. TDS concentration was observed to be higher than the desired level for all the samples. Therefore, in general groundwater samples were observed to be fit for drinking purposes without treatment as per IS10500:2012 standards.

4.4.5 Marine Water and Sediment Quality

Marine water samples were collected from two locations viz. Bay of Bengal (SW-1) and backwater near Konada village (SW-5). The marine water quality analysis reports have been mentioned in **Table 4-7**. Results of marine sediment quality analysis is mentioned in **Table 4-9.**

Interpretation of Marine Sediment Quality Results

Table 4-9: Marine sediment quality results

S.No	Parameter	Unit	Near Kancheru vill (Bay of Bengal)
1	pH (2:5 Suspension)	-	7.12
2	Electrical Conductivity (2:5)	µmhos/cm	3960
3	Bulk Density	gm/cc	0.69
4	Texture	-	Sandy
I.	Sand	%(w/w)	84.5
II.	Clay	%(w/w)	6.5
III.	Silt	%(w/w)	9
5	Organic Carbon	%	0.12
6	Organic Matter	%	0.207
7	Total Nitrogen as N	mg/kg	52
8	Total Phosphorus as P	mg/kg	12.5
9	Exchangeable Potassium as K	mg/kg	14.5
10	Exchangeable Sodium as Na	mg/kg	19.5
11	Exchangeable Calcium as Ca	mg/kg	895.5
12	Exchangeable Magnesium as Mg	mg/kg	255.2
13	Cation exchange capacity	meq/100 gm	6.7
14	Total Iron (as Fe)	mg/kg	211
15	Total Zinc (as Zn)	mg/kg	11.2
16	Total Copper	mg/kg	5.6
17	Total Boron	mg/kg	11.1
18	Total Chromium	mg/kg	BDL(MDL-1)
19	Lead	mg/kg	BDL(MDL-1)
20	Cadmium	mg/kg	BDL(MDL-1)
21	Mercury	mg/kg	BDL(MDL-1)
22	Cyanide	mg/kg	BDL(MDL-1)
23	Nickel	mg/kg	8.5
24	Arsenic	mg/kg	BDL(MDL-1)
25	Sulphate as SO_4	mg/kg	19.9

4.4.6 Soil Quality

To study the soil quality in the study area six soil samples were collected from the study area. Soil analysis results are presented in **Table 4-10.**

Table 4-10: Soil Quality Monitoring Results

S.No	Parameters	Unit	Soil-1	Soil-2	Soil-3	Soil-4	Soil-5	Soil-6
1	pH (1:10 Suspension)	-	7.11	7.16	7.22	6.95	6.59	6.75
2	Electrical Conductivity (2:5)	µmhos/cm	155	142	193	174	155	198
3	Particle Size Distribution							

S.No	Parameters	Unit	Soil-1	Soil-2	Soil-3	Soil-4	Soil-5	Soil-6
I.	Sand	%(w/w)	47.5	41.5	46.2	48.5	41.5	38.9
II.	Clay	%(w/w)	36.2	33.5	34.5	35.6	38.5	32.2
III.	Silt	%(w/w)	16.3	25	19.3	15.9	20	28.9
4	Texture		Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay
5	Permeability	cm/hr	7.2	7.1	7.3	7.9	6.2	6.5
6	Porosity	%(w/w)	41.2	42.5	44.6	44.9	39.5	49.5
7	Nitrite(as NO_2)	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
8	Nitrate (as NO_3)	mg/kg	13.5	14.2	17.5	11.5	16.5	15.8
9	TPH	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
10	PAH	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
11	Organic Matter	%	0.650	0.750	0.460	0.680	0.650	0.480
12	Phosphate (as PO_4)	mg/kg	65.5	68.9	74.5	69.5	55.9	66.1
13	Exchangeable Potassium as K	mg/kg	85.4	74.5	94.5	78.9	88.4	94.5
14	Exchangeable Sodium as Na	mg/kg	45.5	49.5	55.5	46.5	47.5	74.5
15	Exchangeable Calcium as Ca	mg/kg	3525.2	4552.5	4477.5	4788.5	4995.5	5449.5
16	Exchangeable Magnesium as Mg	mg/kg	845.5	954.5	668.5	774.5	812.5	749.5
17	Cation Exchange Capacity	meq/100 gm	25.1	31.1	28.4	30.8	32.2	34.1
18	Iron (as Fe)	mg/kg	3542.5	2854.8	4142.7	6855.9	3627.4	4774.1
19	Zinc (as Zn)	mg/kg	69.9	99.5	78.5	65.5	44.8	112.5
20	Copper (as Cu)	mg/kg	25.1	25.4	23.6	25.5	27.5	31.2
21	Total Chromium (as Cr)	mg/kg	21.1	15.5	16.9	19.5	21.1	24.8
22	Lead (as Pb)	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
23	Manganese (as Mn)	mg/kg	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
24	Barium (as Ba)	mg/kg	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)	BDL(MDL-10)
25	Cadmium (as Cd)	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
26	Mercury (as Hg)	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)
27	Nickel (as Ni)	mg/kg	16.9	19.5	14.4	15.8	16.2	19.9
28	Arsenic (as As)	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)

S.No	Parameters	Unit	Soil-1	Soil-2	Soil-3	Soil-4	Soil-5	Soil-6
29	Total Hydrocarbon	mg/kg	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)	BDL(MDL-1)

Source: Primary environment monitoring by SKAS laboratory, August 2023

Interpretation of Soil Quality Results

The results of the primary soil monitoring are discussed below:

Texture: Texture is an expression to indicate the coarseness or fineness of the soil as determined by the relative proportion of the various sized primary particles in the soil mass. The textures of the collected soil samples were observed to be sandy clay.

Porosity: The porosity of the soils varies from 39.5% to 49.5%.

Permeability: The permeability of the soils varies from 6.2 to 7.9 cum/hr. Soil permeability is the property of the soil to transmit water and air. High permeable soil will lose water through seepage.

pH: pH values in soils varies from 6.96 to 7.22. pH values in the soil samples indicate slightly acidic to neutral.

Macronutrients: Nutrient status of the soil samples can be determined from the concentration of N, P, K and organic carbon in soil samples. Nitrogen contents in the soil samples varies from 11.5 mg/kg to 17.5 mg/kg; phosphate content in the soil samples varies from 55.9 mg/kg to 74.5 mg/kg and potassium contents varies from 74.5 mg/kg to 94.5 mg/kg. organic carbon varies from 0.460 % to 0.750% indicating low organic carbon concentration.

4.5 Biodiversity Baseline

This section of the report presents biodiversity baseline of the Study Area carried out towards the ESIA. It delineates the area covered by the assessment, describes the methodology used for the assessment and establishes a biodiversity baseline covering species, habitats, and ecosystem services, invasive alien species and designated areas. This biodiversity baseline forms the basis for predicting the potential impacts of the project on biodiversity and suggesting mitigation measures to manage the predicted impacts.

4.5.1 Description of the Study Area

The Study Area represents a tract of land situated in the northern coastal regions of Andhra Pradesh in eastern India. The terrain of the Study Area is generally gently undulating, interspersed with hillocks of low elevation of upto 250 meters. The study area is mainly comprised of modified habitats (arable land with interspersed tracts of plantation) in the westward regions while exhibiting a few patches of natural and near natural habitats (forested area and scrubland) in the south-eastern regions. The study area is conspicuous of flat tracts of low-lying land with narrow sand beaches on the eastern side. The main soils in the study region are red soils, sandy loams and sandy clay and they are present in 96% of the total area.

The ecosystem of the Study Area constitutes of both terrestrial (65%) and marine (35%) ecosystem. On the terrestrial front, the ecosystem profile is majorly composed of dry deciduous and shrub ecosystems. The reported dominant natural vegetation (forest type) of the Study Area is Southern Tropical Dry Mixed Deciduous Forests and Dry Deciduous Scrub Forests. The floristic and faunal profiles is characterized by generalist species and a few habitat-specialist present in the coastal regions. On marine front, marine pelagic, marine intertidal and marine oceanic ecosystem are present. The reported land-use of the Study Area is predominantly arable land where agricultural crops and horticulture plantation like coconut, casuarina are present. Apart from the two rivers, a few natural village ponds are also present in the study area. Artificial water storage structures in form of aquaculture ponds and embanked seasonal ponds are scattered throughout the study area. The habitat profile of the Study Area is composed of a mosaic of natural and modified habitat intermixed with each other leading to heavy fragmentation of the natural habitat. Within the project site, due to disuse of arable land post land acquisition by the government for the project, the study area is showing progression towards grassland and shrubland ecosystems dominated by *Lantana camara*.

4.5.1.1 Approach and Methodology

The approach adopted for establishment of the biodiversity baseline involved the following strategy:

a) Conducting a generic assessment using the Integrated Biodiversity Assessment Tool (IBAT) to obtain numbers of IUCN Red List-assessed species potentially occurring within 50 km radius of the Project Site.

b) Extracting the corresponding list of IUCN Red List assessed species having ranges overlapping the Study Area to obtain a master-list of species potentially occurring within the Study Area.

c) Conducting a brief visit to the Study Area to verify the habitat profile therein, as also, the presence of any significant natural habitat, through walk-through and/or drive-through surveys.

d) Consulting the local Forest Department officials, as well as the local community, to verify occurrence of potential CH trigger species and habitats in the Study Area.

e) Establishing a habitat baseline consisting of those habitat types, as recognized by the IUCN Habitat Classification Scheme, noted through primary observations during the visit to the Study Area.

f) Establishing a species baseline consisting of those species for which suitable habitat-types are present within the Study Area, as verified during the visit to the Study Area.

The approach adopted for screening of species involved the following strategies:

a) Prior exclusion of entire groups of species, such as lower flora and fauna, for which screening-relevant data is known to be unavailable in the public domain.

b) Inclusion of only IUCN Red List designated globally threatened species during identification of potential CH triggers, with non-threatened species being included only if they are trigger species with respect to any KBAs overlapping the Study Area.

c) Screening out of potential CH trigger species based mainly on unavailability of adequate extent of suitable habitat-types or elevation range vis-à-vis the species-specific threshold number required to trigger CH.

The approach adopted for screening of habitats involved the following strategies:

a) Use of satellite imagery of the Study Area, as available in Google Earth, in conjunction with governmental maps of the Land Use Land Cover (LULC) of the corresponding area to characterize the habitat types therein.

b) Use of governmental maps of notified Protected Areas and Eco-sensitive Zones, as available in governmental notifications, to identify boundaries of the nearest designated areas that are legally protected.

c) Use of the Integrated Biodiversity Assessment Tool (IBAT), along with Key Biodiversity Areas (KBA) maps to identify boundaries of the nearest designated areas that are internationally recognized, but not legally protected.

The methodology applied for screening species involved the following steps:

i. Excluding lower floral and faunal species from the screening exercise, considering the known unavailability of relevant screening data on the same, and including only higher floral species, namely Angiosperms, and higher faunal species, namely, Vertebrates, that is, Mammals, Birds, Reptiles, Amphibians, and Fishes.

ii. Screening out species that are not designated by the IUCN Red List as globally threatened, considering that non-threatened species are less likely to meet the applicable CH trigger thresholds, except for species that are triggers with respect to any KBAs overlapping the Study Area, considering that such species are more likely to meet the applicable CH trigger thresholds.

iii. Identifying the CH Criteria as per which each screened in species qualifies as a potential CH trigger with respect to the Study Area.

iv. Evaluating the identified potential CH trigger species, based on extent of occurrence (EOO), estimated global population, suitable habitat types and elevation range, to screen in any likely CH triggers as per CH Criteria 1, 2 and/or 3.

v. Referring to relevant published research to determine presence of CH in the Study Area with respect to any likely CH trigger species.

The methodology applied for screening habitats involved the following steps:

i. Conducting a generic assessment using the Integrated Biodiversity Assessment Tool (IBAT) to obtain numbers of internationally recognised Designated Areas situated within 50 km of the centre of the Project Area.

ii. Identifying, mainly from IUCN-associated websites, any internationally recognised designated areas that qualify as potential CH triggers, in terms of overlapping the Project Site and being classified as highly threatened or unique ecosystems, situated within the Study Area.

iii. Identifying, mainly from governmental maps, any nationally designated legally protected areas that qualify as potential CH triggers, in terms of overlapping the Project Site and being classified as highly threatened or unique ecosystems, situated within the Study Area.

iv. Evaluating the identified potential CH trigger habitats within the Study Area to screen in any likely CH triggers as per CH Criteria 4 and/or 5.

4.5.1.2 Field-based Assessment

Approach

The approach to the field-based assessment involved collection of primary data through walk-over surveys at accessible locations within the Study Area and collection of secondary data through opportunistic, informal interviews with local Project personnel, government officials and community members.

Methodology

The Study Area was visited during 16-19th August 2023. Primary data on species and habitats was collected through sampling of floral and faunal species. The timings of the primary data collection covered the diurnal faunal activity-period, from early morning till late evening, but excluded the nocturnal faunal activity-period.

Qualitative data on floral and faunal species was recorded through the visual encounter method. Records were based on direct sightings of species, as well as, indirect evidence, such as flowers, pods, calls, nests, burrows, droppings, scats, moults, and tracks.

The field assessment included a rapid survey, specifically aimed at detecting presence of soaring and wetland bird species vulnerable to project. The said rapid survey was focused on the Project Site and involved searches focused on habitat-types or habitat-features associated with the species, such as forests, cliffs, and riparian habitat.

4.5.1.3 Biodiversity Sampling Sites

The primary biodiversity data was collected through qualitative sampling at 15 sites in the Study Area. The sites were selected through stratified random sampling, governed by considerations of safety and accessibility. At each site, primary observations on species, habitats and ecosystem services were recorded.

Study Area-specific secondary data was collected through formal consultations with the following sources.

Andhra Pradesh Forest Department

Divisional Forest Officer; Vizianagaram District, Andhra Pradesh Forest Department, Range Forest Officer; Vizianagaram District, Andhra Pradesh Forest Department & opportunistic informal consultations were conducted with a few members of the local community and project staff.

Figure 4-18 represents a map showing study area along with the biodiversity sampling locations. **Table 4-11** presents the details of the sampling sites along with their location co-ordinates, elevation above the mean sea level (AMSL), as well as the associated habitat type(s).

Table 4-11: Details of Biodiversity Sampling Sites

Sampling Site ID	Location Coordinates		Habitat Type (s)
EB1	17°58'36.605"N	83°30'18.807"E	Shrubland
EB2	17°58'1.424"N	83°31'9.835"E	Heavily Degraded Former Forest
EB3	17°58'13.913"N	83°30'6.595"E	Plantation
EB4	17°58'12.444"N	83°31'38.568"E	Heavily Degraded Former Forest
EB5	17°59'3.273"N	83°31'31.441"E	Arable Land

Sampling Site ID	Location Coordinates		Habitat Type (s)
EB6	17°53'40.559"N	83°27'14.206"E	Sandy Shorelines and Wetlands (Inland)
EB7	17°56'50.715"N	83°31'21.687"E	Shrubland
EB8	17°58'47.408"N	83°33'7.693"E	Plantation
EB9	17°57'39.866"N	83°32'29.373"E	Sandy Shorelines
EB10	17°57'17.249"N	83°28'56.738"E	Subtropical/Tropical Dry Forest
EB 11	18°0'33.887"N	83°33'55.735"E	Wetlands (Inland) and Subtropical/Tropical Dry Forest
EB 12	18°1'28.032"N	83°30'21.897"E	Arable Land and Ponds
EB 13	17°59'15.484"N	83°30'22.638"E	Ponds
EB 14	17°58'24.641"N	83°26'21.853"E	Ponds
EB 15	17°58'9.616"N	83°27'46.784"E	Ponds

Source: AECOM Primary Survey

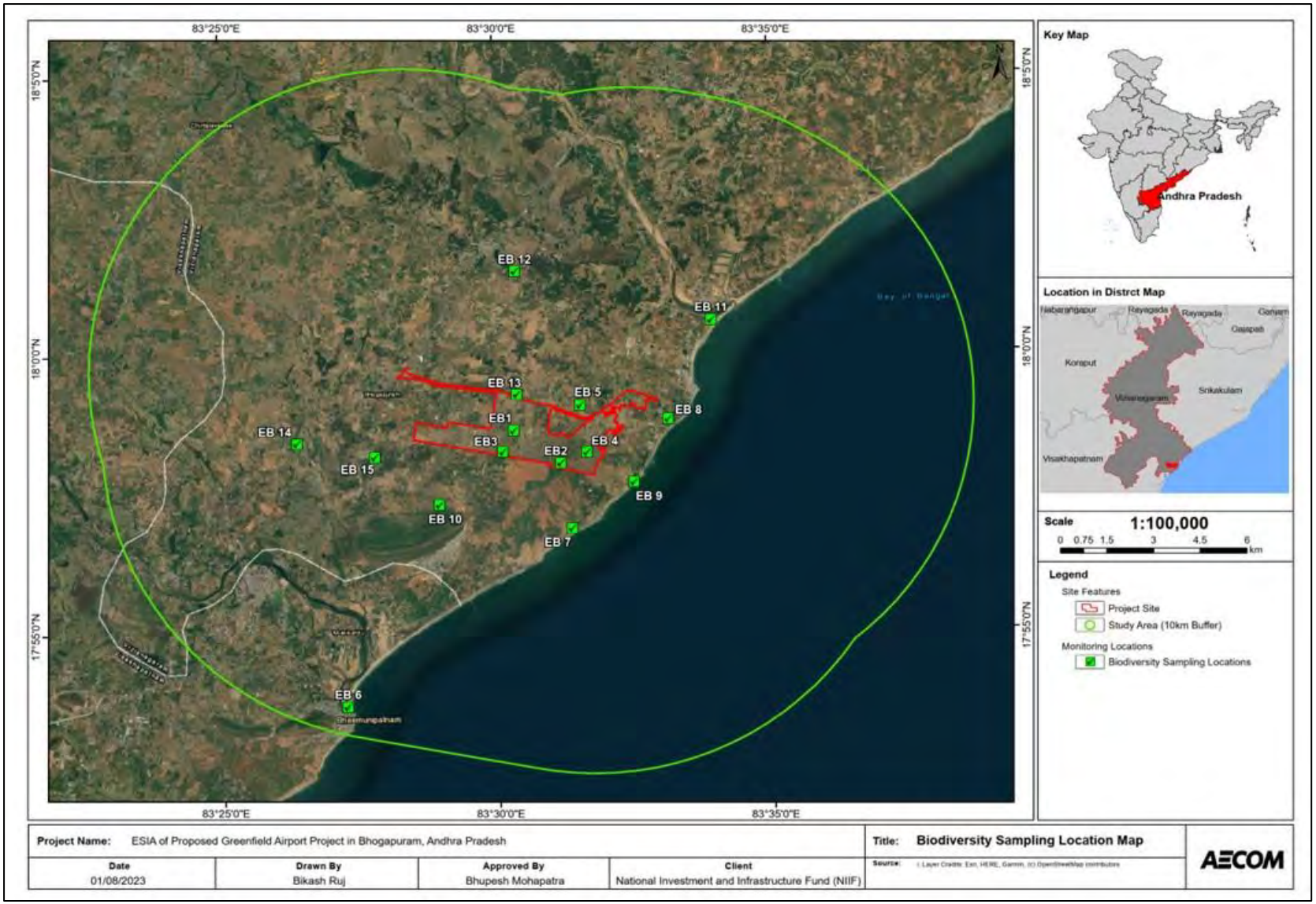


Figure 4-18: Map showing Study Area along with the Biodiversity Sampling Locations

4.5.2 Species Profile of the Study Area

The output of a generic screening using the Integrated Biodiversity Assessment Tool (IBAT) against the IUCN Red List indicates that at least 1774 IUCN Red List assessed species potentially occur within 50 km of the centre of the Project Site.

Figure 4-19 presents the results of the IBAT assessment on IUCN Red List assessed species potentially occurring within 50 km of the Project Site.

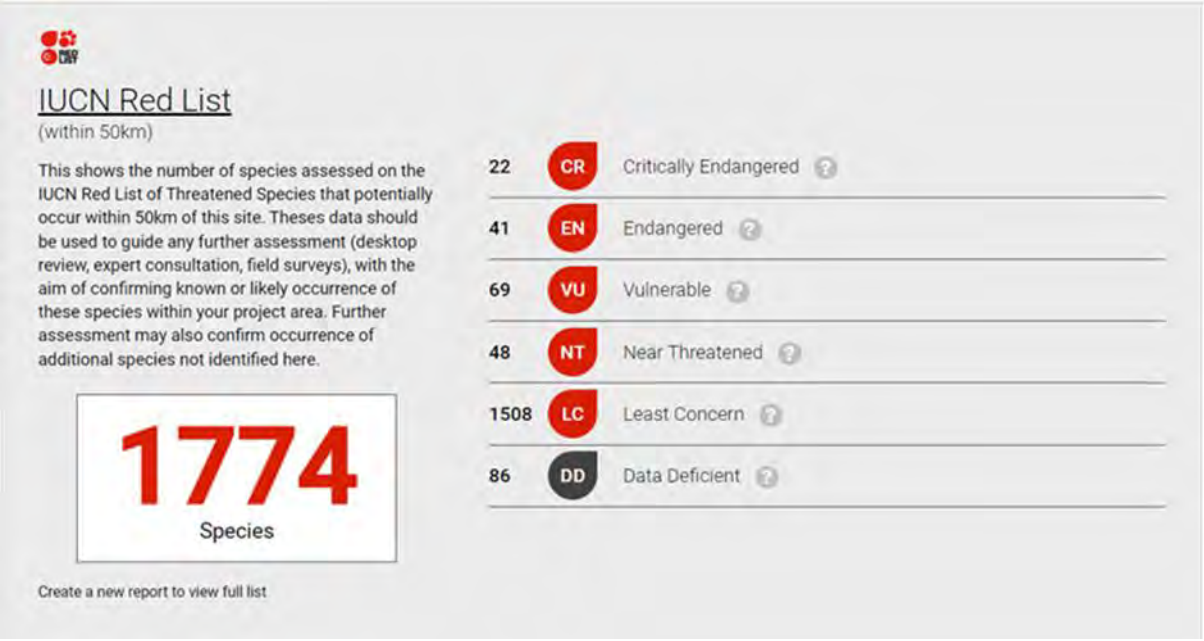


Figure 4-19: IUCN Red List assessed species potentially occurring within 50 km of the Project Site

Evaluation of the output of a generic screening using the Integrated Biodiversity Assessment Tool (IBAT) against the IUCN Red List indicates that at least 1247 higher faunal species, including 85 species of mammals, 281 species of birds, 87 species of reptiles, 18 species of amphibians, 94 species of cartilaginous fishes and 682 species of fishes, potentially occur within 25 km of the Project Site.

Floral Species

This section of the report describes the reported floral profile of the Study Area, in terms of the forest-types into which its natural vegetation is classified. It also describes the recorded floral profile of the Study Area, based on the floral species recorded during the visit.

This sub-section describes the reported and recorded floral and faunal species of the Study Area.

Reported Forest Type

Type 5A/C3 [5A - Tropical Dry Deciduous Forests, Sub Type C3- Southern Tropical Dry Mixed Deciduous Forests]

Southern Tropical Dry Mixed Deciduous Forests are the major forest type in the study area and dominated forest type in the district as well. The other forest types of present in the district include Southern Tropical Moist Mixed Deciduous Forest (3B/C2), Northern Tropical Dry Deciduous Forest (Sal Type- 5B(1)), Dry Deciduous Scrub Forest (5/DS1), Dry Evergreen Forests (7/DS2), Beach Forest (4/S1)

Southern Tropical Dry Mixed Deciduous Forests and Dry Deciduous Scrub Forests available in the division consist of thorny growth and scrub jungle with scattered trees. The upper canopy is uneven and not dense rather open, forming a mixture of deciduous trees. Most of these trees also occur in most deciduous forests and reach satisfactory development there. The height of trees in this dry deciduous forest is generally from 10m to 15 m. The soil is Red sandy loams and Black soils and pervious to roots and capable of supporting vegetation.

These forests are in relatively dry belts of the district. These forests are easily accessible and subjected to heavy biotic pressure. The degradation took place mostly in areas where forest fringe villages exist. The forests are badly degraded, and soil is slowly getting eroded due to heavy grazing incidence and human interferences.

Species associated with this forest-type include:

Trees such as *Terminalia tomentosa, Pterocarpus marsupium, Anogeissus latifolia, Hardwickia binata, Terminalia chebula, Cleistanthus collinus, Chloroxylon swietenia, Soymida febrifuga, Manilkara hexandra, Emblica officinalis, Grewia tiliaefolia, Zizypus xylopyrus, Acacia chundra etc.*

Shrubs and Herbs such as *Carissa carandas, Phoenix acaulis, Maba buxifolia, Gymnosporia montana etc.*

Climbers such as *Bauhinia vahlii, Cassytha spp., Zizyphus oenoplia, Acacia pinnata, Acacia intsia, Dioscoria esculenta etc.*

Grasses such as *Aristida setacea, Thysoloena maxima , Eulaliopsis binata, Cymbopogon contortus etc.*

The Dry Deciduous Scrub Forest Type (5/Ds1) is the degradation stage of the dry deciduous mixed forests, conditioned by the heavy incidences of grazing, fires and illicit removals. Height never exceeds 6 m. and canopy is open. Bamboo is present. Many of the shrubs are not palatable to cattle (Like Holarrhena antidysenterica, Dodonaea viscosa). The grasses occur throughout. The soils are impoverished, eroded, gullied, bouldery and rocky. These forests are characterized by the presence of relatively high percentage of thorny species. The adverse biotic factors over-rule the favourable species and keep these forests in a degraded stage preventing progression.

Source: Champion, H. G., Seth, S. K. (1968) Revised Survey of the Forest Types of India. Manager of Publications, Government of India, Delhi.

Atlas: Forest Types of India 2020

Forest Working Plan, Vizianagaram District

4.5.2.1 Recorded Floristic Species

The natural vegetation of the Study Area is characteristic of Southern Tropical Dry Mixed Deciduous Forests. A total of 38 floristic species were recorded in the Study Area during the primary survey. These include 29 woody species, which would be part of the perennial groundcover of the Study Area, and 9 non-woody species. As the site visit was conducted during the monsoon months, the project site was majorly dominated by seasonal herbs. The Project site has limited presence of tree cover (Cocos nuicfera, Tectona grandis, Magnifera indica, Casuarina) and other woody species such as Calotropis gigantea, Tephrosia purpurea and Lantana camara and were also observed within the Project Site.

Appendix C1 presents the details of the floristic species with range overlapping the study area, including the scientific, common and local name of each species and the conservation status assigned to it as per the IUCN Red List. Figure 4 15 presents a photographic log of some of the floristic species recorded in the Study Area during the primary survey.

	
jatropha gossypifolia	*Agave*
	
Bambusa sp.	*Ficus sp*

	
Anacardium occidentale	*Opuntia ficus-indica*
	
Tectona grandis	*Mangifera indica*
	
Azadirachta indica	*Borassus flabellifer*

	
Lantana Camara	*Calotropis gigantea*

Figure 4-20: Floral Species recorded in the Study Area

Source: AECOM Primary Survey

4.5.2.2 Faunal Species

This section of the report presents the higher faunal species, namely vertebrates, comprising mammals, birds, reptiles, amphibians and fishes, having recorded ranges that include the Study Area. The detailed species-tables are provided as annexures to this report. Each annexed table gives the scientific and common names of each species and the conservation status assigned to it by the International Union for Nature and Natural Resources (IUCN). Names of the species recorded during the field studies appear in bold font in each table.

Mammals

The review of secondary data shows that at least 85 species of mammals have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include five (05) species designated as Endangered and eleven (11) species as Vulnerable.

One (01) of these species were recorded during the primary survey. During field visit none of the Endangered or Vulnerable mammal species were recorded in the Study Area.

Appendix C.2 presents details of the mammal species of the Study Area, with the names of any species recorded during the primary survey appearing in bold font.

Birds

The review of secondary data shows that at least two hundred and eighty-one (281) species of birds have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include three (03) species designated as Critically Endangered, three (03) species designated as Endangered and five (05) species as Vulnerable.

Thirty-three (34) of these species were recorded during the primary survey. During field visit none of the Critically Endangered, Endangered or Vulnerable avian species were recorded in the Study Area.

Appendix C.3 lists the bird species of the Study Area, with the names of any species recorded during the primary survey appearing in bold font.

Reptiles

The review of secondary data shows that at least eighty-six (86) species of reptiles have reported ranges that fully or partially overlap the Study Area. Significant species with respect to the IUCN Red List include one (01) species as Critically Endangered and seven (07) species as Vulnerable.

None of these species was recorded during primary survey. All of these species have large known ranges beyond the study area and hence, are not deemed as species of conservation concern with respect to the Study Area.

Appendix C.4 presents details of the reptile species of the Study Area, with the name of a species recorded during the primary survey appearing in bold font.

Amphibians

The review of secondary data shows that least eighteen (18) species of amphibians have reported ranges that fully or partially overlap the Study Area. None of these species are significant with respect to the IUCN Red List.

None of these was recorded during the primary survey. Additionally, all of these species have large known ranges beyond the study area and hence, are not deemed as species of conservation concern with respect to the Study Area.

Appendix C.5 presents details of the amphibian species of the Study Area.

Figure 4-21 represents a photographic log of some faunal species recorded in the Study Area during the primary survey.

Black Kite

Indian Roller

House Sparrow

Common Myna

Figure 4-21: Photographs of some of the fauna species recorded in the Study Area

Source: AECOM Primary Survey

4.5.3 Habitat Profile

Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. As per PS6 guidance, in areas of natural habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible. Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. As per PS6 guidance the client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

The habitat-profile of the Study Area is a mix of marine and terrestrial habitats; the latter being majorly dominated by modified habitat intermixed with natural and near natural habitat. The structure of the terrestrial habitat is largely modified and highly fragmented, with natural habitats being indistinguishable from modified habitats at times due to the presence of horticultural plantation such as coconut, palm and Casuarina. Natural and near-natural habitats mainly comprise of marine habitats and terrestrial habitats like shrubland and tropical dry forest habitats which suffer from anthropogenic pressure. Areas of modified habitat mainly include the rural establishment, arable land, plantations and artificial-aquatic habitats (aquaculture ponds developed for rearing fish, shrimp, prawn etc). The chief habitat-fragmenting features of the Study Area consist of a metalled road, dirt roads and dirt tracks. The aerial envelope within the Project Site is largely uninterrupted; although the arial envelope of the Study Area is interrupted by power transmission pylons, and associated transmission cables and also a cellular phone tower.

The natural and near natural habitats constitute approximately 55% of the study area. The natural habitats consist of tracts of terrestrial and marine habitat which comprises approximately 35% and 20% of the study area respectively. The terrestrial natural habitats of the Study Area consist of natural patches of Southern Tropical Dry Mixed Deciduous Forests and Dry Deciduous Scrub Forests.

The modified habitats of the Study Area comprise approximately 45% of the Study Area and majorly constitute arable lands, plantations, rural habitations, aquacultural ponds and metalled road. Artificial waterbodies for aquaculture of fish, shrimps, prawns, oysters etc form the artificial aquatic habitats in the Study Area. The aerial habitats within the Project site is largely uninterrupted while most of the Study Area has presence of transmission pylons and cables and cellular phone towers.

Figure 4-22 presents a photographic log of some of the natural and near natural habitats recorded in the Study Area during the primary survey. **Figure 4-23** presents the Habitat profile of the Study Area assessed by primary and secondary survey.

Shrubland

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Sandy Shorelines</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Plantation</td><td>Wetlands (Inlands)</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Arable Land</td><td>Heavily Degraded Former Forest</td></tr>
</table>

Vantage Point view of the Project Site

Figure 4-22: Photographs of the Habitats in the Study Area

Source: AECOM Primary Survey

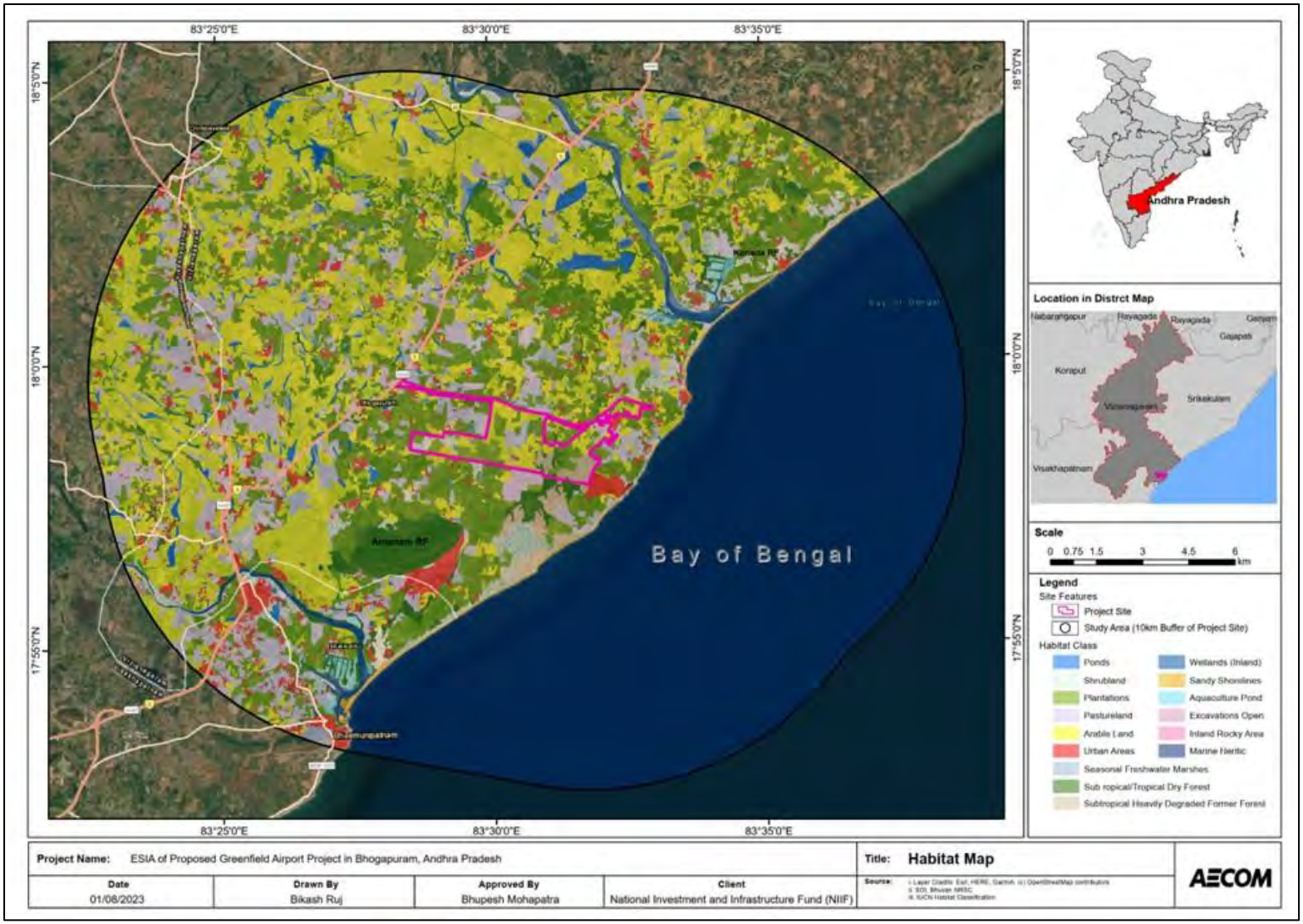


Figure 4-23: Map indicating Habitat Profile of the Study Area

4.5.3.1 Critical Habitats

As per the IFC PS6 Critical Habitat (CH) Criteria 1, 2 and 3, habitats, either natural or modified, that are critical for the survival of IUCN Red List-designated globally threatened species, endemic or restricted range species and migratory and/or congregatory species are potential CH triggers. As per the IFC PS6 CH Criteria 4 and 5, highly threatened or unique ecosystems, as well as, spatial features that support key evolutionary processes, are also potential CH triggers.

CH Screening

The species of the Study Area were screened against CH Criteria 1, 2 and 3, while the habitats of the Study Area were screened against the Criteria 4 and 5.

CH Criterion 1 – Globally Threatened Species

Globally Threatened Species are defined as species designated by the IUCN Red List as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). As per CH Criterion 1, an area that supports a globally important concentration of a CR or EN species, as well as an area that supports a globally important concentration of a VU species, the loss of which would lead to the species being designated as EN or CR, both qualify as potential CH.

Thresholds stipulated for triggering CH Criterion 1 are:

a. Areas that support globally important concentrations of an IUCN Red-listed CR or EN species (0.5% of the global population containing 5 reproductive units of a CR or EN species);

b. Areas that support globally important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds specified in (a);

c. As appropriate, areas containing nationally/regionally important concentrations of an IUCN Red-listed CR or EN species.

At least 122 species including both terrestrial and marine species were screened in for evaluation as potential CH triggers. These are designated by the IUCN Red List as globally threatened and have geographic ranges overlapping the Study Area. These include 22 species designated by the IUCN Red List as Critically Endangered (CR), 36 as Endangered (EN) and 64 as Vulnerable (VU). Out of the 121 screened species, 86 species are of marine and riparian fishes which include 75 species of Chondrichthyes class (Cartilaginous fishes) and 11 species of Actinopterygii class (Ray-finned fishes). The remaining 36 species are terrestrial species or marine coastal species including mammals, birds, reptiles and amphibians.

The proposed airport project is land based and the outer boundary is situated at approximately ~1.5km from the high tide line. Therefore, the no infrastructure or construction activity is planned on coastal sandy shores or the marine intertidal/neritic/oceanic habitat. As per the information provided no wastewater or treated effluent will be released into the ocean. Additionally, no supply chain route is planned through the adjacent coastline and hence no disturbance to the natural marine habitat is envisioned. Further, no river body flows through the Project site. A few seasonal water channels feeding small streams are present. However, the presence of the any substantial riparian wildlife in these streams is not feasible due to their seasonal nature.

Hence, limited or minimal impact on the marine neritic/oceanic/intertidal biodiversity is envisioned due to the terrestrial nature of the project. Therefore, the said 86 marine and riparian have been scoped out of the Critical Habitat Assessment process while the 36 terrestrial species have been recognised as potential CH trigger and will be evaluated further.

Therefore, the said 36 species qualify as potential CH triggers with respect to the Study Area as per CH Criterion 1.

Ch Criterion 2 – Endemic/ Restricted Range Species

Species which occur in a limited area are referred to as Endemic or Restricted Range species.

The species reported from the Study Area have first been evaluated as endemic or restricted range species based on their extent of occurrence (EOO), described as follows:

a. For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an EOO less than 50,000 km^2

b. For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km^2

c. For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (e.g., rivers), restricted range is defined as having a global range less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations farthest apart).

As discussed above in CH Criterion 1, limited or minimal impact on the marine neritic/oceanic/intertidal biodiversity is envisioned due to the terrestrial nature of the project and hence 86 marine and riparian species have been scoped out of the Critical Habitat Assessment process.

Based on review of secondary literature, amongst the 36 terrestrial species, at least one (01) reptilian species, Geochelone elegans (Indian Star Tortoise) is considered endemic to the eastern coast of Indian Subcontinent and has a reported range that includes the Study Area. The reported extent of occurrence (EOO) for the species is 20,000 km2, as per its IUCN Red List assessment. Therefore, the said species qualifies as an Endemic or Restricted Range species, as defined by CH Criterion 2. Hence, the said species is a potential CH trigger with respect to the Study Area as per CH Criterion 2b.

Therefore, one species namely, Geochelone elegans (Indian Star Tortoise, Vu), qualifies as potential CH trigger species with respect to the Study Area as per CH Criterion 2b.

CH Criterion 3 – Migratory and/or Congregatory Species

Migratory Species are defined as species of which a significant proportion of its members cyclically and predictably move from one geographical area to another, including within the same ecosystem. At least 10 such globally threatened Migratory Species, have reported ranges in the Study Area, which may serve as wintering/summering destination, staging site, or flight-corridor for bird species.

Species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis are known as congregatory species. At least 14 globally threatened species, consisting of both resident and migratory species, which are known to form large congregations, have recorded ranges that include the Study Area. Thresholds stipulated for triggering CH Criterion 3 are:

a. areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle; and

b. areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

The entire Indian subcontinent, including the Study Area, falls within the limits of the Central Asian Flyway (CAF), a major global flyway. The CAF connects a large swathe of the Palaearctic region with the Indian subcontinent and contains several well-established routes along which several bird-species migrate annually. This flyway covers a large part of the continental area of Eurasia and includes the whole of the Indian sub-continent. Thus, the Study Area is very likely to be situated in the annual cyclical flightpaths of the various winter, summer and passage visitor-birds migrating either to or through the region in which it is situated.

Based on secondary research and the consultation held with the local Forest Department office, it is reported that there is no significant presence of migratory and/or congregatory sites for avifauna in the Study Area. Further, the Project Site as well as the study area is majorly composed of modified habitats which makes them unsuitable resting grounds for migratory birds. The globally threatened species avifaunal species have large geographic ranges and due to the limited availability of suitable habitat types within the Study Area, it is unlikely that the Study Area contains Critical Habitat with respect to any of them. Amongst the reptilian species, congregation points for marine turtle species, especially Olive Ridley Turtle, have been recognised by local Forest Department. Therefore, it is reported that the study area is likely to support congregations of marine turtle species which use the coastal sandy regions for nesting purpose.

Therefore, at least 5 marine turtle species qualify as potential CH trigger species with respect to the Study Area as per CH Criterion 3.

CH Criterion 4 – Highly Threatened and/or Unique Ecosystems

Assessment of the Study Area towards Criterion 4 is based on national/regional level assessments carried out by governmental bodies, recognized academic institutions and/or internationally recognized NGOs.

Thresholds stipulated for triggering CH Criterion 4 are:

a. areas representing ≥5% of the global extent of an ecosystem-type meeting the criteria for IUCN status of CR or EN; or

b. areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

No part of the Study Area is assessed by IUCN towards the IUCN Red List of Ecosystems. Much of the Study Area is dominated by modified and near-natural habitats such as arable lands, monoculture plantations, aquaculture farms and urban areas. Patches of natural habitat include reserve forests and inlands wetlands. While these habitats support biodiversity, potentially including globally threatened, migratory and/or congregatory species, these habitats are not determined to be of high priority for conservation. Additionally, no Designated Area including both LPA or KBA have been reported within 10km radius of the Project Site.

Hence, the said habitat does not qualify as potential CH trigger as per CH Criterion 4.

CH Criterion 5 – Key Evolutionary Processes

Assessment of the Study Area towards CH Criterion 5 is based on structural attributes such as topography, geology, soil, temperature and vegetation or combinations of these variables, which can influence evolutionary processes that give rise to regional species-configurations or ecological properties. The overall aim of evaluating the Study Area against this criterion is to conserve genetic and species diversity, as also, processes which drive speciation, for the purpose of ensuring evolutionary flexibility in a rapidly changing climate.

- Features associated with key evolutionary processes include:
- Landscapes with high spatial heterogeneity, which drive speciation
- Ecotones, which aid speciation and are associated with high species and genetic diversity
- Edaphic interfaces, which drive formation of unique plant communities characterized by endemism and rarity
- Connectivity between habitats, which facilitates migration and gene flow, aiding conservation of meta-populations in fragmented habitats.

The Study Area is not known to contain isolated sub-populations of any species. No key evolution process has been observed or reported from the Study Area.

Hence, the Study Area does not qualify as potential CH trigger with respect to CH Criterion 5.

4.5.4 Legally Protected or Internationally Recognized Areas

Assessment of the Study Area towards this criterion is based on overlap of the Project Site with a Legally Protected Assessment of the Study Area towards this criterion is based on overlap of the Project Site with a Legally Protected Area (LPA) or Internationally Recognized Area (IRA). As per PS6 Point 20, if a proposed project is located within an LPA or IRA, it would need to meet PS6 requirements for CH, depending on the qualifying biodiversity values present in the concerned LPA (including areas officially proposed for protection) or IRA.

For an area to be considered as an LPA towards this assessment, it must meet the IUCN definition: “A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.” Areas proposed by governments for such designation must also be treated as LPAs. LPAs that meet the criteria of the IUCN’s Protected Area Categories Ia, Ib and II are more likely to qualify as potential CH.

For the purposes of this assessment, an IRA is exclusively defined as a UNESCO Natural World Heritage Site, UNESCO Man and the Biosphere Reserve, Key Biodiversity Area and/or wetland designated under the Convention on Wetlands of International Importance (the Ramsar Convention).

Thus, project sites that are located fully or partially within nationally and/or internationally designated areas of high biodiversity value qualify as potential CH.

As per the IBAT result, no Designated Area are situated within 50 km of the Project Site location. However, based on secondary research it was reported that nearest legally protected area with respect to the Project Site is the nationally designated, Kambalakonda Wildlife Sanctuary (KWLS) situated at approximately 17km southwards from the Project Site. Hence, there is no overlap between the Project Site/Study Area and any designated area.

Figure 4-24 presents the IBAT result on Designated Areas which are Legally Protected Areas.

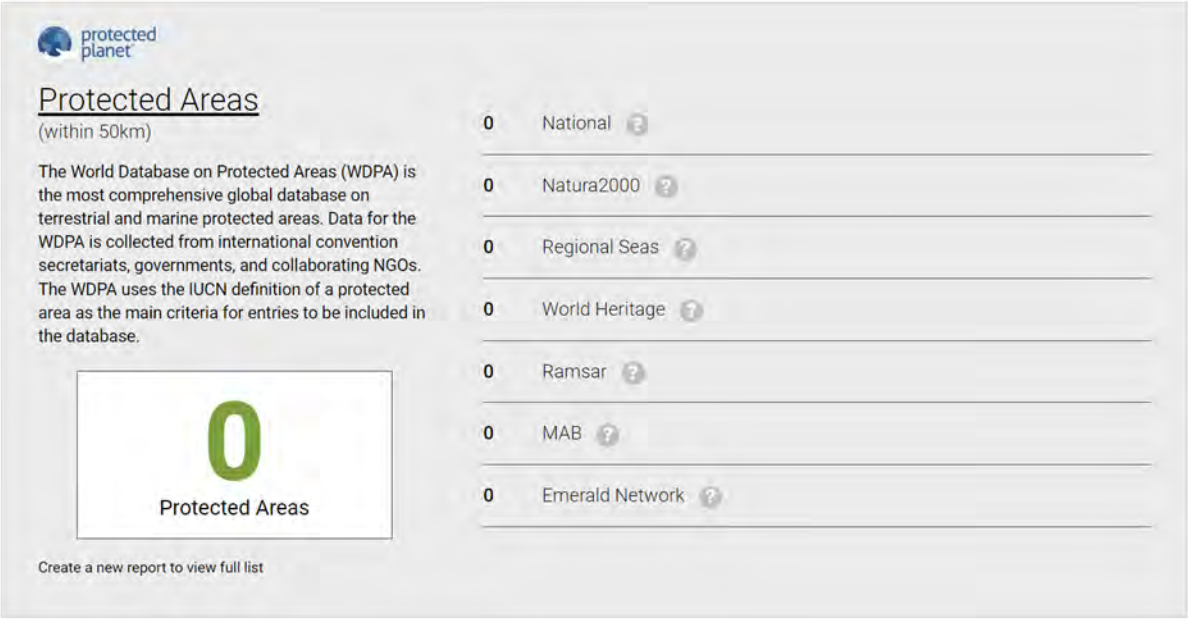


Figure 4-24: Protected Areas situated within 50 km of the Project Site

Note: IBAT fails to identify 4 legally protected areas namely, Marine National Park, WLS, Khijadiya WLS, Wild Ass WLS and Rampara WLS situated within 50 km radius of the centre of the Project Site.

Figure 4-25 presents the IBAT result on Designated Areas which are Internationally Recognized Areas, but not legally protected.

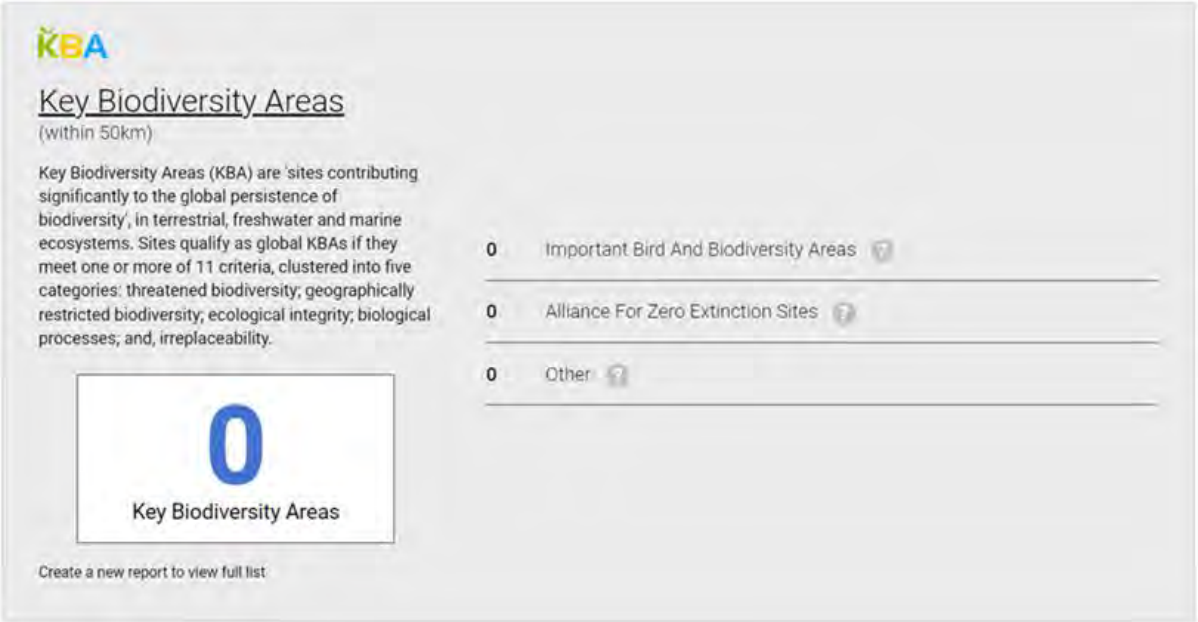


Figure 4-25: Key Biodiversity Areas situated within 50km of the Project Site

Source: Key Biodiversity Areas Partnership (2022) Key Biodiversity Areas factsheet: Marine National Park and Wildlife Sanctuary. Extracted from the World Database of Key Biodiversity Areas. Developed by the Key Biodiversity Areas Partnership: BirdLife International, IUCN, American Bird Conservancy, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Global Wildlife Conservation, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, World Wildlife Fund and Wildlife Conservation Society. Downloaded from http://www.keybiodiversityareas.org/ on 27/08/2023.

As per the IBAT assessment no KBA within 50km of the project area. The nearest Legally Protected is Kambalakonda Wildlife Sanctuary (KWLS) situated at approximately 17km southwards from the Project Site. Hence, there is no overlap between the Project Site and any designated area.

The Kambalakonda Wildlife Sanctuary is composed of a Protected Area (PA) of 71.39 sq.km., which forms the core protected area, and an Eco-sensitive Zone (ESZ) of 30.51 sq.km., which is intended to serve as a buffer to most of the core protected area. The ESZ extends 0 km to 4.33 km outwards from the boundary of the PA. There is no overlap between the Project Site itself and any part of the PA or ESZ. The forest cover in the sanctuary is mostly considered as a dry evergreen forest mixed with scrub . The apex species found in the area is the Indian leopard (Panthera pardus).

Figure 4-26 represents the locations of the designated areas in closest proximity to the Study Area. **Figure 4-27** presents a map indicating the designated area near to the Project Site.

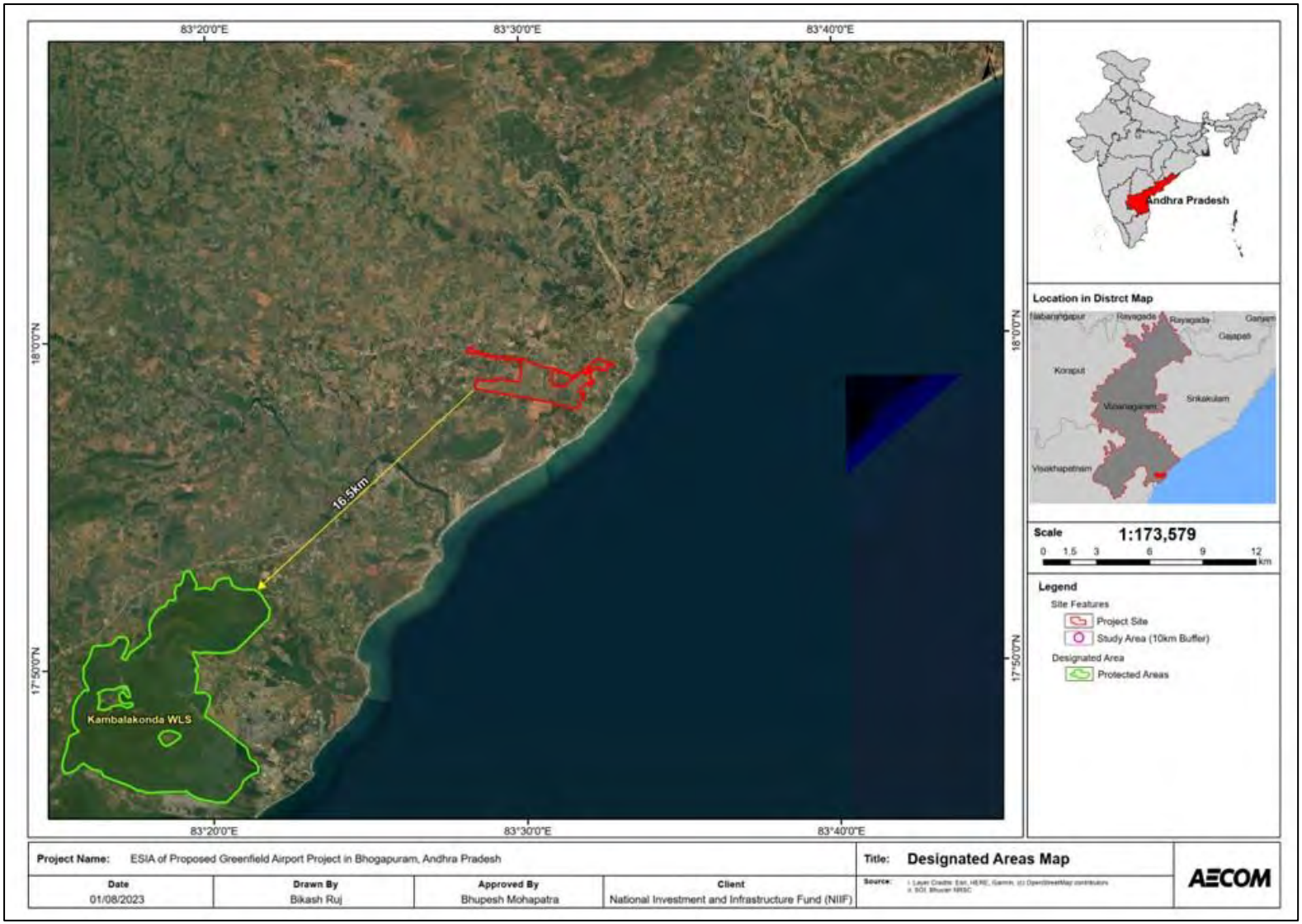


Figure 4-26: Locations of the Designated Areas in Closest Proximity to the Study Area

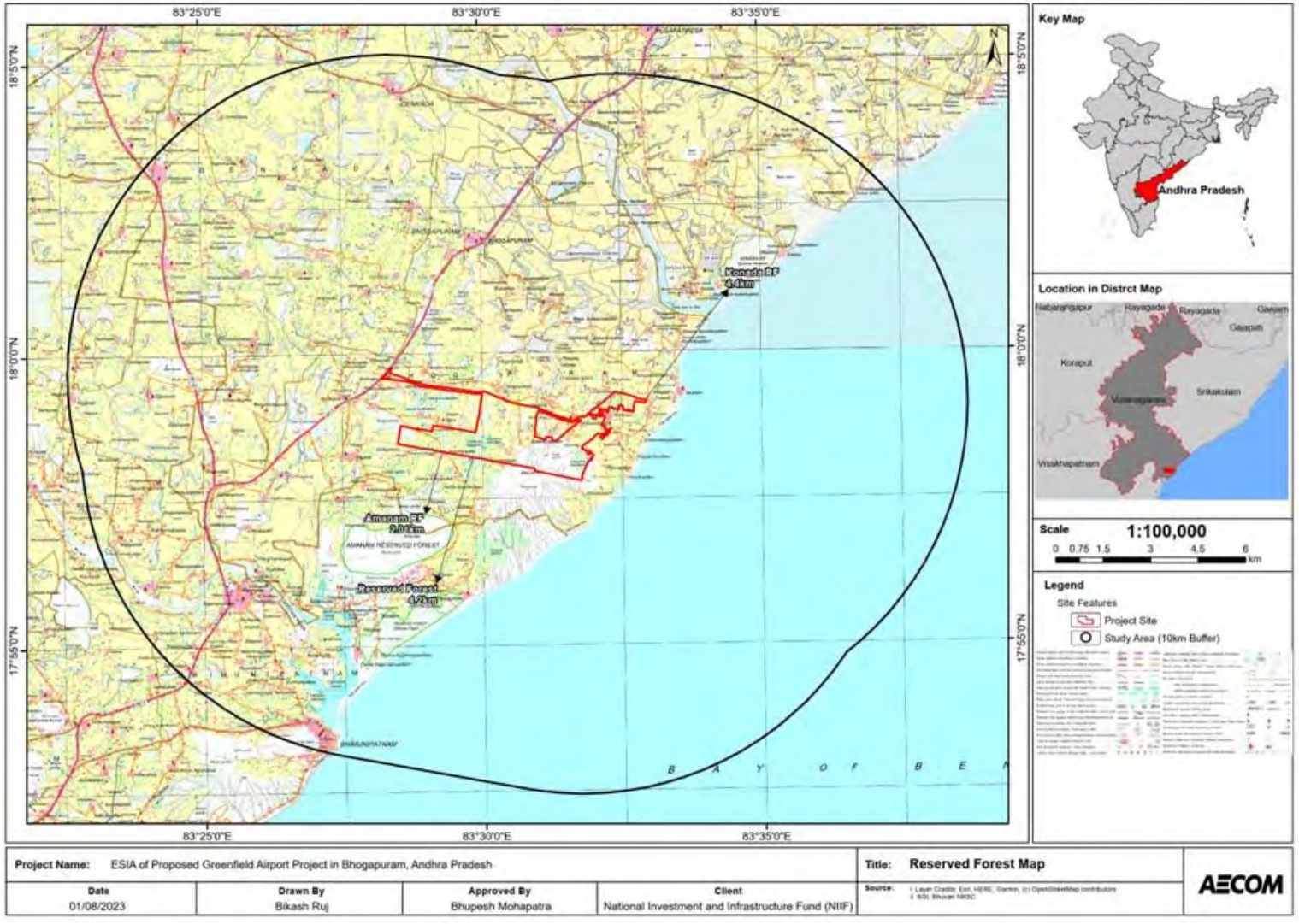


Figure 4-27: Locations of the Reserve Forest in Closest Proximity to the Project Site

Thus, potential CH triggers identified with respect to the Study Area consist of 36 potential CH trigger species and no habitats.

Table 4-12 presents the screening-relevant details of each potential CH trigger species identified with respect to the Project, including the applicable CH criteria, its geographical range or extent of occurrence (EOO), its estimated global population, the habitat types deemed suitable for it and the elevation range from which it is known.

Table 4-12: Potential CH Trigger Species

Sl. No.	Scientific Name	Common Name	Applicable CH Criterion	Migratory/ Congregatory (M/C)	Global Population / (Mature Individuals)	EOO (sq km)	Suitable Habitat Types*	Elevation Range (m)
Critically Endangered Species								
1	Eretmochelys imbricata	Hawksbill Turtle	1a, 3a	C,M	-	-	M (n), M (o), M (In)	-
2	Gyps bengalensis	White-rumped Vulture	1a, 3a	C	6000-9000	7370000	F, S, Sh, G, U	0-1500
3	Gyps indicus	Indian Vulture	1a, 3a	C	(5000-15000)	2150000	F, S, Sh, G, R, P, U	0-2000
4	Sypheotides indicus	Lesser Florican	1a, 3a	C,M	356-1228, 730	520000	G/A (t)	-
Endangered Species								
5	Aquila nipalensis	Steppe Eagle	1a, 3a	C,M	(50000-75000)	12600000	F, S, G, R, D	0-3000
6	Balaenoptera musculus	Blue Whale	1a, 3b	C	5000-15000	-	M (o), M(n)	-
7	Cuon alpinus	Dhole	1a, 3a	C	949-2215	-	F/S/G	0-5300
8	Chelonia mydas	Green Sea Turtle	1b, 3a	M	-	-	M (n), M (o), M (In/s)	
9	Manis crassicaudata	Indian Pangolin	1a	-	-	-	F/Sa/S/G/A (t)	0-1850
10	Neophron percnopterus	Egyptian Vulture	1a, 3a	C,M	12400-36000	50100000	S, Sh, G, W, D, R	0-4500
11	Orcaella brevirostris	Irrawaddy Dolphin	1a	-	-	-	W (In)/M (n)/M (c) (su)	0-50
12	Panthera tigris	Tiger	1a	-	2680-3905, 3140	6407413	F/Sa/S/G/W (In)/A (t)/M (Co)	0-4500
13	Sterna acuticauda	Black-bellied Tern	1a, 3a	C	800-1600, 900-1100	4810000	W (In)	700
Vulnerable Species								
14	Aonyx cinereus	Asian Small-clawed Otter	1b	-	-	-	F/S/G/W (In)/M (n)/M (Co) (Su)/ A (Aq)	0-2000
15	Aquila rapax	Tawny Eagle	1b, 3a	C	100000-499999	52700000	F, S, Sh, G, A, P	0-3000
16	Aythya ferina	Common Pochard	1b, 3a	C,M	760000-790000	548000	W, M	0-2690
17	Bos gaurus	Gaur	1b	-	6000-21000	-	F/Sa/S/G/A (t)	0-2800
18	Caretta caretta	Loggerhead Turtle	1b, 3a	M	-	-	M (n), M (o), M (In)	-
19	Crocodylus palustris	Mugger	1b	-	5700-8700	-	W, M	?-420
20	Dermochelys coriacea	Leatherback Turtle	1b, 3a	C, M	-	-	M (n), M (o), M (In/s)	0-1300

Sl. No.	Scientific Name	Common Name	Applicable CH Criterion	Migratory/ Congregatory (M/C)	Global Population / (Mature Individuals)	EOO (sq km)	Suitable Habitat Types*	Elevation Range (m)
21	Geochelone elegans	Indian Star Tortoise	1b, 2a	-	-	20000	F/S/G/A (t)	100-900
22	Halcyon pileata	Black-capped Kingfisher	1b, 3a	M	-	5160000	F/W (In)/M (n)/M (It)/M/C (s)/A (t)	0-1524
23	Lepidochelys olivacea	Olive Ridley Turtle	1b, 3a, 3b	C, M	-	-	M (n), M (o), M (In)	-
24	Lissemys punctata	Indian Flapshell Turtle	1b	-	-	-	W (In), A, Aq, M	0-500
25	Lutrogale perspicillata	Smooth-coated Otter	1b	-	-	-	F/S/G/W (In)/M (n)/M (Co) (Su)/ A (Aq)	0-7000
26	Melursus ursinus	Sloth Bear	1b	-	-	-	F/Sa/S/G/A (t)	0-2000
27	Neophocaena phocaenoides	Yangtze Finless Porpoise	1b	-	500-1800	-	W (In)	
28	Ophiophagus hannah	King Cobra	1b	-	-	-	F/G/S/W (In)/A (t)/Aq & M	0-2000
29	Panthera pardus	Leopard	1b	-	-	-	F/Sa/S/G/R	0-5200
30	Physeter macrocephalus	Sperm Whale	1b	-	-	-	M (n)/ M(O)	-
31	Prionailurus viverrinus	Fishing Cat	1b	-	-	238006	F/S/G/W(In) /A (t)	0-1800
32	Rusa unicolor	Sambar	1b	-	-	-	F/Sa/S/G/W (In)/A (t)	0-3900
33	Schoenicola striatus	Bristled Grassbird	1b, 3a	M	2500-9999	1270000	S/G/W(In)	460
34	Sousa chinensis	Indo-Pacific Humpback Dolphin	1b	-	-	-	M (n)/M (C) (s)	0-30
35	Sterna aurantia	River Tern	1b, 3a	C	20000-70000	9330000	W, M	? - 600
36	Tetracerus quadricornis	Four-horned Antelope	1b	-	7000-1000	-	F/S/G	

**A=Arable Land, D=Desert, DF=Degraded Former Forest, F=Forest, G=Grassland, M=Marine, P=Pastureland, Pl=Plantation, R=Rocky Areas, RG=Rural Gardens, S=Savanna, Sh=Shrubland, U=Urban Areas, C-Caves and W=Inland Wetland*

Source: IUCN 2022. The IUCN Red List of Threatened Species. Version 2022-2.

The CH screening process was based on evaluation of the known attributes of each potential CH trigger species, namely its geographical range or extent of occurrence, global population, suitable habitat types and elevation range, against the attributes of the Study Area. The screening resulted in 19 out of the 36 identified potential CH trigger species being screened out completely with respect to the Study Area. Mammalian species like dolphins and whales were screened out as minimal or no impact is envisioned on the marine habitat due to the project. Other species were screened out because the presence of these terrestrial species has not been confirmed in the district as well as the study area due to the lack of continuous suitable habitat. The remaining seventeen (17) species which were screening in include four (04) mammalian, five (05) avian and eight (08) reptilian species. These have been discussed in detail below.

Four (04) mammalian species namely *Cuon alpinus* (Dhole, En), *Manis crassicaudata* (Indian Pangolin, En), *Melursus ursinus* (Sloth Bear, VU), *Panthera pardus* (leopard, Vu) were screened in due to their confirmed presence in the district. The presence of these species has been majorly reported from Parvathipuram region (Sangamvalasa Reserved Forest) located in the northern part of the district. Presence of Indian Pangolin has also

been reported from Kamabalakonda WLS. Parvathipuram is located at distance of approximately 80km northwards while Kamabalakonda is situated approximately 17km southwards from the Project Site. Further, there is no wildlife corridors or patches of natural habitat to facilitate the movement of these species. Therefore, it can be safely concluded that the Study area does not support globally important concentration of any IUCN Red-listed species as stipulated by CH Criteria 1. Hence, these species do not qualify as a CH trigger species for the Project.

Five (05) globally threatened avian species have direct reported range overlap and might have presence within the study area. Amongst the 5 species, two (02) species namely, Black bellied tern (*Sterna acuticauda*, En) and River tern (*Sterna aurantia*, Vu) are majorly associated inland wetlands. The other two (02) species i.e. Common Pochard (*Aythya farina*, Vu) and Black-capped Kingfisher (*Halcyon pileata*, Vu) are associated with coastal and marine ecosystems, although presence in inland regions has also been reported. One (01) raptor species namely Twany Eagle (*Aquila rapax*, Vu) also has range area overlapping the study area. Detailed assessment of habitat type and reported presence is given below.

Black bellied tern (*Sterna acuticauda*, En) is found along the major river systems of India, usually breeding on sand spits or a sandy island. It is an entirely an inland species and not found on the coast[25]. As reported by the citizen science website eBird, the nearest sightings of Black bellied tern (*Sterna acuticauda*, En) have been in the region of Srikakulam (approximately 50km northwards from the Project site).[26] Hence, the said species does not qualify as a CH trigger species for the study area.

River tern (*Sterna aurantia*, Vu) has a wide range across southern Asia. In India, it is found throughout the country, inhabiting rivers and freshwater lakes, occasionally occurring on estuaries[27]. As reported by the citizen science website eBird, River Terns have been sighted in the Vizianagaram district.[28] The global population of this species is estimated to be in between 20000-70000 individuals. Therefore, considering that there is a lack of significant water bodies and river channels within the Project Site and the Study Area being highly fragmented and heavily modified nature, it is concluded that there is limited suitable habitat availability for the species. Hence, the presence of significant number of individuals of the species in the Study Area is less likely. The threshold for triggering criteria 1b is 100 individuals or more, which is not expected to be triggered. Thus, it is less likely that the Study Area qualifies as a potential CH with respect to this species. However, the Study Area contains some habitat suitable to the species. Therefore, therefore the client is recommended to take suitable mitigation measures to mitigate any potential impact (if any) of the project on the species.

Black-capped Kingfisher (*Halcyon pileata*, Vu), in the tropics and subtropics, is found in coastal mangroves and wooded seashores, but also inland across creeks, lagoons, estuaries, rice fields, open cultivated land, Nipa palm groves, willow jungle, forest clearings, streams in bamboo-forest and in gardens. They feed on insects and occasionally frogs and reptiles in inland habitats, but mainly on fish and crabs in coastal habitats[29]. As reported by the citizen science website eBird, the nearest sightings of Black-capped Kingfisher are in Visakhapatnam district (approximately 25km south of project site)[30]. Hence, the said species does not qualify as a CH trigger species for the study area.

Common Pochard (*Aythya farina*, Vu) requires well-vegetated eutrophic to neutral swamps, marshes, lakes and slow-flowing rivers with areas of open water and abundant emergent fringing vegetation. It also breeds on saline, brackish and soda lakes and occasionally even in sheltered coastal bays (Kear 2005)[31]. As reported by the citizen science website eBird, Common Pochard's have been sighted in the Vizianagaram district.[32] The global population of this species is estimated to be in between 760000-790000 individuals. There is lack of significant water bodies and river channels within the Project Site, absence of significant estuaries on the coast. Therefore, considering the above factors and the highly fragmented and modified nature of the Study Area it can be concluded that there is limited suitable habitat availability for the species. The threshold for triggering criteria 1b is 3800 individuals or more which is not expected to be triggered. The presence of significant number of individuals of the species in the Study Area is less likely. Hence, it is less likely that the Study Area qualifies as a potential CH with respect to this species. However, the Study Area contains habitats suitable to the species. Therefore, the client is recommended to take suitable mitigation measures to mitigate any potential impact (if any) of the project on the species.

[25] https://www.wii.gov.in/nmcg/priority-species/birds/black-bellied-tern
[26] https://ebird.org/species/blbter1/
[27] https://www.wii.gov.in/nmcg/priority-species/birds/river-tern
[28] https://ebird.org/species/rivter1/
[29] http://datazone.birdlife.org/species/factsheet/black-capped-kingfisher-halcyon-pileata/text
[30] https://ebird.org/species/blckin1/
[31] BirdLife International (2023) Species factsheet: Aythya ferina. Downloaded from http://datazone.birdlife.org/species/factsheet/common-pochard-aythya-ferina on 07/09/2023.
[32] https://ebird.org/species/compoc

Twany Eagle (*Aquila rapax*, Vu); The species occupies dry open habitats from sea level to 3000m, and will occupy both woodland and wooded savannah. In India it can be found near cultivated areas, settlements and slaughterhouses (Ferguson- Lees and Christie, 2001)[33]. As reported by the citizen science website eBird, no sighting of the species has occurred in the Study Area and the neighbouring districts.[34] Hence, the said species does not qualify as a CH trigger species for the study area.

As reported the citizen science website eBird, except from River tern and Common Pochard, no recent sighting of the above species has been reported in the Study Area. There is lack of significant water bodies and river channels within the Project Site as well as absence of significant estuaries on the coast. Therefore, considering the above factors and the highly fragmented and modified nature of the Study Area it can be concluded that there is limited suitable habitat availability for the species. Limited presence of these species is not enough to trigger CH Criteria 1 of PS 6. As per PS6 guidance the project should also seek to mitigate any future foreseeable impacts on the region. Therefore, therefore the client is recommended to take suitable mitigation measures to mitigate any potential impact (if any) of the project on the species.

The eight (08) potential CH trigger reptilian species with globally threatened status include 6 species of turtles, 1 species of tortoise and one snake species i.e. King Cobra. Detailed assessment of the same is given below:

King Cobra (*Ophiophagus hannah*, Vu) prefers streams in dense or open forest, bamboo thickets, adjacent agricultural areas and dense mangrove swamps. They often stay near streams, where the temperature and humidity are relatively constant. According to the Forest working plan, the presence of King Cobra in the Vizianagaram district has been majorly reported in Makkuva and Duggeru blocks located approximately 70 Kms northwest from the project site. The said area is suffering from anthropogenic pressure and hence the forest department plans to convert it into a protected area. No reports of presence of the species have been reported in the Study area. Hence, these species do not qualify as a CH trigger species for the Project.

Indian Star Tortoise (Geochelone elegans, Vu) is a medium sized tortoise endemic to parts of India, Pakistan and Sri Lanka. In India it occurs in two main disjunct areas, in the north-western states of Gujarat and Rajasthan, and in the southern states of Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Orissa, and Tamil Nadu. Suitable habitat is primarily open dry scrublands. However, it also occurs in scrub forests, grasslands and some coastal scrublands of arid and semi-arid regions throughout its range[35]. Estimates on global population levels are unavailable. A map showing the range areas of is given below (Source: Convention of International Trade in Endangered Species). The project site is majorly a modified habitat (disused agricultural land) and deemed to be unsuitable for the species. Hence, it does not qualify as a potential CH trigger for Criteria 1 and 2. However, small pockets of the study area contain habitat suitable for the species. Therefore, the client is recommended to take suitable mitigation measures to mitigate any potential impact (if any) of the project on the species.

[33] BirdLife International (2023) Species factsheet: Aquila rapax. Downloaded from http://datazone.birdlife.org/species/factsheet/tawny-eagle-aquila-rapax on 07/09/2023.
[34] https://ebird.org/species/taweag1
[35] https://cites.org/sites/default/files/eng/cop/18/prop/060319/E-CoP18-Prop-36.pdf

Figure 4-28 Range Area of Indian Star Tortoise

Indian Flapshell Turtle (*Lissemys punctata,* Vu) inhabits a wide variety of aquatic environments, from rivers, lakes, ox-bows, streams and ponds to salt marshes, rice fields and urban canals. Its global population has not been assessed comprehensively. Also, its presence has not been recorded in the forest working plan for the district. Since there is lack of substantial inland wetlands and the Project Site is majorly a modified habitat, it is less likely that the species will be present in significant numbers. Further, as the Project is expected to have limited indirect impact in the surrounding regions, it can be safely concluded that the species does not qualify as a CH trigger species.

Marine Turtles: Five species of sea turtles namely, **Olive ridley** (*Lepidochelys olivacea*), **Green** (*Chelonia mydas*), **Hawksbill** (*Eretmochelys imbricata*), **Loggerhead** (*Caretta caretta*) and **Leatherback** (*Dermochelys coriacea*) occur along the Indian coast and except loggerhead, all other four species are reported for nesting. **Figure 4-30** shows the distribution of marine turtles along the coastal regions of India. The four species (olive ridley, hawksbill, green and leatherback) occur along Andhra Pradesh coast (Dutt 1976, 1979, Biswas 1982, Kar and Bhaskar 1982), but only olive ridleys have been reported to nest in this state (Kar 1983, Subba Rao et al 1987) and all other (leatherback, hawksbill and green) form non-nesting species[36,37]. The nesting of olive ridley is affected by the problems of urbanisation, sand-mining and predation of eggs and hatchlings. Andhra Pradesh coast is considered as the migratory pathways of olive ridleys for approaching mass nesting beaches in Orissa[38]. The global population of the marine turtles has not been assessed comprehensively and sufficient data on turtle number is lacking. Based on secondary research it can be safely assessed that only Olive Ridley turtle uses the coast of Vizianagaram district for nesting. All other species have reported presence in the region but do not use the coast regions for nesting thereby reducing any potential impact on the hatchling post nesting.

[36] https://www.seaturtlesofindia.org/about/distribution/andhra-pradesh/
[37] Sea turtles and their Nesting Habitats along the Andhra Pradesh Coast (B. Tripathy, K. Shanker and B C Choudhury)
[38] Dr, Murugan. (2023). The past and present scenario of sea turtles in India: An overview of possibility for recurrence of history.

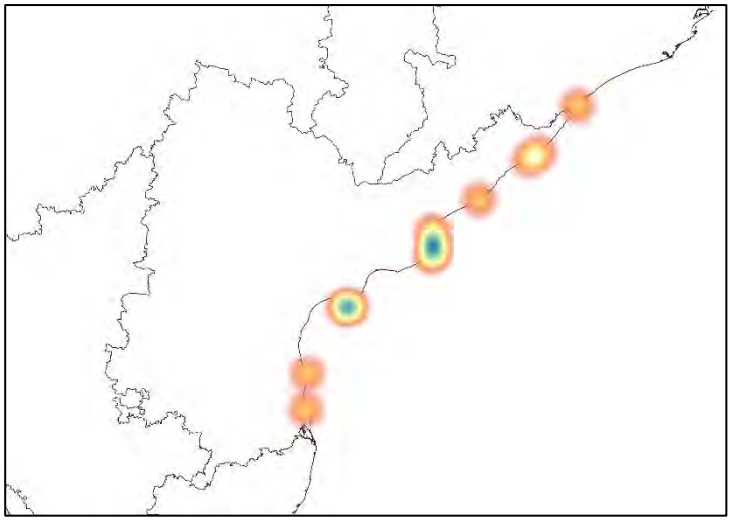


Figure 4-29 Heat map of turtle nesting along Andhra Pradesh Coast

(Source: https://www.seaturtlesofindia.org/about/distribution/andhra-pradesh/)

Figure 4-30 Distribution of Marine Turtles in India

As a part of the study, consultation with the forest department were held and it was confirmed by the local forest department officials that nesting of Olive Ridley turtles takes place on the coast adjacent to the Project Site. Additionally, it was confirmed that the forest department has proposed the development of 10 hatcheries along the 14km stretch of the Vizianagaram district coast during the nesting season of Olive Ridley. Each hatchery will have a radius of approximately 500 m and will be comprise a temporary structure established from November to March which will be dismantled for the rest of the year. It is worth noting that above plan is in planning stage and a proposal for the same has been sent to the Coastal Zone Management Authority and hence the plan is subject to approval.

Estimation of Number of Olive Ridley Present in the Study Area and beach adjacent to project site.

As discussed above, Olive Ridley Turtles exhibit nesting in the study while the other species show presence but do not exhibit nesting. Hence, Olive Ridley has been considered as the primary species for being potential CH trigger in this study. As per the data available it is suggested that beaches adjacent to river mouths are preferred.

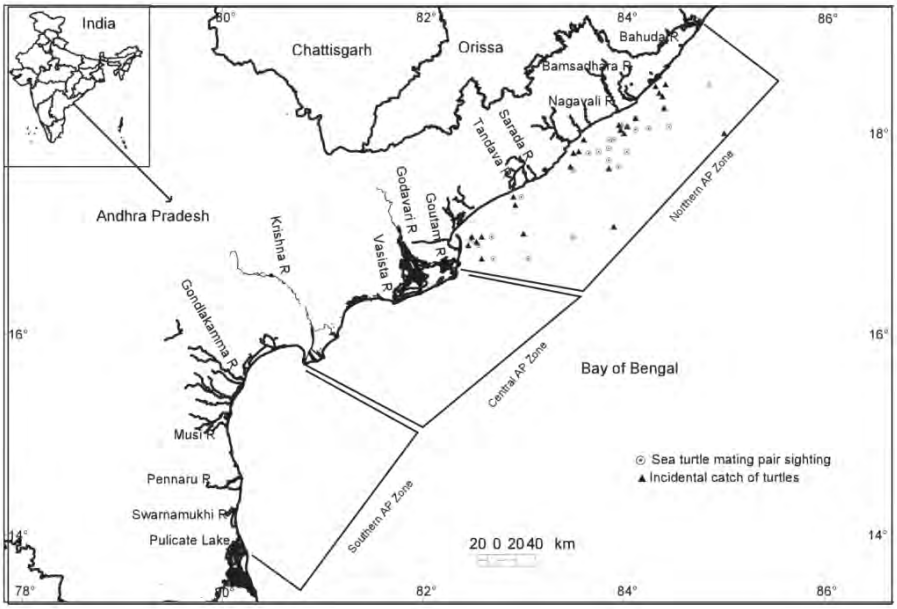


Figure 4-31 Visual sightings of Olive Ridley Mating Pairs During Offshore Surveys and Incidental Capture During Experimental Trawls

nesting habitats for olive ridleys; these beaches have densities of 50–100 nests/km/season, while nesting densities average ~10 nests/km/season along other parts of the coast in Andhra Pradesh (Tripathy et al 2003).[39,40] The clutch size of Olive Ridley is approximately 100-110 individuals per nest[41].

The study area (including a 10km buffer) has a total stretch of approximately 27 km of coastal region while a stretch of approximately 15 km of coastal region lies within a 5 km of buffer from the project site. There is presence of 2 river mouths in the Study Area (10km buffer). Considering one (01) km on either side from the river mouth as high preferred nesting location we can estimate the total number of nests in the Study Area.

Particulars	Details
Total length of coast in Study Area	27 km
River Mouths	2
High Intensity Breeding ground adjacent to river mouth (Estimate)	2 km
Total length of High Intensity Breeding ground adjacent to river mouth	2*2 = 4 km
Nesting intensity in beaches adjacent to river mouths (considering mean value)	75 nest/km
Nesting intensity in other parts of the coast	10 nest/km
Estimate of total nest in high intensity nesting beaches	4*75= 300
Estimate of total nest in other parts of the coast	23*10 = 230
Total estimated female population on the Study area coast during nesting	300+230 = 530
Applying 10% +/- as to reduce error load	477-583
Clutch Size	100 Individuals
Total Hatchling estimate to be born per nesting cycle (each year)	530 * 100 = 53,000

[39] Tripathy, B, K Shanker, and B C Choudhury. 2003. Important nesting habitats of olive ridley turtles (Lepidochelys olivacea) along the Andhra Pradesh coast of eastern India. Oryx 37(4):454–463.
[40] Sea turtles and their Nesting Habitats along the Andhra Pradesh Coast (B. Tripathy, K. Shanker and B C Choudhury)
[41]

According to recent estimate the total female nesting global population is estimated to be at 8,00,000 individuals.[42] Estimate for the male population is not known as male turtles remain underwater for majority of the lifespan and they exhibit global migration. Therefore, for the purpose of this assessment, female populations only have been considered. According to CH criteria 1b and 3a, the global population should be 4000 individuals and 8000 individuals (population in the congregation zone) respectively. The estimates as per AECOM's assessment is 477-583 individuals in the Study Area. Therefore, it can be concluded that Olive Ridley turtles do not qualify as a potential CH trigger species with respect to the study area. However, the Study Area contains habitats suitable to the species. Therefore, the client is recommended to take suitable mitigation measures to mitigate any potential impact (if any) of the project on the species.

According to Andhra Pradesh Forest Department circular, Tree Felling Permission is required under the Andhra Pradesh Water, Land &Trees Act 2002. The latest GO MS No.87, dt: 29-11-201743, details out the procedure for tree felling process and specifics required for the approval process. The circular gives out instructions for Permission to fell trees other than Red Sanders, Sandal wood & Rose wood and trees present in Scheduled Areas of the State. Procedure for working of tree growth in the patta lands situated in scheduled areas shall be in accordance with the Chapter III A of AP Forest Act 1967. Additionally, as per the provisions of APWALTA Act/Rules, applicant shall have to plant double the number of trees felled of the same species or suitable species within one year from the date of felling. The trees may be planted in the same site where the trees are permitted to be felled existed or any other suitable place close by. In case he fails to plant and raise the required number of plants, the Divisional Forest Officer will arrange for raising the required number of plants and the cost of which shall be borne by the applicant and shall be met out of the security deposit amount deposited by the applicant. A separate Transit Permit is also required for movement of wood. At present, trees belonging to Eucalyptus, Subabul and Casuarina species are exempted from tree felling permission under APWALTA/APWALTA Rules. Forest clearance is not required as not forest area is being affected due to the project.

As per inputs received from officials of the forest department, local community and data available in recent research publications, it was known that there is presence of venomous snakes in the Project area. Data from the forest working plan also confirms the presence of venomous snakes in the study area. Presence of snakes in the study area may lead to man-animal conflict during construction and operational phase due to disturbance in their habitat. The Client is recommended to prepare a management plan/ Dos and Don'ts list to counter human-animal conflict with respect to snakes (if it arises at all).

Thus, the Study Area exhibits a mosaic of modified and natural/near habitat intermixed with each other. Modified habitat with disused arable land, comprise the main habitat feature of the Project Site. Based on the site visit and secondary information available, the Critical Habitat Assessment shows the absence of any species or habitats that might fulfil the criteria to trigger Critical Habitat as defined by IFC PS 6. However, significant biodiversity values have being found in the region which can be adversely affected and would need mitigative steps. As per US DFC, NIIF and IFC PS6 guidance, for projects in modified habitats, the client should minimize impacts on significant biodiversity values and implement mitigation measures as appropriate. As envisioned, there will be loss/degradation of habitat (especially marine turtle habitat) which must be mitigated. Additionally, measures to mitigate any foreseeable Project-related impact on, or risk to, the biodiversity must be instituted and implemented through a Biodiversity Management Plan (BMP).

Therefore, it is recommended that a Biodiversity Management Plan (BMP), designed to minimize and mitigate the impacts on biodiversity as appropriate be formulated and implemented for the Project. The said plan must be designed to mitigate any Project-related impacts on biodiversity values as per the mitigation hierarchy., followed by suitably compensating any residual impacts. The client is recommended to collaborate with the forest department and undertake CSR activities for protection of the nesting sites of marine turtles (specifically Olive Ridley Turtles) on the adjacent coast which can be potentially adversely affected.

Thus, factoring in the overall ecological conditions and possibility of presence of IUCN threatened species and potential habitat of these threatened species having significant conservation values in the study area, the PS6 has been made applicable to the Project. The client is recommended to formulate a Biodiversity Management Plan (BMP) designed to minimize and mitigate the impacts on biodiversity with primary focus on protection of marine

[42] Cáceres-Farias L, Reséndiz E, Espinoza J, Fernández-Sanz H, Alfaro-Núñez A. Threats and Vulnerabilities for the Globally Distributed Olive Ridley (Lepidochelys olivacea) Sea Turtle: A Historical and Current Status Evaluation. Animals (Basel). 2022 Jul 19;12(14):1837. doi: 10.3390/ani12141837. PMID: 35883384; PMCID: PMC9311662.
[43] https://forests.ap.gov.in/PDF/GOs/4.pdf

turtles in the airport vicinity. According to Andhra Pradesh Water, Land &Trees Act 2002, the client is required to take tree felling permission and transit permit for movement of wood.

4.5.5 Ecosystem Services

This section presents an overview of the significant ecosystem services provided by the ecosystems of the Study Area to the local community, which consist of mainly priority provisioning ecosystem services, details of which are provided in this section. Besides these, the ecosystems of the Study Area would also be providing generic or standard regulating and supporting ecosystem services, such as groundwater recharge, surface water purification, soil erosion control, temperature regulation, soil replenishment, primary production, pollination, and pest control.

4.5.5.1 Provisioning Services

The provisioning ecosystem services provided by the Study Area include water, as well as, wild or cultivated species that provide food, medicine, fodder, fuel, fertilizer, fibre and timber to the local community.

Water

The groundwater reserves and artificial surface water reservoirs of the Study Area provide the freshwater requirements of the local community. Groundwater is accessed through tube-wells. The surface waterbodies get recharged during the monsoon rainy season and dry up during the dry seasons. A number of surface water ponds dug for aquaculture purposes are present within the Project site and the study area. The study area also has covered artificial water reservoirs which are used by people during agricultural operations or while grazing animals.

Cultivated Species (Agriculture)

As per inputs received from the local community, the arable soils of the Study Area are cultivated to grow food, fodder and fuelwood species. The local community uses the soils of the Study Area to cultivate food species, such as *Oryza sativa* (Rice), *Zea mays* (Maize), *Sorghum vulgare* (Great Millet or Jowar), *Arachis hypogea* (Groundnut), *Sachharum officinarum* (Sugar cane), *Mangifera indica* (Mango), *Anacardium occidentale* (Cashew Nut) and *Musa spp*. (Banana), as well as, timber species, such as *Casuarina equisetifolia* (Australian Beefwood).

Wild Species

Wild plant, fungi and animal species of the Study Area provide food to the local communities. The vegetation of the Study Area, especially the herbaceous species regenerating across all open lands over each monsoon and post-monsoon season, provide highly valued fodder for the local livestock, including goats, sheep, cattle and camels. Nomads were found in the study area with their herd of cattle. The Study Area is also likely to be providing fuel wood and timber to the local community through social or community forestry plantations of *Acacia auriculiformes* (Australian Acacia), *Leucaena leucocephala* and *Eucalyptus spp*.

Animal Grazing

The study area also serves pastureland and free ranging cattle (sheep, goats etc) were observed in the project area during the site visit.

4.5.5.2 Regulating Services

The Study Area provides regulating services to the local community in the form of groundwater recharge, surface-water purification, soil-erosion control, pollination and pest control.

Ground Water Recharge

The water-flows in the Study Area contribute to the recharge of wells and ponds of the area, which fulfils the freshwater needs of the local communities. The vegetation of the Study Area slows down surface run-off, which increases percolation of water into sub-surface layers, thereby promoting groundwater recharge.

Soil Erosion Control

The vegetation of the Study Area anchors soil-particles, lowering the rate of soil erosion by water and wind. Grasses, in particular, provide ground cover and anchorage to the erosion-prone sandy soil.

Pollination and Pest Control

The vegetation of the Study Area provides habitats to pollinator species, such as, pollen or nectar feeding insects and birds, as well as, insectivorous species, including frogs, lizards, birds and bats. By harbouring these species, the Study Area provides pollinator-services and pest-control services to natural, as well as agricultural plants.

4.5.5.3 Supporting Services

The Study Area provides supporting ecosystem services to the local community in the form of capture and recycling of nutrients, as well as primary production.

Nutrient Capture and Recycling

The food-chains constituted by the organisms of the Study Area capture, transfer and recycle the macro and micronutrients in the soil, water and air, making them available in the nutrient-sinks of the local ecosystems.

Primary Production

The photosynthetic organisms of the Study Area produce food that directly or indirectly supports the consumer organisms of the area, including the local human communities.

4.6 Socio-Economic Profile

4.6.1 Approach and Methodology

The socio-economic baseline date with respect to demographic profile, livelihood profile, gender, literacy, indigenous peoples (ethnic minorities, scheduled tribes), workforce, infrastructure, vulnerability etc. have been collected using primary and secondary data sources of the Project.

Primary Data Collection:

- Interaction with the GVIAL officials, Land teams, landowners, Gram Panchayat representatives and other villagers at the site was undertaken on 17th and 18th August 2023.
- Individual interviews (IIs) and focus group discussions (FGDs) with the directly and/or indirectly impacted Project Displaced Families (PDFs) and project affected people (PAPs) were carried out from 17th and 19th August 2023.
- Socio-economic baseline from the State level to village level was developed through discussion with project officials, District Administration, community members and Community representatives. It is supplemented through secondary database available in the public domain.

Secondary Data Collection:

The following government publications (secondary database) were referred to while developing the socio-economic baseline for the study:

- Primary Census Abstract, 2011; Office of the Registrar General & Census Commissioner, India; Ministry of Home Affairs
- District Census Handbook, Vizianagaram
- Village Data Abstract 2011, Office of the Registrar General & Census Commissioner, India; Ministry of Home Affairs
- Socio-Economic Survey 2022-2023, Government of Andhra Pradesh, India
- Human Development Report, 2007 – Andhra Pradesh
- National Family Health Survey (NFHS-4) 2019 -21, Andhra Pradesh

As per the google imagery and consultation with site representative the Project location falls in 7 villages namely Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district of Andhra Pradesh.

According to census 2011, The Bhogapuram Mandal has total 19 villages covering an area of 10,935 hectares. Bhogapuram Mandal population represents 2.34% of total district population of which entire 100% population lives in rural areas. The literacy percentage stands at 51.22% in the Bhogapuram Mandal of which male literacy is 51.71% and female literacy is 38.81%. While the majority of population fall under general category, there is about

6.66% are SCs and around 0.19% are STs in the Bhogapuram Mandal which is lowest ST population among all 34 Mandals of the district. The sex ratio in the Mandal is 1003 which is lower when compared with Vizianagaram district (1019) and but higher than the state Andhra Pradesh (993). 68.07% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 31.93% were involved in Marginal activity providing livelihood for less than 6 months. Of the total area, about 65.07% is cultivable area and 26.74% is irrigated area of the total cultivable area. **Table 4-13** depicts the village falls within the project area.

Table 4-13 Villages falling within the project site.

District	Tehsil	Villages
Vizianagaram	Bhogapuram	Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru

Source: GVIAL

4.6.2 Administrative Profile

4.6.2.1 State Profile: Andhra Pradesh

Andhra Pradesh is a state on the southern coast of India. It is the seventh largest state with an area of 162,970 square kilometers and the tenth most populated state with a population of 49,577,103. Andhra Pradesh comprises two regions namely Kostaandhra (Coastal Andhra) and Rayalaseema. The state is further divided into 26 districts out of which Uttarandhra consists of 6 districts, Kostaandhra of 12 districts and Rayalaseema of 8 districts. It is bordered by Telangana, Chhattisgarh, Odisha, Tamil Nadu, Karnataka and Bay of Bengal. It has the longest coastline of India of approximately 974 km. After the existence of the state of Andhra and the united Andhra Pradesh, the state assumed its present form on 2 June 2014 when the new state of Telangana was formed as a bifurcation. As per Indian Forest Report 2021, Andhra Pradesh state forest covers an area of 38060.39 Sq. Kms, which amount to 23.35% of the total geographical area. Out of this, very dense Forest is 1994.28 Sq. Kms, Moderate Dense Forest is 13928.75 Sq. Kms, Open Forest is 13861.27 Sq. Kms and Scrub Forest is 8276.09 Sq. km.

According to the 2011 census, Andhra Pradesh has a population of 49,577,103 and a density of 304/square km. 70.53% of the total population lives in the rural area and 29.47% in the urban area. The state has 17.08% Scheduled Caste and 5.53% Scheduled Tribe population. The state's sex ratio is 997 females per 1,000 males, which is higher than the national average of 926 females per 1,000. The enrolment in all types of schools during 2022-23 in the state is 71.79 lakhs, of which 21.72 Lakhs (30.25%) are in primary schools, 9.79 Lakhs (13.63%) in upper primary schools and 40.29 lakhs (56.12%) in High schools. The state provides key health services such as Maternal Health care, child Health Care and Family Welfare Services through 11071 Sub-centres, 1142 Rural Primary Health Centres, 542 Urban Primary Health Centres, 172 Community Health Centres and 12 District Hospitals. The male and female expected life at birth for the combined states of Andhra Pradesh are 68.4 and 72.1 respectively as against the All-India figures of 68.8 and 71.1 in (2016-20).

60% of the population is engaged in agriculture and allied sectors. Agriculture includes farming, livestock, poultry and fishing. The four major rivers of India Godavari, Krishna, Penna and Tungabhadra flow through the state and provide irrigation to the agriculture sector. As per the Livestock Census 2019, the Livestock resources in the state include 46 lakh cattle, 62.19 lakh Buffaloes, 176.27 lakh sheep, 55.22 lakh Goats, 0.92 lakh pigs, 340.60 lakh total livestock and 1078.63 lakh poultry. During 2021-22, Andhra Pradesh stood 1st in Egg Production and 5th in Milk production.

In Andhra Pradesh, 1.56 crore motor Vehicles are registered of which 1.37 Crore non-transport Vehicles are used for personalised purposes and 18.28 lakhs Transport Vehicles. Currently there are 3 International and 3 domestic operational Airports in Andhra Pradesh which connect with major cities.

4.6.2.2 District profile: Vizianagaram

Vizianagaram district is a part of North Andhra Coastal plain and lies between 17°15’ to 19°15' North latitudes and 83°00' to 83°45’ East longitudes. The district was formed on 1st June 1979 taking areas from Srikakulam and Visakhapatnam districts which presently surrounds the district on east and west sides respectively. Very small portion of the district touches the Bay of Bengal on the South while the North and North-east is bounded by Odisha State. The total area of the district is 6,539 Sq. Km and ranks 20th in the State. The district is elongated in the north-south direction and a portion with Gantyada, Srungavarapukota, Vepada, Lakkavarapukota, Kothavalasa, Jami and Vizianagaram Mandals is projected towards the south-west direction in Visakhapatnam district. The district has 34 Mandals organised into two revenue divisions namely Vizianagaram Division (19 mandals) and

Parvathipuram Division (15 mandals). As per census 2011, there are total 1520 villages, 14 towns (4 statutory towns as Municipalities and 10 Census towns) and one Urban Agglomeration. District is headed by District Magistrate and play a pivotal role for maintaining Law and Order, planning and development, law and order, scheduled areas/agency areas, general elections, arms licensing etc.

Vizianagaram district shows a varied topography including alluvial and coastal plains, uplands and hilly areas. The Northern part of the district is mostly hilly and picturesque. This hilly part and sand area on the Western Margin of the district consist of the Eastern Ghats. The height exceeds 600 metres and the average height of the plain between this hilly part and the coastal plain is about 200 meters. The hilly areas are mostly forested mainly belonging to southern tropical dry mixed deciduous forest types which play an important role in the economy of the district. The district is chiefly covered under Ustalfs -Ochrepts soil sub-order classification, Psamments is formed in some extreme Western and Eastern areas.

Vizianagaram district is predominantly an agricultural district as 72.6% of the workers are engaged in agriculture and about 83% of the population of the district is living in rural areas and depend on agriculture for their livelihood. About 39,298 hectares of land is being irrigated in the district. The principal rivers flowing in the district are Nagavalli, Vegavathi, Gomukhi, Suvarnamukhi, Valligedda, Champavathi, Gosthani and Vengalaraya sagar. As per 2012 livestock census, total livestock in the district is 1177838 of which 385119 are cattle. The livestock plays a multi-faceted role in providing drought power for the farm, manure for crops and energy for cooking, food, milk and meat for household consumption as well as for the market. Livestock also provides raw material such as hides and skins, blood, bone, fat etc., required for industrial use.

4.6.3 Demographic profile of the Study Area

The demographic profile section below intends to present an understanding of the prevalent demography in the study area. The population of the study area has been analysed below with a focus on the size and its composition.

Demographic profile of the study area is described in **Table 4-14.**

Table 4-14: Demographic profile of the Study Area

Administrative Unit	Total Population	Male Population	Female Population
District			
Vizianagaram	2344474	1161477	1182997
		49.54%	50.46%
Mandal			
Bhogapuram	54891	27403	27488
	2.34%	49.92%	50.08%
Villages			
Savaravilli	3477	1781	1696
	0.15%	51.22%	48.78%
A. Ravivalasa	1805	899	906
	0.08%	49.81%	50.19%
Gudepuvalasa	2184	1081	1103
	0.09%	49.50%	50.50%
Kancheru	5163	2630	2533
	0.22%	50.94%	49.06%
Kavuluvada	2118	1006	1112
	0.09%	47.50%	52.50%
Ravada	2934	1532	1402
	0.13%	52.22%	47.78%
Munjeru	3571	1778	1793
	0.15%	49.79%	50.21%

Source: PCA 2011

It can be noted from the **Table 4-14** that the total population of Bhogapuram Mandal wherein the Project is located comprises about 2.34% of the total population of the Vizianagaram district. Furthermore, it is noted that in all administrative units, the male population is around 50%. Hence it is concluded that the Male female ratio is equivalent in the study area. Among all study villages, Kavuluvada has the highest percentage of Female population (52.50%) which is even higher than the Bhogapuram Mandal and Vizianagaram District. Ravada Village has the lowest female population (47.78%) among the study villages. The villages are administrated by a sarpanch who is elected representative of the village by the local elections.

The sex ratio of Vizianagaram district which is 1019 per 1000 males is higher than the State sex ratio of 993 per 1000 males. Also, the child sex ratio of the district which is 960 is comparatively higher than the state child sex ratio which stands at 939 females per 1000 males. This shows declining trend of sex ratio in the district as well as state. According to National Family Health Survey -5 (2019-20), Andhra Pradesh registered low Population growth rate, with low Total Fertility Rate (TFR) of 1.8.

The Government policy measures for "*Beti Bachao, Beti Padhao*" are the need of the hour. Proper implementation *of Janani Suraksha Yojana, Kalyana Lakshmi and Sukanya samruddhi Yojana* are very helpful to encourage girl births. Widespread propaganda of Pre-Conception and Pre-Natal Diagnostic Techniques (PC & PNDT) Act, 1994 in regional languages, compulsory registration of scanning centres along with active tracking system to scanning machine with a centralised location may prevent misuse of technology in sex selective abortions. Treatment of female foeticide on par with murder case and speedy prosecution of such cases with fast-track courts control such fearless operations[44].

4.6.3.1 Social Stratification: Vulnerable Groups, SCs and STs

Vulnerable groups are those groups of people who may find it difficult to lead a comfortable life and lack developmental opportunities due to their disadvantageous positions. Further, due to adverse socio-economic, cultural, and other practices present in each society, they find it difficult many a times to exercise their human rights fully[45].

The accessibility to development opportunities or its absence thereof can be attributed to the level of integration and responsiveness to mediums which enhance and improve livelihoods. Marginalization from the resources can be a result of social exclusion thereafter hindering all round development and improvement of livelihood of these groups. Categories such as scheduled tribes, scheduled castes primitive tribal group, legally released bonded labour and manual scavengers and other backward classes are recognised as socially excluded categories by the constitution of India. Recognising the relative backwardness of these weaker/socio-economically disadvantaged sections of the society, the Constitution of India guarantees equality before the law (Article 14) and enjoins the State to make special provisions for the advancement of any socially and educationally backward classes or for SCs (Article 15(4)).

The section below aims to define the status of these socially excluded categories/ groups within the study area. ***Table 4-15*** represents the presence of vulnerable sections of the community in the study area.

Table 4-15 Presence of Vulnerable Sections of Community within the Study Area

Administrative Unit	Total Population	SC Population	ST Population
District			
Vizianagaram	2344474	121493	235556
		10.57%	10.05%
Mandal			
Bhogapuram	54891	1793	106
	2.34%	6.66%	0.19%
Villages			
Savaravilli	3477	61	12

[44] Trends in Child Sex Ratio in the State of Andhra Pradesh and Social Implications of Gender Ratio Imbalances; Voleti Usha Padmini; Government Degree College, Srikakulam; 2022
[45] Human Rights of Vulnerable & Disadvantaged Groups; Dr. T. S. N. Sastry; University of Pune; 2012

Administrative Unit	Total Population	SC Population	ST Population
	0.15%	3.71%	0.35%
A. Ravivalasa	1805	13	0
	0.08%	1.66%	0.00%
Gudepuvalasa	2184	134	0
	0.09%	12.23%	0.00%
Kancheru	5163	66	0
	0.22%	2.61%	0.00%
Kavuluvada	2118	26	1
	0.09%	2.17%	0.05%
Ravada	2934	125	49
	0.13%	7.91%	1.67%
Munjeru	3571	224	1
	0.15%	12.13%	0.03%

Source: Census of India, 2011

Table 4-15 suggests that the presence of vulnerable communities (Scheduled Caste and Scheduled Tribe) is vary between 0% to 12.23% in all administrative units. SC population of Bhogapuram Mandal forms 6.66% of the total population of the tehsil whereas ST population forms only 0.19% of the total population. A. Ravivalasa, Gudepuvalasa and Kancheru villages has nil ST population, whereas Ravada village has highest 1.67% of ST population among all study villages. However, Gudepuvalasa has highest SC population which is 12.23% among the study villages. During site visit, it was reported that, the SC population in study villages are mainly from Relli community.

No land from ST was procured for the Project. During consultation with the SC community, it was observed that they are small and marginal farmers and most of them are engaged in daily wage labours in agriculture and construction works. Some of the households impacted from the land acquisition are Women Headed Households (WHH). These households need special consideration so that they can be benefitted from the project and do not further get socially and economically marginalised.

4.6.4 Gender Profile

Table 4-16 represents the gender profile of the study area.

Table 4-16: Gender Profile of the Study Area

Administrative Unit	Total Population	Female Population	Female Literate Population	Main Female Workforce Population
District				
Vizianagaram	2344474	1182997	530885	350704
		50.46%	49.87%	14.96%
Mandal				
Bhogapuram	54891	27488	10669	4956
	2.34%	50.08%	38.81%	9.03%

Administrative Unit	Total Population	Female Population	Female Literate Population	Main Female Workforce Population
Villages				
Savaravilli	3477 0.15%	1696 48.78%	589 39.64%	491 14.12%
A. Ravivalasa	1805 0.08%	906 50.19%	336 43.41%	178 9.86%
Gudepuvalasa	2184 0.09%	1103 50.50%	351 35.67%	393 17.99%
Kancheru	5163 0.22%	2533 49.06%	712 32.35%	714 13.83%
Kavuluvada	2118 0.09%	1112 52.50%	342 35.08%	27 1.27%
Ravada	2934 0.13%	1402 47.78%	608 49.47%	90 3.07%
Munjeru	3571 0.15%	1793 50.21%	664 42.05%	547 15.32%

Source: PCA 2011

The total workforce in Andhra Pradesh, according to the 2011 census estimates is 33.03 million, out of which 21.46 million are males and only 11.57 million are females. Female labour force participation rates (FLFPRs) in Andhra Pradesh have been historically higher than the national average, in both rural and urban areas. The Periodic Labour Force Survey (PLFS) 2017-18 reports that rural FLFPR is 39 percent, which is way above the national level estimate of 18.2 percent. The difference between the state's FLFPR and the national FLFPR in rural areas is visible, despite the fact that FLFPR in AP has been consistently declining since 2004-05. It dropped from 48.8 percent in 2004-05 to 44.78 percent in 2011-12, and then declined further to 39 percent in 2017-18[46].

A gender profile of the study area is presented in the table above. The demographic study of the project study area indicates that the female population is comparable to the males, in the state of Andhra Pradesh, District Vizianagaram, Bhogapuram Mandal and in all study villages. It was reported during consultations that traditionally women and girl children are respected more than men in north coastal Andhra. However, the child sex ratio of the district which is 960 is comparatively higher than the state child sex ratio which stands at 939 females per 1000 males. But overall, it indicates a declining trend in the sex ratio. The total female population of Vizianagaram district is 50.46% (1182997), in Bhogapuram Manadal it is at 50.08%%, in study villages it varies between 47.78% to 52.50%. Female literacy in Vizianagaram district is 49.87%, Bhogapuram manadal at 38.81%, and in project villages varies between 49.47% to 32.35%. There is a substantial gap in male and female literacy rate in the study area.

4.6.5 Literacy level

The Census of India defined a person a literate who is aged seven years or above and can both read and write in any Indian language with understanding. The literacy level of the study area has been represented in ***Table 4-17.***

[46] PLFS, 2017-18, 61st round of NSS (2004-05) and 68th round (2011-12)

Table 4-17 Literacy Profile of the study area

Administrative Unit	Total Population	Literate Population	Literate Male Population	Literate Female Population
District				
Vizianagaram	2344474	1238388	707503	530885
		58.89%	68.15%	49.87%
Mandal				
Bhogapuram	54891	24838	14169	10669
	2.34%	51.22%	51.71%	38.81%
Villages				
Savaravilli	3477	1455	866	589
	0.15%	47.74%	55.44%	39.64%
A. Ravivalasa	1805	781	445	336
	0.08%	53.00%	62.26%	43.41%
Gudepuvalasa	2184	825	474	351
	0.09%	42.97%	50.64%	35.67%
Kancheru	5163	1728	1016	712
	0.22%	38.36%	44.10%	32.35%
Kavuluvada	2118	777	435	342
	0.09%	42.00%	49.71%	35.08%
Ravada	2934	1469	861	608
	0.13%	56.67%	63.17%	49.47%
Munjeru	3571	1528	864	664
	0.15%	48.49%	54.96%	42.05%

Source: Census of India, 2011

Table 4-17 denotes that Vizianagaram district and Bhogapuram manadal record literacy rates of 58.89% and 51.22% respectively. Female literate population in these administrative units comes up at 49.87% and 38.81% which is much lower than the literacy rate of the male population. Among all study villages, the literacy rate is highest in Ravada village which is 56.67% and lowest in Kancheru Village 38.36%. Female literacy rate is highest in Ravada Village 49.47% and lowest in Kancheru village 32.35% in the study villages. The average and female literacy rate is much low than the national average and female literacy rate. The Government policy measures for “Beti Bachao, Beti Padhao” and other initiatives to support the literacy are the need of the hour in the study area.

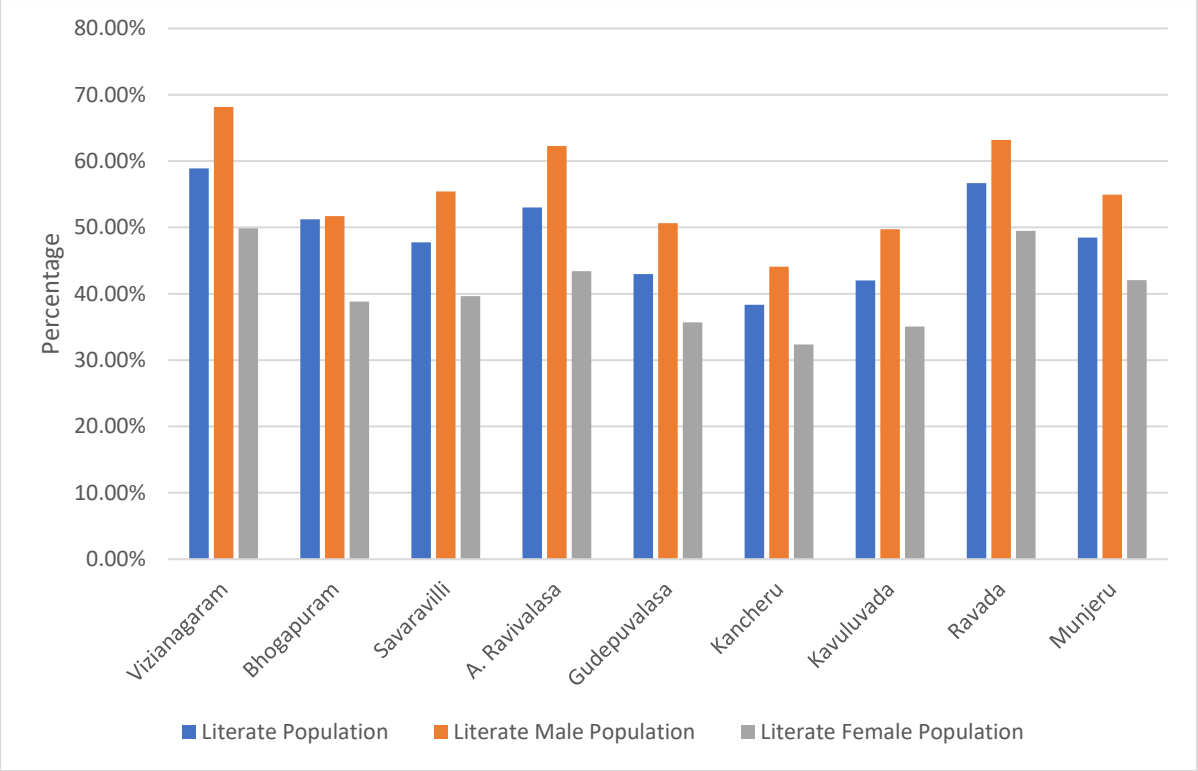


Figure 4-32: Literacy rate in the study area

The literacy rate of the study area has been compared with the literacy rate of district, state and national level which shows that literacy rate of the study area is below than the literacy rate of the district, state and national level. Details of comparison are given in **Figure 4-32**.

4.6.6 Workforce Population and Livelihood

According to Census 2011, the work is defined as participation in any economic activity, with or without compensation for a given time. The total population in the study area that engages in such an economic activity is called as the workforce population. Main workers comprise of those people who engage in an economic activity for a period of more than six (06) months while Marginal workers are those who engage in an economic activity for less than six (06) months. The workforce pattern of the study area is given in **Table 4-18.**

Table 4-18 Workforce profile of the study area

Administrative Unit	Total Workforce Population	Total Main Workforce Population	Main Male Workforce Population	Main Female Workforce Population	Total Marginal Workforce Population	Marginal Male Workforce Population	Marginal Female Workforce Population
District							
Vizianagaram	1,157,962	953,215	602,511	350,704	204,747	76,778	127,969
	55.07%	82.32%	63.21%	36.79%	17.68%	37.50%	62.50%
Mandal							
Bhogapuram	25,512	17,365	12,409	4 ,956	8,147	3,453	4 ,694
	52.61%	68.07%	71.46%	28.54%	31.93%	42.38%	57.62%
Villages							
Savaravilli	1,566	1,380	889	491	186	92	94
	51.38%	88.12%	64.42%	35.58%	11.18%	49.46%	50.54%

Administrative Unit	Total Workforce Population	Total Main Workforce Population	Main Male Workforce Population	Main Female Workforce Population	Total Marginal Workforce Population	Marginal Male Workforce Population	Marginal Female Workforce Population
A. Ravivalasa	835	640	462	178	195	49	146
	52.38%	76.65%	72.19%	27.81%	23.35%	25.13%	74.87%
Gudepuvalasa	1,093	956	563	393	137	51	86
	56.93%	87.47%	58.89%	41.11%	12.53%	37.23%	62.77%
Kancheru	2,755	2,164	1,450	714	591	132	459
	61.15%	78.55%	67.01%	32.99%	21.45%	22.34%	77.66%
Kavuluvada	1,160	142	115	27	1,018	482	536
	62.70%	12.24%	80.99%	19.01%	87.76%	47.35%	52.65%
Ravada	1,368	675	585	90	693	266	427
	52.78%	49.34%	86.67%	13.33%	50.66%	38.38%	61.62%
Munjeru	1,632	1,541	994	547	91	28	63
	51.79%	94.42%	64.50%	35.50%	5.58%	30.77%	69.23%

Source: PCA 2011

Review of the **Table 4-18** shows that in Vizianagaram district, 82.32% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 17.68% were involved in Marginal activity providing livelihood for less than 6 months. In Bhogapuram Mandal, 68.07% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 31.93% were involved in Marginal activity providing livelihood for less than 6 months. Of 25,512 workers engaged in Main Work, 2,064 were cultivators (owner or co-owner) while 7,489 were Agricultural labourers. The data in above table shows large number of female workers are engaged in Marginal works as compared to male. During consultation with women, it was reported that the female workforce is mainly engaged in households works, agricultural labour, cattle grazing etc. Due to low female literacy rate and lack of skill development opportunities in the area, they became vulnerable to the mainstream job opportunities.

4.6.7 Physical Infrastructure and Civic Amenities

Consultations with local communities, Village sarpanch and site observations of the village were undertaken to understand the existing public utilities in the study villages. It has been further supplemented by the Village Data Abstract (VDA) for the year 2011.

Table 4-19: Educational Institutions in Study Villages

Villages	Primary School	Middle School	Secondary School	Senior Secondary school	Other Higher institutions
Savaravilli	5	1	0	0	0
A. Ravivalasa	5	0	0	0	0
Gudepuvalasa	7	0	0	0	0
Kancheru	7	1	1	0	0
Kavuluvada	5	1	0	0	0
Ravada	5	1	1	0	0
Munjeru	7	1	1	0	1

The above table shows the educational institutions in the study villages. All the 7 villages have the primary schools which provide basic education up to 5th class. 5 villages have middle schools, and 3 villages have the secondary

schools. However, no village have the presence of Senior secondary schools. During consultation, local people raise concern over the quality of education in government school. Those who are economically well off prefer private school for their children. Student goes to Vizianagaram town for higher education which is about 25 km from the study village. There is one private engineering college near the project area.

4.6.7.1 Health Infrastructure

Table 4-20: Health Infrastructure in study villages

Villages	Community health centre (CHC)	Primary health centre (PHC)	Primary health sub centre (PHS)	Maternity and child welfare centre (MCW)	Veterinary hospital (VH)
Savaravilli	0	0	1	0	0
A. Ravivalasa	0	0	0	0	0
Gudepuvalasa	0	0	1	0	0
Kancheru	0	0	0	0	0
Kavuluvada	0	0	0	0	0
Ravada	0	0	1	0	0
Munjeru	0	0	1	0	1

The **Table 4-20** shows the health institutions in the study villages. As per census 2011, There are no CHC and PHC in the study villages. There is one Primary Health Sub-center (PHS) in Savaravilli, Gudepuvalasa, Ravada and Munjeru villages. As reported, nearest CHC available in Bhogapuram Village which is about 10 km from the study villages. District Government hospital, Vizianagaram is about 30 km from study villages. Discussion with villagers indicated that there has been no major outbreak for the last 10 years. However, Outbreak reported from Polipalli Village/PHC, Bhogapuram Mandal due to consumption of contaminated water in 201047.

4.6.7.2 Educational Infrastructure

According to the census of India 2011, 97 number of government primary school are present in within the area of influence of the project. In addition, 35 government middle school, 15 numbers of government secondary school, and 3 numbers of senior secondary school are also available within the study area.

Table 4-21: Transport facilities in study villages

Villages	Bus service (Public & Private)	Railway stations	Auto/Modified Autos	Taxis and Vans	Sea /River ferry service
Savaravilli	Yes	No	Yes	Yes	No
A. Ravivalasa	No	No	Yes	No	No
Gudepuvalasa	Yes	No	Yes	No	No
Kancheru	Yes	No	No	No	No
Kavuluvada	No	No	0	No	No
Ravada	No	No	Yes	No	No
Munjeru	Yes	No	Yes	No	No

The **Table 4-21** above shows the transport facilities in the study villages. Project site is well connected to Visakhapatnam through NH-16 (45km) and Vizianagaram via NH-43 (25km). The site is surrounded by Bay of Bengal on the eastern side (about 1.5 km) and NH-5 (about 1.5 km) on the western side. It was understood after discussions with the community members of the village that there is good mobile phone coverage. Nearest post office branch is in Bhogapuram village. The Project site is connected to nearby Mandal and towns through both

[47] *https://idsp.mohfw.gov.in/WriteReadData/DOB2010/34th_wk10.pdf*

pucca road (MDR) and kutcha road (village road). There are limited Government and Private bus services available from the study villages. Villagers are mostly dependent on private Auto and taxi for commuting to the nearest market and cities.

4.6.8 Socio-economic Survey

This section describes the profiling of the Project Affected Households (PAHs), Project Affected Persons (PAPs) and consulted community members. As complete census and socio-economic surveys was not conducted as scope of this ESIA, a sample of 09 households were surveyed by AECOM of those were available for survey during the site visit as part of the assessment. Analysis of the survey on the backdrop of the qualitative consultations undertaken with key stakeholder groups has been highlighted on the succeeding sections.

4.6.9 Demography

Details of the demographic details of the Affected Population have been presented in the ***Table 4-22*** below.

Table 4-22 Demographic Details of Households Surveyed

S.N.	Item	Number
1.	Number of Sample[48] Households Surveyed	9
2.	Total Number of Population	31
3.	Total Number of Males	16 (51.61%)
4.	Total Number of Females	15 (48.39%)
5.	Average Household Size	3.44
6.	Women-headed households	2 (22.22%)

Source: Primary Socio-Economic Survey

As presented in the table above, a total of 9 households were surveyed during the site visit who were available. Out of the total population surveyed, the male population comprised of 51.61% (16) and the female population comprised of 48.39% (15). The average household size of the population is 3.44. There were two woman-headed household among those surveyed. It was reported that, though recent, more and more women are given share in the family-owned property.

4.6.10 Family Size

The family size of the surveyed population has been highlighted in ***Table 4-23.***

Table 4-23 Family Size of the Affected Population

Total Households Surveyed	Joint Family[49]	Nuclear Family	Individuals
9	0	7	2
	(00.00%)	(77.78%)	(22.22%)

Source: Primary Socio-Economic Survey

The **Table 4-23** indicates that 77.78% of the surveyed families are nuclear family set up and remaining 22.22% individual household. In the Indian context, joint families are typically characterised by members who live together, have a common mess and are descendants from a common ancestor. They would include wives or husbands, as the case may be, of its member, but shall exclude married daughters and their children. There were no joint family set up found amongst the surveyed population.

[48] During site visit 9 sample surveys were conducted based on availability of people.
[49] An extended family, typically consisting of three or more generations and their spouses, living together as a single household.

4.6.11 Literacy Level

The literacy level of the surveyed population has been presented below.

Table 4-24 Literacy Level

Sl. No.	Literacy Level	Number	Percentage
1.	Illiterate	10	32.26
2.	Primary School level	4	12.90
3.	Secondary School level	7	22.58
4.	Senior Secondary School level	2	6.45
5.	Graduate and above	4	12.90
6.	Too young for school (0-6 age group)	4	12.90
	Total population surveyed	**31**	**100**

Source: Socio-Economic Survey of the site

Table 4-24 The social development of a region is signified by many indices. One of which is literacy status of the population. Among the literate households 32.26% households are reported to be Illiterate hence cannot read, write or even sign their names. About 12.90% achieved up to primary level of education. Remaining 41.94% households comprises education upto secondary, senior secondary, graduate & above education level. About 12.90% of population are too young for school (0-6 age group).

4.6.12 Occupational Pattern

The table below represents the occupational pattern of the surveyed population. As per the primary survey no person below 14 years of age are found to be working. The working age group above 18 years, has only been considered for their occupational profile. The findings of survey reveal that primary occupation of 27% PAPs is agriculture, 39% PAPs are labour, 17% are in service and business/trade each.

During discussion it is noted that in the study area, the consulted households have less than one acres of land. Acquired land is irrigated cultivable land depending on rain. Mango orchards, cashew plantation, coconut and groundnuts are major plantation grown by the PAFs. Paddy crop is cultivated by few households mainly during Kharif season. During the remaining part of the year people look for alternate source of income to maintain their livelihood i.e., animal rearing and non-agricultural labour work in nearby town. Few of the PAPs who are involved in business are having shops and bakery in the villages. The details of occupational status of affected persons are summarized in ***Table 4-25***.

Table 4-25: Primary Occupation Status of PAPs

Sl. No.	Occupation	No of PAFs involved in	No of Earning Members			% Share to total earning members
			Male	Female	Total	
1	Agriculture		4	1	5	27
2	Labour		5	2	7	39
2	Service (Private & Government)		3	0	3	17
3	Business/Trade	9	3	0	3	17
Total		-	**15**	**3**	**18**	**100**

Source: Sample primary survey, July 2023

Table 4-26 indicates that only 4 PAPs are engaged in secondary occupation, of which 2 PAPs are involved in labour, 8 of them do agricultural work and remaining 4 PAP working in business/trading.

Table 4-26: Secondary occupational status of PAPs

Sl. No.	Occupation	No of PAFs involved in occupation	No of Earning Members			
			Male	Female	Total	Share to total (%)
1	Labour	2	2	0	2	50
2	Agriculture		0	0	0	0
3	Business/Trade		2	0	2	50
Total		-	**4**	**0**	**4**	**100**

Source: Socio-Economic Survey

4.6.13 Income Levels

Table 4-27 represents the income levels of the surveyed households.

Table 4-27 Income Level of Surveyed Households (Monthly Income)

Total No. Of Households Surveyed	Less than INR 10,000	Between INR 10,000-15,000	Between INR 15,000-30,000	Above INR 30,000
09	02	02	04	01
	(22%)	(22%)	(45%)	(11%)

Source: Socio-Economic Survey

It is noted from the table above that majority PAHs, five (05) representing 56% of surveyed have monthly earning above INR 30,000 and between INR 15,000 to INR 30,000. Followed by 22% PAHs falling in the range category of income less than INR 10,000 and INR 10,000 to 15,000 each.

5 Stakeholder Engagement and Consultation

Stakeholder consultations are an important medium to understand and communicate with the stakeholders regarding the various project related activities. It is a process which initiates a two-way dialogue between the project proponent and the stakeholders. During site visit, AECOM team conducted consultations with Project Affected Persons (PAPs), Revenue Division officer-Vizianagaram, community members, Village head, SC Community, Fishermen Community and Women members at the project site.

5.1 Approach and Process of Stakeholder Engagement

The stakeholder engagement and consultation process have the following objectives:

- The consultation process provided opportunities for the affected communities to express their views on the planned project, whilst providing key information on issues faced by the landowners;
- To ensure timely and consistent disclosure of project information to all stakeholders and facilitate their feedbacks, any decision making and concerns;
- To assess awareness levels of the project and to determine the impacts of future developments plans on the project area; and
- To ensure a process by which any grievance, suggestions or general feedback are accepted and addressed in a timely manner and incorporated in the project where applicable and relevant.

Consultations conducted during the ESIA study involved focus group discussions and natural interviews. The following aspects form the structure of consultation process adopted for impact assessment:

- Identification of the relevant stakeholders including all those individuals, groups and organizations potentially influenced by or interested in the project;
- Information disclosure about the project and its potential impacts on livelihoods of locals;
- Verification and validation of site, to avoid infringement of formal/informal rights of the local population;
- Document concerns and aspirations of the stakeholders through discussions; and
- Respond to queries in a neutral manner.

The discussion process involved a questionnaire with a list of open-ended questions addressed to either individuals or groups from the project impact area of Indirapuram and Sahibabad industrial area.

5.2 Stakeholder Mapping and Identification

The project consists of range of stakeholders with varied interests and influence in the project. A stakeholder is ‘a person, group or organization that has a direct or indirect stake in project because it can affect or be affected by the project/ project proponent actions, objectives and policies. Thus, they vary in terms of degree of interest, influence and control they have over the project.

Primary stakeholders are those stakeholders who have direct impact or are directly impacted while those are indirectly impacted by the project are secondary stakeholders. The details of project associated impacts as gathered through the consultation process from the affected stakeholders have been elaborated in the subsequent section. For the study, consultations were undertaken with landowners and RDO-Vizianagaram who are directly associated with the project. The consultations were focussed on Status of land acquisition, understanding the land acquisition process, status of compensation and R&R implementation. Evaluation on whether the acquisition of the land leads to the impact on livelihoods of the PAPs, their concerns and expectations from the project were also assessed during the consultation.

Focus Group Discussions (FGDs) were held with the Project Displaced Families (PDFs), women members, SC community, and Fishermen group at the Project site to understand the prevalent socio-economic conditions and project associated issues. Prevailing socio-economic conditions and project associated issues were also assessed through interviews and discussions. The following section provides the summary on the various consultations, FGDs and interviews undertaken during the site visit.

5.2.1 Consultations with Project Affected Persons

The total land required for the development of Bhogapuram International Airport is 2203.26 acres, which includes 1453.71 acres of Zeroyiti land, 505.42 acres of assigned land and 244.13 acres of Govt. land. The entire land

required for the Project is predominantly a coastal plain area and are spreads over seven (07) villages namely, Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district. Land for the proposed project is acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014. Further, APADCL shall hand over required land for the project to the GVIAL free from any encumbrance as per clause 4.1.2(a) and 10.3.1 of concessionaire agreement. Two resettlement colonies are developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approx. 17 acres and 23 acres respectively. all the PDFs have voluntarily vacated the houses and relocated to the R&R colony after construction of houses. AECOM team had a consultation with about 17 PAPs. **Table 5-1** represents the summary of the consultations undertaken with the Project PAPs.

Table 5-1 represents summary of the consultations undertaken with the land sellers.

Table 5-1 Summary of Responses from PAPs

Questions	Summary of Responses received from PAPs
What is the previous land use of the project site?	Based on discussion with PAPs, AECOM noted that most of the PAPs are dependent on agriculture and allied sectors. About 205 families were residing in Rellipeta, Bollinkalapalem, Mudasarlapeta and Maradapalem village with all basic amenities. At the time of site visit all the houses were dismantled and families were shifted to R&R colony. Acquired land is irrigated cultivable land depending on rain. Small rainfed waterbodies were observed on the site for irrigation purpose. Mango orchards, cashew plantation, coconut and groundnuts are major plantation grown in the area. Paddy crop is cultivated by few households mainly during Kharif season. Some PAPs also graze cattle on their own land or open field. Grass and shrubs were observed on the proposed land during the site visit of the AECOM team.
Process of land procurement	Land for the Project is acquired, and compensation paid by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014.
Have the PAPs received the compensation for the acquired land?	Consulted PAPs have received the compensation amount based on the Government of Andhra Pradesh GO notification.
Are the PAPs contended with the remuneration received? Were they aware of the prevalent market rate?	Compensations were paid after prolonged negotiations with the landowners under the provisions of G.O.MS.No.262, Revenue (LA) Dept., dated13.07.2015 and the agreeable compensation package higher than that provided under the LARR Act, 2013 including all benefits like market value, Solatium etc.
Do you own any more land?	During consultation, it was observed that the PAPs are small and marginal farmers. About 10 landowners out of 17, has responded that their entire land has acquired in the Project. The remaining landowners has left with very small portions of land (5 cents to 50 cents).
What have you utilised the compensation received for?	All consulted PAPs have utilised the compensation in construction of houses in R&R colony. Two PAPs have set up small shops and one PAP has purchased land from the part of the compensation amount.
Skill training and Employment	About 10 PAPs out of 17 consulted PAPs showed their interest in Skill Development in the employable skills. All the consulted PAPs have not taken any Skill development training however, some of them acquired the skills in construction work while working on the job. They had the views that either themselves or the member of their families should get skill development training to secure their livelihood.
What is the perception about the upcoming Airport project in the area amongst the community members?	Some of the key opinion points of the community members regarding the project are as follows: - • Preference should be given to local people in employment and self-employment opportunities in the project; • The community members hope that community developmental activities will improve key physical and social infrastructure in the villages; • Key concerns on congestion, accidents due to movement of vehicles during construction and operation phase of the project.

Questions	Summary of Responses received from PAPs
Grievances, if any	PDFs in Polipalli R&R colony raise the concern on landscape where some houses are constructed on high altitude and some on low. Elderly people find difficulty in climbing from low to high altitude while commuting in village. Few PDFs also reported about the blockage of drainage system in R&R colony due to non-maintenance.

5.2.2 Consultations with the Institutional Stakeholders

Table 5-2 represents the key discussion points with the Revenue Divisional Officer (RDO)-Vizianagaram

Table 5-2 Key discussion points with the Mrs. M V Suryakala, Revenue Divisional Officer (RDO)-Vizianagaram

Major Themes	Discussion
Land Procurement	The total land required for the development of Bhogapuram International Airport is 2203.26 acres, which includes 1453.71 acres of Zeroyiti land, 505.42 acres of assigned land and 244.13 acres of Govt. land. The entire land required for the Project is spreads over seven (07) villages namely, Savaravilli, A. Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district. Land for the Project is acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013. The private land is acquired from 1465 landowners from 7 villages. Total 405 families are displaced due to the acquisition of land from 4 village hamlets namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. Total about 72 Government Orders (GO) were passed during the period for the compensations and R&R entitlements for the landowners and PDFs of this Project. Separate compensations were given to landowners for the assets on the land such as structures, trees, etc. Two resettlement colonies are developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approx. 17 acres and 23 acres respectively. The entire 40 acres of land on which R&R colony is being developed was the government land. Each PDFs were given 5 cents (240 square yards) of land and R&R assistance of INR 9.70 lakh. All community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies.
Issues in land procurement	It was informed by the RDO-Vizianagaram that the entire land is under the possession of State government. However, about 39.86 acres of land belongs to 111 landowners are under litigations on the title disputes in the Vizag Tribunal. As reported, the compensation amount relating to 39.86 acres of land has been deposited by the state government in the court/designated account. The compensation amount will be released to the respective titleholders after the title disputes will be resolved with the order of the Vizag Tribunal. Except the 7 court cases mentioned above, there are another 54 cases pending with LARR Authority involving demand for additional compensation on 156 acres of land. The entitled compensation amount has been deposited by the State Government with the LARR Authority in the year 2022 and 2023. The petitioners are being advised by APADCL to approach LARR Authority to look into their claims and accordingly the State Government will take final decision on the enhanced compensation amount. As entire land has been already acquired and in possession of APADCL (also handed over to GVIL) the construction of Project can start. On closure of cases, APADCL will deposit additional compensation amount with LARR Authority for payment to the entitled persons who have filed the cases.
Current procurement status	The entire 2203.26 acres of land has been transferred to the Andhra Pradesh Airports Development Corporation Limited (APADCL) vide. District Collector, Vizianagaram proceedings vide Rc.No.1491/2023/E1 dated 26th May 2023.
SC/ST land within the project area	The land acquired for the Project does not comprise of any Schedule tribe land. However, out of 405 displaced families, about 65 PDFs are from SC community from Rellipeta hamlet. All the 65 SC PDFs from Rellipeta hamlet are relocated in the Gudepuvalasa R&R colony after payment of compensation and R&R entitlements. The displaced SC PDFs is from *Relli* community.
Encroachers, Squatters, or illegal occupier on the acquired land	No encroachers, squatters or illegal occupiers are reported on the acquired land.

Grievance redressal of PAPs	Andhra Pradesh Government SPANDANA scheme where citizens can lodge their grievances by calling on number 1902. The grievances are resolved within the timeframe. Also, RDO-Vizianagaram schedule a weekly meeting where any complainants lodge their grievances. All the grievances of PAPs were resolved, and no grievances were received from past 2 months.

5.2.3 Focus Group Discussions with Community Members of Study Village

Table 5-3: represents the summary of discussions with community members and Village representatives.

Major Themes	Sub themes	Details
Socio-economic Conditions	Socio-Cultural (Scheduled Tribes and Religion)	More than 90% of the community in the villages is from Hindu religion. ST population is very limited and mainly in Ravada village. Presence of SC community in all the study villages but their population is less than 5%. However, as per Census 2011, SC population in study villages is 3.05%. The SC population mainly lives in separate hamlet or groups in the villages, and they are basically from Relli community.
	Occupational Pattern and Livelihood Activities	Primary occupation of the village is agriculture, wage labour and small business such as shops. Since small landholding of the PAPs, most of the consulted PAPs are engaged in manual work like construction, automobile services etc as skilled and unskilled labour. Yadava community in the villages are involved in livestock mainly cow, sheep and goat rearing. Youth in the villages migrated to nearby cities and towns such as Vizianagaram and Vishakhapatnam in search of livelihood. There are some fishermen communities in the villages due to closeness of villages to the sea beaches.
	Agricultural Crops Grown	Acquired land is irrigated cultivable land depending on rain. Mango orchards, cashew plantation, coconut and groundnuts are major plantation grown in the study villages. Paddy crop is cultivated by few households mainly during Kharif season.
Presence of Development Infrastructure and related aspects	Educational Facilities • Schools • Higher Educational Institutions • Technical Education Centres	• Primary school present in all the study villages. • No senior secondary school and other higher degree colleges are present in the study villages. • One private engineering college present close to the study village. • For higher studies, students travel to Vizianagaram town which is about 25 km from the study villages. • Tribal welfare department of Andhra Pradesh runs Primary / High Schools to the Tribal Children and provide free boarding and lodging with basic amenities. These schools are located in tribal region of the district.
	• Health Care Facilities • Health Centres • Pharmacies	• As per Census 2011, Savaravilli, Gudepuvalasa, Ravada and Munjeru villages have the Primary Health sub-Centres (PHS) which provide basic medical facilities. • No PHC or CHC is present in the study villages. Local people from the study villages go to Bhogapuram village to access the PHC and CHC facilities. • District Government hospital is present in Vizianagaram town which is about 25 km from the study villages. • Outbreak reported from Polipalli Village/PHC, Bhogapuram Mandal due to consumption of contaminated water in 201050.
Information and awareness of the project	All the community members consulted during the site visit stated that they were aware of the development of International Airport at Bhogapuram.	

[50] *https://idsp.mohfw.gov.in/WriteReadData/DOB2010/34th_wk10.pdf*

Major Themes	Sub themes	Details
Expectation and Benefits from the Project		• Employment generation for the village youths. • During construction, local people, and resources available in the village should be prioritize. • Development of the village infrastructure in terms of education, health, and sanitation.
Concerns of the Project		It was pointed out during the discussion that there are no grievances regarding the land acquisition and compensation. However, villagers are concerned over future road congestion, accidents due to movement of vehicles during construction and operation phase of the project. They had the view that proper mechanism should be developed on community health safety aspects.

5.2.4 Focus Group Discussions with SC community, Women members and Fishermen community.

Table 5-4 represents the summary of discussions with SC community, Women members and Fishermen community.

Table 5-4 Summary of Discussions with SC community, Women members and Fishermen community

Major Themes	Discussion
SC Community	The land acquired for the Project comprise about 65 PDFs are from SC community from Rellipeta hamlet. All the 65 SC PDFs from Rellipeta hamlet are relocated in the Gudepuvalasa R&R colony after payment of compensation and R&R entitlements. The displaced SC PDFs is from Relli community. As per Census 2011, SC population in study villages is 3.05%. As reported, SC community comprises the vulnerable category such as Women Headed Households (WHH), Old age (above 65 years) and economically weaker households. Due to acquisition of land some of the households loses their entire land. The main occupation of the SC households are agriculture and wage laborers. The people from SC community are small and marginal farmers having average landholding size is approx. 1 acre. Women from SC community are engaged in households work, daily wage labourer and cattle rearing and grazing. The key expectations from the proposed project that it will create employment opportunities to their family leads to their socio-economic development.
Women member	As reported, literacy among women is low as compared to male literacy. Most of the women consulted during the site visit were illiterate or having education upto primary level. As per Census 2011, Bhogapuram mandal has 38.81% literacy rate as compared to male counterpart of 51.71%. Due to low literacy women participation in workforce is low. Most of the consulted women are engaged in household work or daily wage labour. The accessibility of higher educational institution from the study villages also one of the reasons for low enrolment in the higher education. As reported, Women self Help Groups (SHGs) are operating in the study villages under National Rural Livelihoods Mission (NRLM) where women from economically and socially weaker background are included in the group. Due to SHGs, women financial inclusion is ensured, and loans are available at the doorsteps for self-employment. However, women show concern over the loss of land in the project as that was the primary assets available for livelihood of the family. Their expectation from the government or project proponent to give employment opportunities to the family member so that their economic condition may improve.
Fishermen Community	Fishermen from Chepala Kancheru were consulted during the site visit. Most of the families in Chepala Kancheru village is from fishermen community. The village is approx. 4-5 km from the project site. As reported, approx. 1000 family's livelihood in the region is dependent on fishing. They are aware about the upcoming airport Project in the region. They showed positive feedback towards the development of Airport in the area. Fishermen have the view that their next generation don't want to be in fish business and that is why they migrate to the cities in search of livelihood. Development of airport in the region will create job opportunities in the area and they will be benefitted with this. Fishermen also has the view that the demand of their fish will increase with the development of airport in the area.

5.2.5 Summary of Social Issues and Consultation

- The total land required for the development of Bhogapuram International Airport is 2203.26 acres, which includes 1453.71 acres of private land, 505.42 acres of assigned land and 244.13 acres of Govt. land. The entire land required for the Project are spreads over seven (07) villages namely, Savaravilli, A.

Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru of Bhogapuram Mandal in Vizianagaram district. The state government has transferred the entire land to APADCL. As reported, APDCL will transfer the entire land to GVIAL by last week of August 2023.

- The private land is acquired from 1465 landowners. Total 405 families are displaced due to the acquisition of land from 4 village hamlets namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. As reported by RDO-Vizianagaram, compensation was paid to all the PAPs.
- About 39.86 acres of land belongs to 111 landowners are under litigations on the title disputes in the Vizag Tribunal (at the time of site visit).
- Two resettlement colonies are developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages. Each PDFs were given 5 cents (240 square yards) of land and R&R assistance of Rs. 9.70 lakh. All community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies.
- Based on discussion with the various stakeholders, AECOM noted that they were aware about the project.
- The Project does not fall under the schedule V area. No ST land is acquired for the project. However, about 65 SC families are displaced from Rellipeta village hamlet and they are resettled in Gudepuvalasa R&R colony.
- No forest land is involved in the acquired 2203.26 acres of land for the project.
- Primary occupation of the village is agriculture, wage labour and small business such as shop. Since small landholding of the PAPs, most of the consulted PAPs are engaged in manual work like construction, automobile services etc as skilled and unskilled labour.
- No encroachment and squatters are reported during the consultation with PAPs and RDO-Vizianagaram.
- During consultation, it was observed that the PAPs are small and marginal farmers having the average landholding size about 1 acre. As reported, the monthly income reported by PDFs are ranging between INR 10,000 to INR 40,000 per month. Entire land was acquired from some of the landowners which leads to landlessness. Vulnerable PAPs were identified during the consultations such as WHH, Elderly people (above 65 years) and landlessness. Some of the landowners invested their entire compensation on construction of houses in R&R colony. Acquisition of land envisage to have an impact on livelihoods of PAPs.
- About 2000 Shepherds families are live in Kongavanipalem and other nearby villages. They usually use the open field within 10-15 km area for grazing livestock. During consultation, it was observed that grazing is not a big concern as lot of open fields are available for grazing for the village livestock in the area.
- As per Census 2011, Bhogapuram mandal has 38.81% literacy rate as compared to male counterpart of 51.71%. Due to low literacy women participation in workforce is low. Most of the consulted women are engaged in household work or daily wage labour. This was confirmed during the consultations with women members in the study village.
- All the stakeholders show positive feedback towards the project. People’s expectations from the project were creation of jobs and self-employment opportunities for the village youth.

6 Analysis of Alternatives

Consideration of alternatives is one of the most critical elements of the environmental assessment process. Its role is to provide a framework for sound decision-making based on the principles of sustainable development. Alternatives should be identified as early as possible in the project cycle.

Assessment of alternatives includes a comprehensive comparison of all potential impacts, both direct and indirect and cumulative, on the environment. The goal of evaluating alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, or through reducing or avoiding potentially significant negative impacts. The alternative analysis is mainly aimed to mitigate the adverse social and environmental impacts in the project and make technically feasible and economic and financially viable alternative.

6.1 Identification of alternative options to the project

This section of the report presents the analysis of the alternatives considered for the proposed airport project. The following scenarios have been considered.

- No Project Scenario;
- Analysis of Alternate Location for the Airport;
- Analysis of Alternate Layout for the Project;

6.2 No Project Scenario

The Government of Andhra Pradesh (GoAP) is committed to establish world class infrastructure for Andhra Pradesh. As a part of this initiative, GoAP proposes to set up Greenfield International Airport (Aerotropolis) near Visakhapatnam in Bhogapuram Mandal in Vizianagaram district.

The state of Andhra Pradesh has witnessed a remarkable growth in aviation traffic in past couple of years. Moreover, when the erstwhile Andhra Pradesh was divided into two States, namely, State of Andhra Pradesh and State of Telengana and the major civilian airport at Hyderabad has become part of State of Telangana, the GoAP felt the necessity for establishment of a new airport as the existing airport at Vishakhapatnam is not sufficient to cater to load. Further in order to develop the economic, industrial and tourism development, they felt it is necessary to have one more international airport. Therefore Andhra Pradesh Government is planning to develop a world class state of the air international airport at Bhogapuram Mandal.

The Present airport project is of national importance and also is expected to play a vital role in the economic and financial growth of the State of Andhra Pradesh.

6.3 Analysis for Alternate Locations for the Airport

Analysis of alternatives also explored different locations for the Project. Initially, four sites were shortlisted for development of the greenfield airport as per MoCA Policy namely, Sabbavaram, Atchutampuram, Bhogapuram and Koruprolu. However, after careful deliberation on the feasibility aspects, Bhogapuram location was selected considering the equal distance between Vizianagaram and Vishakhapatnam Districts. Following factors were favourable for the Bhogapuram site in comparison to other selected sites:

- Minimum land acquisition cost.
- Avoiding villages/habited area to the extent possible.
- Avoiding built up areas/educational institutions/ resorts.
- Reduce resettlement cost/displacement of population.
- Utilization of maximum Government land.
- Avoiding forest land, estuary, river with back-water, mangroves and does not fall within any eco-sensitive zone.
- Avoiding CRZ area.

6.4 Design and Services Provisions

The Bhogapuram International Airport (BIA) will be a state-of-the-art airport with modular facilities for both domestic and international passengers and cargo capacity to accommodate the projected air traffic.

The Master Plan addresses all the required facilities related to air traffic operations viz. Runway, taxiways, aprons and isolation bay, Navigational aids, Passenger terminal building, Cargo complex, Control tower and technical building, Maintenance work shop for ground handling equipment and vehicles, service buildings, Fuel farm and fuel hydrant system, Aircraft hangar and maintenance facilities, Car parking Sewage treatment plant, Utilities, Housing, etc.

The development of the master plan of the Project was done in accordance with civil aviation requirements as prescribed by the Directorate General of Civil Aviation (DGCA), International Civil Aviation Organization (ICAO) guideline conforming to Good Industry Practice.

7 Environmental and Social Impact Assessment

This section describes the environmental and social impacts identified by accessing the primary and secondary information gathered. Impacts have been identified based on review of available project information, discussions with representatives of the project and the local community, as well as sector-specific professionals and subject experts.

Additionally, this chapter evaluates the significance of each identified impact on the basis of the collective severity of its spread, duration, intensity and nature. Mitigation measures have been suggested for each identified impact evaluated as significant.

7.1 Impact Assessment Criteria

Identified impacts have been appraised along the criteria of spread, duration, intensity and nature. As presented in ***Table 7-1***, each appraisal criterion is further classified based on the level or type of its spread, duration, intensity or nature, while stating the defining limit of each level or type.

Table 7-1: Impact Assessment Criteria

Criteria	Sub-Classification	Defining Limit	Remarks
Spread: Refers to area of direct influence from the impact of a particular project activity.	Local spread	Impact is restricted within the footprints of the Project boundary	In case of biodiversity, the farthest directly impacted habitat or ecosystem service would be considered
	Medium Spread	Impact is spread up to 2 km around the project area	In case of biodiversity, the farthest directly impacted habitat or ecosystem service would be considered
	High spread	Impact is spread beyond 2 km from footprint boundary of the Project	In case of biodiversity, the farthest directly impacted habitat or ecosystem service would be considered
Duration: Based on duration of impact and time taken by an environmental aspect to recover to its original state	Short Duration	When impact is likely to be restricted for a duration up to construction period	In case of biodiversity, the anticipated recovery time of impacted habitats or ecosystem services would be considered
	Medium Duration	When impact extends up to two years after construction period.	In case of biodiversity, the anticipated recovery time of the impacted habitats or ecosystem services would be considered
	Long Duration	When impact extends beyond two years after construction period.	In case of biodiversity, the anticipated recovery time of the impacted habitats or ecosystem services would be considered
Intensity: Defines the magnitude of impact	Low intensity	When changes in the prevailing (baseline) environmental conditions does not exceed 20%	In case of biodiversity, percentage of loss or degradation of habitats and/or ecosystem services would be considered
	Moderate intensity	When changes in the prevailing (baseline) environmental conditions does not exceed 30%	In case of biodiversity, percentage of loss or degradation of habitats and/or ecosystem services would be considered
	High intensity	When changes in the prevailing (baseline) environmental conditions exceeds 30%	In case of biodiversity, percentage of loss or degradation of habitats and/or ecosystem services would be considered
Nature: Refers to whether the effect is considered beneficial or adverse	Beneficial	-	Useful to Environment and Community
	Adverse	-	Harmful to Environment and Community

Table 7-2 presents the Impact Significance Matrix applied in order to assess the overall significance of the impacts appraised as per the Impact Assessment Criteria outlined in ***Table 7-1***.

Table 7-2: Impact Significance Matrix

Spread	Duration	Intensity	Overall Significance	
			Adverse	Beneficial
Local	Short	Low	Insignificant	Insignificant
Local	Short	Medium	Minor	Minor
	Medium	Low		
	Medium	Medium		
Medium	Short	Low		
Local	Long	Low		
Local	Short	High	Moderate	Moderate
Local	Medium	High		
Local	Long	Medium		
Medium	Short	Medium		
Medium	Medium	Low		
Medium	Medium	Medium		
Medium	Long	Low		
Medium	Long	Medium		
High	Short	Low		
High	Short	Medium		
High	Medium	Low		
High	Medium	Medium		
High	Long	Low		
Local	Long	High	Major	Major
Medium	Short	High		
Medium	Long	High		
High	Short	High		
High	Medium	High		
High	Long	Medium		
High	Low	Low		
High	Low	High		

7.2 Impact Identification

Table 7-3 below presents the Activity-Impact Interaction matrix for pre-construction, construction, operation and decommissioning phases of the project based on environmental, social and ecological variables. Each of the impacts identified has been further discussed and corresponding mitigation measures have been proposed.

Table 7-3: Activity- Impact Interaction Matrix – Pre-Construction, Construction, Operation and Maintenance Phase

Sl. No.	Main Activities	PHYSIC0-CHEMICAL ENVIRONMENT											BIOLOGICAL ENVIRONMENT				SOCIO-ECONOMIC ENVIRONMENT							
		Land Environment	Air Quality	Noise Quality	Soil Quality	Drainage	Water Resource	C & D Waste	MSW	Hazardous Waste	OHS	Energy Conservation	Habitat	ESZ	Flora & Fauna	Ecosystem Services	Agriculture	Grazing land	Loss of land and livelihood source	Common Property Usage Conflict	Local Economic Opportunity	Cultural and Behavioural Conflict	Traffic	Community Health and Safety
Preconstruction Activities																								
i.	Survey Work																				P			
ii.	Land Acquisition																√		√					
iii.	Design & Approval																				P			
Construction Activities																								
i.	Site Clearance	√	√		√				√							√			√					
ii.	Cutting of trees	√	√		√	√										√			√					
iii.	Construction of Access Road	√	√		√	√															P			
iv.	Site Leveling & Grading	√	√		√																P			
v.	Sourcing and transportation of construction material etc.		√		√						√										P		√	√
vi.	Storage and handling of construction material etc.		√		√						√													√
vii.	Transportation of mech. & elec. equipment		√	√																	P		√	
viii.	Establishment of Site Office and labour accommodation		√		√		√		√	√											P	√		√
ix.	Employment of Workers																				P			
x.	Waste handling and Disposal				√			√	√	√														√
xi.	Sewage Generation				√		√																	√
xii.	Civil Works: Runway, Taxiway, Apron, etc.		√	√	√			√			√										P			
xiii.	Construction of Terminal Building		√	√	√			√			√										P			
xiv.	Electrical works & Other Equipment and services		√	√	√			√			√										P			
xv.	Admin & Control Building		√	√	√			√			√	√									P			
xvi.	Roads & Drains Construction		√	√	√	√		√			√										P		√	
Operation Phase																								
i.	Operation of Aircraft		√	√																				
ii.	Fuel Storage		√		√																			
iii.	Heat & Power Supply		√		√							√												
iv.	Aircraft Maintenance				√																			
v.	Firefighting Services						√																	
vi.	Generation of Wastewater				√		√																	
vii.	Handling of Hazardous Chemicals				√					√														
viii.	Solid & Hazardous waste Disposal				√					√	√													
Decommissioning Phase after Construction																								
i.	Dismantling of campsites and construction equipment		√		√			√		√											√			

7.3 Environmental Impacts

7.3.1 Impacts during the Pre-construction and Construction Phase

During the construction phase, the following activities may have impacts on environment:

- Site Preparation
- Construction of access roads
- Site Levelling and Grading
- Mobilization and employment of workforce;
- Establishment of site office and labour accommodation facilities
- Sourcing and transportation of construction material, etc.
- Storage and handling of construction materials
- Operation of equipment and heavy machineries
- Civil Works: Runway, Taxiway, Apron, etc.
- Construction of Terminal Building
- Electrical works & Other Equipment and services

Based on activity – impact interaction matrix for construction phase of the proposed project, following impacts have been identified:

- Landuse, Topography, Soil Erosion, soil contamination of the project area;
- Ambient Air Quality
- Impact on noise level
- Water Resources & Quality;
- Waste Generation, Storage and Disposal
- Traffic and Transport
- Biological environment
- Impact on Community, Culture and Heritage
- Occupational Health and Safety
- Livelihood (Agricultural Activities in the Surroundings)

Landuse, Topography, Soil Erosion, soil contamination

Anticipated Impacts

Major impact of land acquisition is permanent change of land use, which is unavoidable. There will be irreversible change of existing land use due to construction of the project. The Project has acquired 2203.26 acres of land for development of airport including 1453.71 acres of private land, 505.42 acres of assigned land and 244.13 acres of Govt. land. The entire land acquired for the Project is mix of agricultural land, vacant open land, fallow land and built-up area. The project land is acquired from total 1462 landowners. Total 405 families are displaced due to the acquisition of land. Land for the proposed project is acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014.

Land procurement has impacts on local population by way of physical displacement, loss of agriculture land, loss of open land for grazing, etc. These impacts can be mitigated to a large extent by providing adequate rehabilitation facilities for the displaced people as well as compensation against the loss of livelihoods .

Land procurement also led to loss of flora and fauna by way of clearing of vegetation on the acquired land. Moreover, during construction phase, impact on land is also anticipated due to various activities such as site levelling, filling and site preparation activities. Some impact on natural drainage system is also anticipated due to permanent change in topography.

It has been estimated that around 10.5 million cum. of soil needs to be excavated which will be recycled for backfilling in the project.

Soil Contamination

Fuels, lubricant, paints, etc., would be used during construction work. Thus, the contamination of soil can happen only due to accidental spillage of fuel, lubricants and paints from storage areas and during transfer of fuels and chemicals. Any impacts from the above-mentioned activities will deteriorate the baseline condition.

Mitigation Measures

- People require physical displacement should be properly rehabilitated.
- People losing livelihoods should be adequately compensated.
- Site preparation and development shall be planned only after a detailed drainage plan has been prepared for site.
- If channels/drains get blocked, it will be ensured that they are cleaned regularly especially during monsoon season.
- Accidental spills of contaminants on soil should be managed using standard engineering practices.
- Fuel & lubricant, chemical, hazardous waste etc. should be stored in impervious storage area.
- Disposal of waste should be carried out as per the various waste management rules under the Environmental Protection Act.
- Re-vegetation to be done in the area after the completion of construction, in order to reduce the risk of soil erosion.

Significance of Impact

Most of these project activities are expected to be restricted within the project activity boundaries. The spread of impact can be considered local, duration of impact is short with a moderate intensity, hence, the overall impact significance can be considered as **Moderate**.

Table 7-4: Impact Significance – Landuse, Topography, Soil Erosion, soil contamination

Aspect	Scenario	Spread	Duration	Intensity	Overall
Landuse, Topography, Soil Erosion, soil contamination	Without Mitigation	Local	Long term	High	Major
	With Mitigation	Local	Long Term	Medium	Moderate

Ambient Air Quality

Anticipated Impacts

In construction phase, various project activities such as site preparation, tree cutting, foundation excavation work, sourcing and transportation of construction materials, storage and handling of raw materials, construction work for various civil structures, construction of access roads, establishment of labour camp, etc. will generate emission of fugitive dust caused by construction material handling, on-site excavation and movement of earth materials. Some of the prominent sources of air pollution during construction phase may be listed as follows:

- Excavation, backfilling, movement of vehicles, storage and handling of construction materials especially fine dust particles increases dust level and particulate matter (PM) concentration in ambient air.
- Emissions from Aggregate Processing Plant and Batching Plant
- Vehicle exhausts from construction machinery and from light and heavy vehicles for transportation increases PM, SO2 and NOx.
- Use of diesel generators and other fuel fired machinery releases PM, SO_2, NOx and CO
- Blasting of quarry materials

Fugitive Emissions from material handling and vehicular movement

Dust will also be generated from activities such as excavation, drilling, blasting, loading and unloading operations, and transportation of materials. Dust is also anticipated from stoke pile, overburden dumps, storage area, etc. during windy conditions.

The fugitive dust generated during the construction activities may cause immediate effect on the construction workers who are directly exposed to the fugitive dust and to the community in the vicinity. Although it is very difficult to completely eliminate such impact, it is possible to reduce its intensity by implementing mitigation measures.

Pollution due to fuel combustion in DG set and various construction equipment

The operation of various construction equipment requires combustion of fuel. Normally, diesel is used in such equipment. The major pollutant which gets emitted as a result of combustion of diesel is SO_2, NOx and particulate matter. Depending upon the fuel quality and quantity and rating of DG sets and other equipment, it is important to provide adequate stack height for emission to be dispersed in the atmosphere to have minimum increase in Ground Level Concentrations (GLCs).

Emissions from Aggregate Processing Plant (APP) and Batching and Mixing (BM) Plant

The operation of the APP and BM plants during the construction phase generates dust and fugitive emissions, which can impact plant area and surrounding area as well, depending on wind direction. Such fugitive emissions will mainly comprise of particulate matter of various aerodynamic sizes. Preventive and protective measures are required to be implemented by contractors at site to control such emissions and further reduce their impacts on workers and locals.

If not managed properly, there is a risk of deteriorating ambient air quality due to increased loads of particulate matter in the ambient air. Poor ambient air quality causes health impacts for the construction workers onsite and to a lesser extent to nearby community members.

However, based on past experience, significant adverse impacts on this account are not anticipated. However, during finalising the project layout, it should be ensured that the labour camps, colonies, etc. are located on the leeward side and outside the impact zone (about 1.5 to 2 km) of the APP and BM plant.

Mitigation Measures

- The APP and BM should be provided with air pollution control devices as per the rules laid down by pollution control board, so as to minimize the release of particulate matter into the atmosphere.
- The chimneys of the Diesel Generator Sets should be kept at appreciable height (as per the CPCB guidelines). The DG sets should be properly maintained and with valid certificates of Type Approval and also valid certificates of Conformity of Production.
- Regular water sprays at the construction sites, dumping sites as well as on roads should be ensured. Necessary clause shall be incorporated in the contractor's agreement.
- It shall be ensured that all stockpiles are covered, and storage areas provided with enclosures to minimize dust from open area source. Stock piling and storage of construction material shall be oriented after considering the predominant wind direction.
- Loading and unloading of raw materials should be carried out in the most optimum way to avoid fugitives.
- Vehicles engaged for the Project will be required to obtain "Pollution under Control" (PUC) certificates.
- Sufficient stack height needs to be provided to D.G. sets (if used) as per the CPCB norms.
- Raw material should be covered with tarpaulin sheet during transportation and in storage area.
- Speed of vehicles on the access road and on the internal site roads shall be limited to 20-30 km/hr in order to reduce fugitive dust emissions.
- Cease or phase down work if excess fugitive dust is observed, or there are any community grievances related to dust. Investigate the source of dust and ensure proper dust suppression.

Significance of Impact

Most of these project activities are expected to be restricted within the project activity boundaries. The spread of impact can be considered local, duration of impact is short with a moderate intensity, hence, the overall impact significance can be considered as **Moderate**.

Table 7-5: Impact Significance – Ambient Air Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ambient Air Quality	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

Ambient Noise Quality and Ground Vibrations

The proposed construction activities are expected to increase the noise levels mainly due to plying of construction vehicles, pumping machines, use of portable generators, mechanical machinery such as cranes, riveting machines, hammering etc. The noise pollution thus created may affect human habitations, particularly during the night time. Increase of noise level at night may produce disturbances, causing sleeplessness in people in the vicinity of the site in case construction activity is extended into the night hours. Facilities that are expected to feel the temporary impacts more than others include manmade sensitive receptor like, school, college, and religious places. However, these impacts are of temporary nature, lasting only during the construction period.

The potential impact on noise quality may arise out of the following:

- Noise due to operation of construction machineries and equipment
- Drilling and blasting for quarry materials;
- Road construction;
- Vehicular movement.

Noise due to Construction Equipment

Operation of APP and BM plant, DG sets, cranes, & all heavy machinery generates noise. The noise levels due to operation of the different construction equipment are given in **Table 7-6**.

Table 7-6: Typical Noise levels of various Equipment

Equipment	Noise Levels, dB
Compressors	75-85
DG Sets	72-82
Concrete Placers	70-80
Batching Plant	75-85
Crushers	68-70
Concrete Pumps	68-70
Tippers	60-65
Excavator	70-80
Mixers	65-75
Shovel	75-85
Loader	70-80

Noise due to increased vehicular movement

During construction phase, there will be significant increase in vehicular movement for transportation of construction material. At present, there is no significant vehicular movement in the area. During construction phase, the increase in vehicular movement is expected to be at least 5-6 trucks/hour during peak construction period. The

impact on noise level due to increased vehicular movement cannot be quantified as it will depend upon various factors such as vehicle condition, vehicle speed, road condition, idling time, traffic condition, etc.

Noise Generated due to Blasting operations during quarrying

Noise generated by blasting is instantaneous in nature. Noise generated due to blasting is site specific and depends on type, quantity of explosives, dimension of drill hole, degree of compaction of explosives in the hole and rock. Noise levels generated due to blasting at various sites recorded in other projects are given in **Table 7-7**.

Table 7-7: **Noise levels generated due to blasting operations**

No. of holes	Total charge (kg)	Maximum charge/delay (kg)	Distance (m)	Noise level dB(A)
15	1500	100	250	76-85
17	1700	100	250	76-86
18	1800	100	250	74-85
19	1900	100	400	70-75
20	2000	100	100	76-80

It can be observed from **Table 7-7** that noise level due to blasting operations are expected to be of the order of 75-85 dB(A) at a distance of about 250m; which will be reduced to 35-45 dB(A) in another 100m. External attenuation factor will reduce it further. As the blasting is likely to last for 4 to 5 seconds depending on the charge, noise levels over this time would be instantaneous and short in duration. Considering attenuation due to various sources, even the instantaneous increase in noise level is not expected to be significant especially during day time. The noise produced by blasting would be for extremely short duration of a second, though with a high intensity. The impacts over the surrounding habitat can be minimised by adopting adequate precautions during blasting and also by properly scheduling it as indicated in the environmental action plan. Creation of noise bunds near the periphery is expected to act as an effective barrier against its propagation of sound waves towards the human settlements, particularly when such activities are close to human settlements. Hence, noise level due to blasting is not expected to cause any significant adverse impact.

(A) Impact on Communities

Nearest receptor to the project site is village Reddy Kancheru which is about 0.15 km from the proposed residential facilities. Other significant noise receptors are Dibbalapalem school and M.P.P. School, Devudumetta which are about 0.43 km from the runway boundary and Avanthi's research and technological academy, Basavapalem which is about 0.61 km from the runway. The proposed project site is located in a rural set up. Ambient noise levels were observed to be within the CPCB/IFC standards.

High noise levels are limited to construction period only. Considering the noise impact to be of localized distribution and moderate intensity, overall impact has been assessed as **Moderate** significance.

(B) Impact on Workers at Project Site

Workers in close proximity to machines are prone to exposure of high levels of noise of machinery. However, considering the temporary nature and short-term duration of project activities minor significant impact is anticipated. Following mitigation measures are suggested:

Mitigation Measures

- Diesel Generator sets should have acoustic enclosures to reduce the noise as per the CPCB guidelines.
- Ear protection aids such as ear plugs, earmuffs, must be provided to the workers who have to continuously work in the high noise area.
- Proper and regular maintenance/lubrication of machines should be done.
- Quieter machines and vehicles with high quality silencers should be used.
- Afforestation around the residential colonies and office complexes should be done as proposed under the Green Belt Development Plan.
- Mobile noise sources such as cranes, earth moving equipment shall be routed in such a way that there is minimum noise disturbance to receptors.

- All the construction machinery and equipment used should be provided with adequate noise mufflers and noise suppression equipment. Proper lubrication and maintenance of the machinery & equipment and vehicle to be carried out to minimize the noise generation due to abrasion.
- Honking should be prohibited at the site.
- Adequate traffic management practices should be followed to avoid any traffic congestions due to the project vehicles. It is also to be ensured that use of local roads is during daytime only and outside busiest hours when the roads are not frequently used by local communities.
- Periodic monitoring of noise level should be conducted and compared with the baseline levels of ambient noise.
- OSHAS and world bank guidelines should be followed for maintaining noise exposure levels of the construction workers as per occupation standards, workers" exposure to 90 dB(A) noise level should not be more than 8 hours. OSHAS guidelines should be followed for exposure to specific noise levels for workers.
- In case of complaints of uncomforting noise received from the inhabitants of nearby settlements possibility of putting noise barriers near to the receptor or alteration of working hours should be considered.

Significance of Impact

The impact due to noise and vibration will have high intensity with a local spread for a short duration which is anticipated to result in an overall **Major** impact without mitigation. However, with proper implementation of suggested mitigation the impact will be reduced to **Moderate**.

Table 7-8: Impact Significance – Ambient Noise Quality

Aspect		Scenario	Spread	Duration	Intensity	Overall
Ambient Quality	Noise	Without Mitigation	Local	Long	Moderate	Major
		With Mitigation	Local	Long	Low	Moderate

Water Resources and Quality

Anticipated Impacts

In the construction phase, water is required for civil works of the foundations and building structures of all facilities, as well as for domestic purpose by the workers engaged during construction phase.

Water requirement during construction activities has been estimated to be approximately 1663 KLD for civil construction work; whereas domestic water requirement for the construction workers will be of 320 KLD for 5500 peak construction labours. As reported, domestic water requirements were met through water supply obtained from Vizianagaram municipal corporation. The project has already obtained water supply permission from Vizianagaram municipal corporation.

Contamination of surface water bodies during the construction phase is possible in the following cases:

- Oil spill from construction equipment and vehicles maintenance;
- In case of contaminated water discharge during the earth works;
- In case of discharging of vehicles or equipment wash down water;
- In case of improper management of construction waste;
- In case of improper management of sewage and storm waters, etc.

Sewage from Labour Camps

During construction phase, wastewater, sewage etc. shall be generated from the labour camps. If disposed untreated, this would substantially deteriorate the surface and ground water quality in the area. The project construction will last for a period of 2.5 years. About 5500 workforces are likely to be employed during the peak construction phase. The domestic water requirement during the construction phase has been estimated to be 320 KLD. With 80% of water demand to be generated as wastewater, it has estimated that the sewage generation will be 280 KLD during construction phase . The sewage if discharged untreated, may lead to water pollution, resulting in increase in coliforms and other pathogens, which can ultimately lead to incidence of water borne diseases. In order to avoid any deterioration in water quality due to disposal of untreated wastewater from labour camps, sewage

will be treated in the proposed septic tank with soak pit facility/portable STP and only treated wastewater complying with “General Discharge Standards” will be discharged.

Effluent from Construction Plants and Workshops

As discussed earlier, construction plants viz. aggregate processing and concrete mixing and workshops will be established. The civil and hydro-mechanical work at site will lead to stockpiling and excavation activity on site, thereby exposing the base soil to erosion. The runoff from this site may contain high quantity of suspended solids which shall add to the inorganic load of water bodies and drainages in the area. However, the impact of runoff may not be very significant except during rainy season. Similarly, from workshops, major pollutant will be oil and grease only.

The Bay of Bengal is about 1.5 km from the project site; no adverse impact on water quality is envisaged as no untreated discharge into surface water will be allowed during construction phase.

Mitigation Measures

- Washing and bathing areas should be provided with proper drainage system so that wastewater is not accumulated in the project site.
- Using a secondary container during transfer of oils, grease etc.
- During Construction phase provision of septic tank with soak pit/portable STP of adequate capacity for labour camp should be ensured.
- Construction of settling tank to settle the suspended impurities from various sources i.e. APP/BM plant, construction sites, etc. before discharging into the main stream.
- The drainage system at site to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff.
- Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc.
- Any discharge from the project site should comply with CPCB/APPCB and IFC discharge standards.
- Use RMC for pile concreting as well as other building construction work to minimize water consumption.
- Explore alternative methods of civil construction work to minimise water consumption.

Significance of Impact

Considering the extent of impact to be of local and of short duration, overall impact significance is considered as **Minor**.

Table 7-9: Impact Significance – Water resource and Water Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resource and Quality	Without Mitigation	Medium	Short	Moderate	Moderate
	With Mitigation	Medium	Short	Low	Minor

Solid and Hazardous Waste Management

Anticipated Impacts

The following types of wastes are expected due to construction of the project:

- Domestic solid waste from labour accommodations;
- Used oil from generator and other construction machinery;
- Packaging waste such as gunny bags, plastics, etc.
- Metal scrap, etc.;
- Hazardous waste (generated from construction machinery and equipment)

Improper disposal of solid waste from the labour camps at site and lack of proper sanitation facility for labour can lead to unhygienic conditions in the area. It can also lead to discontent of local community and result in conflicts with the labour engaged at site.

Improper disposal of packaging materials, boxes, plastics, ropes etc. can lead to littering in the construction site and surrounding areas. Hazardous wastes such as used oil from DG sets, lubricants, hydraulic oil etc. can cause contamination of soil and water resources if adequate precautions for storage, management and handling are not undertaken.

MSW from Construction work camps/colonies

The construction of the proposed airport Project will involve different categories of manpower like labour, technical, other officials and service providers. The total construction work force to be employed during peak construction period has been estimated as 5500. The estimated quantity of MSW generation from the project will be as follows:

Table 7-10: Details on Solid Waste Generation

Particulars	Population	Expected per capita generation, Kg/day	Total Waste Generation, kg/day
Migrant workers in Labour Camp	3000	0.250	750
Local workers employed by the project	2500	0.150	375
Total Estimated Solid Waste Generation			1125 kg/day

Improper disposal of solid waste from the labour camps at site and lack of proper sanitation facility for labour can lead to unhygienic conditions due to open defecation and spread of diseases in the area. It can also lead to discontent of local community and result in conflicts with the labour engaged at site.

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management to dispose off, as warranted under the Solid Wastes Management Rules (SWM) 2016. An efficient waste management system will be required to put in place to keep the environment of the region clean and healthy.

Following mitigation measures are suggested:

Mitigation Measures

- The construction contractor shall ensure that the labour camp at the project site have adequate waste disposal facilities. Arrangements for collection of garbage in dustbins and daily disposal to the nearest dumpsite shall be made.
- Solid waste should be collected in a segregated way. 3-bin system should be used so that food waste, recyclables viz. paper, plastic, glass, scrap metal waste etc. and hazardous waste are segregated and stored in designated waste bins/ containers.
- The recyclables should be periodically sold to local recyclers while food waste will be disposed through waste handling agency.
- Waste/used oil generated from generators and construction machinery and equipment should be stored on paved surface in a secure location at the project site. Appropriate secondary containment should be provided for hazardous waste.
- Hazardous waste should not be stored for more than 90 days as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Hazardous waste should be disposed off through authorized vendor only.
- Construction debris and excavated material to be stored in a confined area to prevent spread by wind or water. The construction debris to be recycled within the site as far as possible.

Significance of Impact

The impact due to waste disposal have potential for high intensity with a local spread for a short duration which may result in an overall moderate impact without mitigation. However, with proper implementation of suggested mitigation measures the overall impact is anticipated to be minor.

Table 7-11: Impact Significance – Waste Storage and Disposal

Aspect	Scenario	Spread	Duration	Intensity	Overall
Waste Storage and Disposal	Without Mitigation	Local	Short	High	Moderate
	With Mitigation	Local	Short	Moderate	Minor

Traffic and Transport

The project site is well connected with road and railway. The national highway 16 (NH 16) is only about 1.5 km whereas Vizianagaram Railway station is at 17 km from the site.

During the construction period additional 15-20 trucks and LCVs daily are expected to ply for carrying construction material. Movement of some large trucks are also anticipated for transporting electro mechanical equipment including.

Movement of heavy vehicles along the road has a potential to cause temporary traffic hazards due to increase in slight traffic volume during construction phase.

Mitigation Measures:

- Trucks should not be loaded beyond their load carrying capacity.
- Proper access road should be developed for smooth movement of traffic.
- Provide necessary training to the drivers for speed restrictions and on do's and don'ts.
- Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles.
- When practicable, construction traffic movements (equipment and materials) should be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimize any potential disturbance to local traffic.
- During the development of roads and site preparation all the drainage courses should be properly channelized to maintain the drainage pattern of the area.

Table 7-12: Impact Significance – Impact to Traffic Safety

Aspect	Scenario	Spread	Duration	Intensity	Overall
Traffic Safety	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

Community Health and Safety

During the construction stage of the project, there will be an influx of workmen and labours, with some of them being from different socio-cultural settings as compared to the residential settlement around site. In the case that hygienic conditions are not maintained at the project site, there may be a vector borne and other ailments in the immediate vicinity.

The site clearing activities and construction activities (involving fill materials, brick and concreting work) would result in emissions of dust and noise, discharge of sanitary wastewater and potential littering from labour camps during a short phase and has a potential to contribute to additional nuisance levels for the community and households located immediately adjacent to site. The increase in vehicular movements as a result of plying of construction vehicles on the adjoining roads and the site access road would add to the risk of accidents.

Mitigation measures:

- Development of labour accommodation standards to adhere to EBRD / IFC guidelines.
- Implement onsite vector control measures.
- All contractors should be bound through contractual provisions to observe environmental, health and safety regulations of the Company, including compliance with local security requirements. Violations of these regulations should result in fines and/or cancellation of contracts.
- The proponent to ensure no conflict with community due to different cultural behaviour and sharing of local resources occurs between the labours and residents.

- All construction site, activity area, fuel storage area, workshop area etc should be barricaded and the entry should be restricted to authorized personnel only. ID cards should be issued to all the authorized personnel including the workers, labour, employee, staff, inspectors & visitors.
- GVIAL to ensure provision of safe and convenient passage for vehicles, pedestrians and general public to and from roadsides and property accesses, providing temporary connecting road towards villages.
- Labour should be trained for on social behaviour and community interaction and should be cautioned for not indulging in any unfair means, crime or similar activity at site.
- Load carrying vehicle should move at slow speed only to prevent accidents like toppling over, collisions etc. Speeds should be designated for these vehicle as per the load and vehicle violating the rules shall be penalized.
- Workers should be trained on proper usage of community property resources like roads, plantation areas, etc.
    - Workers should not cut/damage any tree from nearby areas or plantation areas.
    - No killing / hunting of wildlife should be done.
    - Water should be used from source allotted and no other water should be used.
    - No activities like defecting in open, disposal of garbage in non-allocated area, etc. should be done which could lead to land or water pollution.
    - No damage to any community property should be done like roads, medical centre, Scholl, public lights, etc.
    - Usage of public resources like religious structures, public health centres, school, etc. should be done as per usage norms / guidelines of that facility.
- For any clarification, project team should be consulted prior.
- GRM procedures to be developed and made aware to all labours and community. The grievances should be resolved on emergency basses and without any biases.

Table 7-13: Impact Significance – Impact to Community Health and Safety

Aspect	Scenario	Spread	Duration	Intensity	Overall
Community Health and Safety	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

Labour influx

Workers' influx in the vicinity of a community may strain existing infrastructure, in particular the water, sanitation, electricity and transport systems.

The social impact associated with the engagement of local and migrant labour in the proposed project could become potential of conflict between labour and contractor or developer if not managed properly. Also chances of conflict between local and migrant labour can be due to cultural difference, on the use of common resources or work insurgence of viral diseases etc. Considering the project in designing phase and construction phase yet to be started.

The social impact associated with the labour accommodation or setting up labour camp (onsite) is anticipated in the form of conflict between labours and contractors /community, if not managed properly.

With the inflow of migrant workers and their interaction with the local population, health issues among the local community might emerge. Health problems like STD's and HIV Aids might spread in the area because of this floating population. Medical camps can be conducted amongst the labours and the local population to make them aware about diseases like STD's and HIV Aids.

Mitigation measures:

- To the extent possible, locate the labour camp inside the site boundary.
- GVIAL and the construction contractors to ensure to restrict the interaction of migrated labour with local community as to avoid any conflict.

- Development of labour accommodation standards to adhere to EBRD / IFC guidelines:
- Adequate supply of safe potable water;
- Sanitation facilities for contract labourers: Proper functional toilets have been provided in the labour camp. The disposal of wastewater is managed by the septic tanks and soak pits constructed in the camp.
- Proper and adequate drainage system to drain out the wastewater to avoid any kind of contamination or spread of disease thereby;
- Implement onsite vector control measures.
- Security Staff will have instructions to ensure women's safety.
- All contractors will be bound through contractual provisions to observe environmental, health and safety regulations of the Company, including compliance with local security requirements. Violations of these regulations should result in fines and/or cancellation of contracts.
- Undertake health awareness amongst the local community.
- Provide necessary training to the drivers for speed restrictions and on do's and don'ts.
- Identify route for movement of project vehicles which, should not include narrow village road and road passing through cluster of settlements.
- Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles.
- Keep limited speed of project vehicles near settlements and within the project site.
- GRM procedures to be developed and made aware to all labours and community. The grievances should be resolved on emergency basses and without any biases.

Significance of Impact

The impacts have high intensity with a local spread for a short duration which is anticipated to result in an overall moderate impact without mitigation. However, with proper implementation of suggested mitigation, the intensity can be reduced to **minor**.

Table 7-14: Impact Significance – Impact due Labour Influx

Aspect	Scenario	Spread	Duration	Intensity	Overall
Labour Influx	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

Occupational Health and Safety

Anticipated Impacts

Occupational Health and Safety (OHS) of workers is important during construction and operation phases where local and migrant workers are involved. The activities included in the construction phase that have potential impact to OHS of workers are land clearance for establishment of temporary structures, access road, construction of civil structure and installation of mechanical equipment.

The following occupational health and safety risks are frequently present, in particular during the construction phase:

- Working at height
- Lifting operations
- Mobile vehicles and heavy equipment accidents;
- Heat stress when working in humid and high temperatures. Heat-related illness includes conditions such as heat cramps, fainting, convulsion, heat fatigue, rashes, and heat exhaustion as well as the more severe condition known as heat stroke.

- Additionally, Ultraviolet (UV) radiation burns occurs when the skin is exposed to UV radiation from been out in the sun or from activities such as welding. The symptoms include reddening and inflammation of the skin and blistering and peeling of the skin in severe cases.
- Temporary or permanent hearing loss from noise generated machinery used for excavation or piling work;
- Tripping due to uneven surfaces and obstacles; and
- Electrical shocks.

Mitigation Measures

- Appropriate OHS programme and procedures to be in place to align with the local regulations, as well as IFC PS-2.
- Develop and implement a Health and Safety (H&S) plan to follow throughout the construction phase. This should include management plans for proper water supply, sanitation, drainage, health care and human waste disposal facilities at construction site. In addition to these, efforts need to be made to avoid water spills, adopting disease control measures, awareness programmes etc.
- Labour accommodation should be provided with all the basic facilities like proper bedding, proper sanitation facility (toilets, bathroom & washing area), clean kitchen area, potable drinking water, waste & sewage management facility, LPG fuel for cooking.
- Rest area should be provided for the workers at site and workers should not be allowed to rest or lay down on the floor/machine or any other area at the construction site. Provide a cool rest area in which workers can take their meal breaks and tea breaks;
- It should be ensured that all contractors and sub-contractors follow the OHS programmes and procedures. Provide occupation health and safety orientation training to all employees and workers consisting of basic hazard awareness, site-specific hazards, safe working practices, and emergency procedures.
- The contractors will provide training, awareness and supervision to ensure all of its construction workers comply with the OHS procedures;
- Job-specific PPE should be provided to all workers. Use of appropriate PPEs should be ensured and supervised by the Company HSE team.
- Transportation vehicle should be in good conditions and should comply with all safety conditions. Transportation vehicle should carry the load according to its capacity.
- Person involved for lifting and installation works and those working in heights should be properly trained for the work assigned.
- Safety officers and supervisors should be present all the time at site during construction activities.
- Firefighting facility should be available at the site. Fire extinguishers should be provided at all areas as per suitability defined in IS: 2190. Fire evacuation plan should be explained to all the workers, staff and visitors.
- First aid trained personnel should be available at the site and tie ups with the nearby hospital should be made so as emergency situation can be handled. Ambulance or safety motorized vehicle should be available at the site 24 X 7.
- An emergency response procedure and infrastructure should be available on Site. Emergency contact nos. (HSE head, SHE officers, Traffic managers, First Aid Personnel, Ambulance, Fire Brigade, Hospital) should be displayed at the site.
- Safety guidelines, safety policy, safety slogans should be displayed at the site in English and local language of the area.

Significance of Impact

The health and safety impacts have high intensity with a local spread for a short duration which is anticipated to result in an overall moderate impact without mitigation. However, with proper implementation of suggested mitigation, the intensity can be reduced to **minor**.

Table 7-15: Impact Significance – Impact to Occupational Health and Safety of Workers

Aspect	Scenario	Spread	Duration	Intensity	Overall
Occupational Health and Safety of Workers	Without Mitigation	Local	Short	Moderate	Moderate
	With Mitigation	Local	Short	Low	Minor

7.3.2 Impacts during Operation Phase

Noise

Aircraft is a major source of noise particularly during landing and take-off (LTO) cycles. During take-off, noise is predominantly generated by aircraft engines, while aerodynamic noise generated at flaps, gears, etc. are more prominent than engine noise during landing. Other important sources of noise in an airport includes variety of ground operations equipment including aircraft taxiing; operation of ground support vehicles (e.g. passenger buses, mobile lounges, fuel trucks, aircraft tugs, aircraft and baggage tractors, and dolly carts); aircraft auxiliary power units (APUs); and aircraft engine testing activities in airports with aircraft maintenance activities. Other indirect sources of noise include ground vehicle traffic from access roads leading to the airport.

Noise Modelling

Aircraft noise impact assessment around airports using modelling technique serves multiple purposes. The model can estimate cumulative noise exposure, or they can identify and describe the size of annoyed population in certain areas. Airport noise maps that result from complete airport noise modelling are an essential noise management tool. The noise maps may be used in forming the basis for noise zoning policies and land-use planning decisions. Typically, the final results of these computations are presented as noise contour diagrams. Noise contours illustrate how the specific noise index varies from location to location as the result of a given aircraft traffic pattern at an airport.

For an aircraft noise impact assessment study, the calculations methodology includes the following steps:

a. Determination of the noise levels from individual aircraft movements at observation points around the airport.

b. Addition or combination of the individual noise levels at the respective desired receptors points, according to the formulation of the chosen noise index.

c. Interpolation and plotting of contours of selected index values.

Calculations are repeated at a series of points around the airport and then interpolations are made between those points of equal noise index values (i.e. noise “contours”). The noise levels for individual movements are calculated assuming flat terrain from noise-power-distance with projected Air Traffic Movement (ATM) data (93 as per Design Day Forecast (1st Busy Day) – 2030) of all 13 categories of aircrafts operation for the planned runway orientation (East–West direction designates as 10L-28R; length 3.742 km, width 45 m) located at 85 m elevation from mean sea level. This confirms the necessity to account for certain operational factors when calculating noise levels around airports. Proposed 13 aircrafts taken into consideration for noise impact assessment study is provided in **Table 7-16**.

Table 7-16: Details of Proposed Aircraft

Aircraft Proposed	ICAO* Code
A319, A320, A321, ATR, B737	C
A310, B757, B763	D
A330, A340, A350, B777, B78	E

* *ICAO International Civil Aviation Organization*

In order to predict noise level due to the proposed aircrafts operations, **Integrated Noise Model (INM; 7.0d)** was used. The Integrated Noise Model (INM) is a computer program developed **by Federal Aviation Administration’s (FAA) Office of Environment and Energy (AEE), United States**. In particular, the FAA's Integrated Noise Model (INM) is widely used by the civilian aviation community for evaluating aircraft noise impacts in the vicinity of airports. For such modelling exercise, important input parameters are the atmospheric temperature, pressure and humidity, all of which may influence both the flight performances of the aircraft and the sound propagation and standard temperature (14.40 C), atmospheric pressure (759.97 mm-Hg) and average wind speed (14.8 km/hr) was assumed. In addition, aircraft specific data and airport operational information are required to compute the noise of each individual operation. Further, the assessment of the impacts of noise on the surrounding community also depends

upon (i) Characteristics of noise source (instantaneous, intermittent, or continuous in nature) (ii) Time of day at which noise occurs and (ii) Location of noise source with respect to noise receptor. Predicted noise level contours maps were generated for one day-evening-night aircrafts movement using the FAA prediction methodology. A 3° approach angle is used for all 13 types of aircrafts and the ground topography is assumed to be flat and soft ground lateral attenuation is assumed for noise impact evaluation. Day-Night Average Sound Levels (DNL) was used to know the sound exposure on people/residents due to aircrafts and for land use planning around airports. Day-Night Average Sound Levels (DNL) is the Energy-Averaged Sound Level (Leq) measured over a period of 24 hours, with a 10 dB penalty applied to night-time (10:00 PM and 6:00 AM) sound levels to account for increased annoyance during the night hours. Noise exposure contours was generated for single noise metric DNL in dB(A) at the interval of 5 dB (A) in the noise contour level range from 45-85 dB (A). The noise contours generated for both sides of approach/departure operation modes (West to East and East to West) are presented in **Figure 7-1** and **Figure 7-2**.

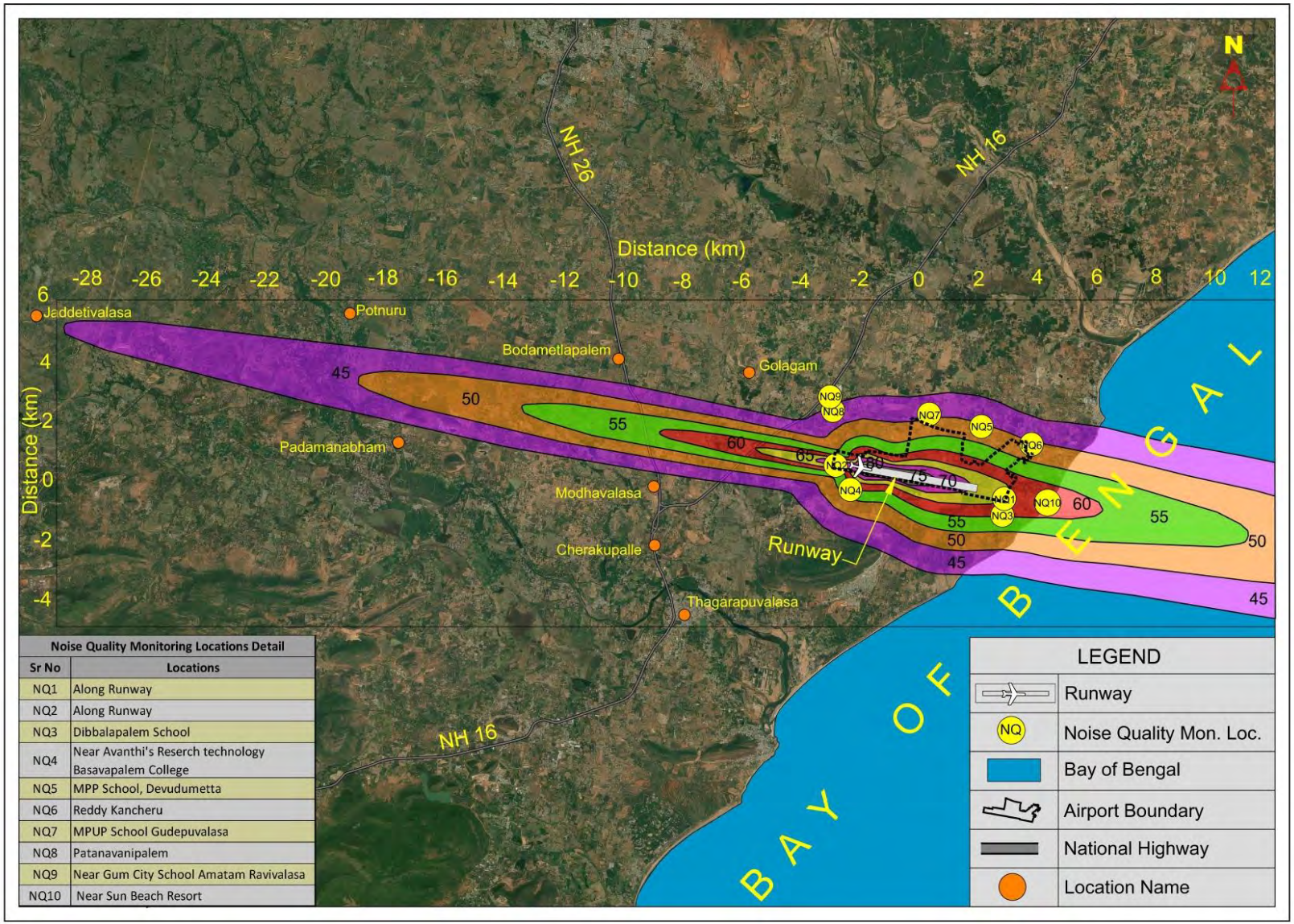


Figure 7-1: Predicted Noise Level Contours: Approach (West)-Departure (East): Flight Scenario-I

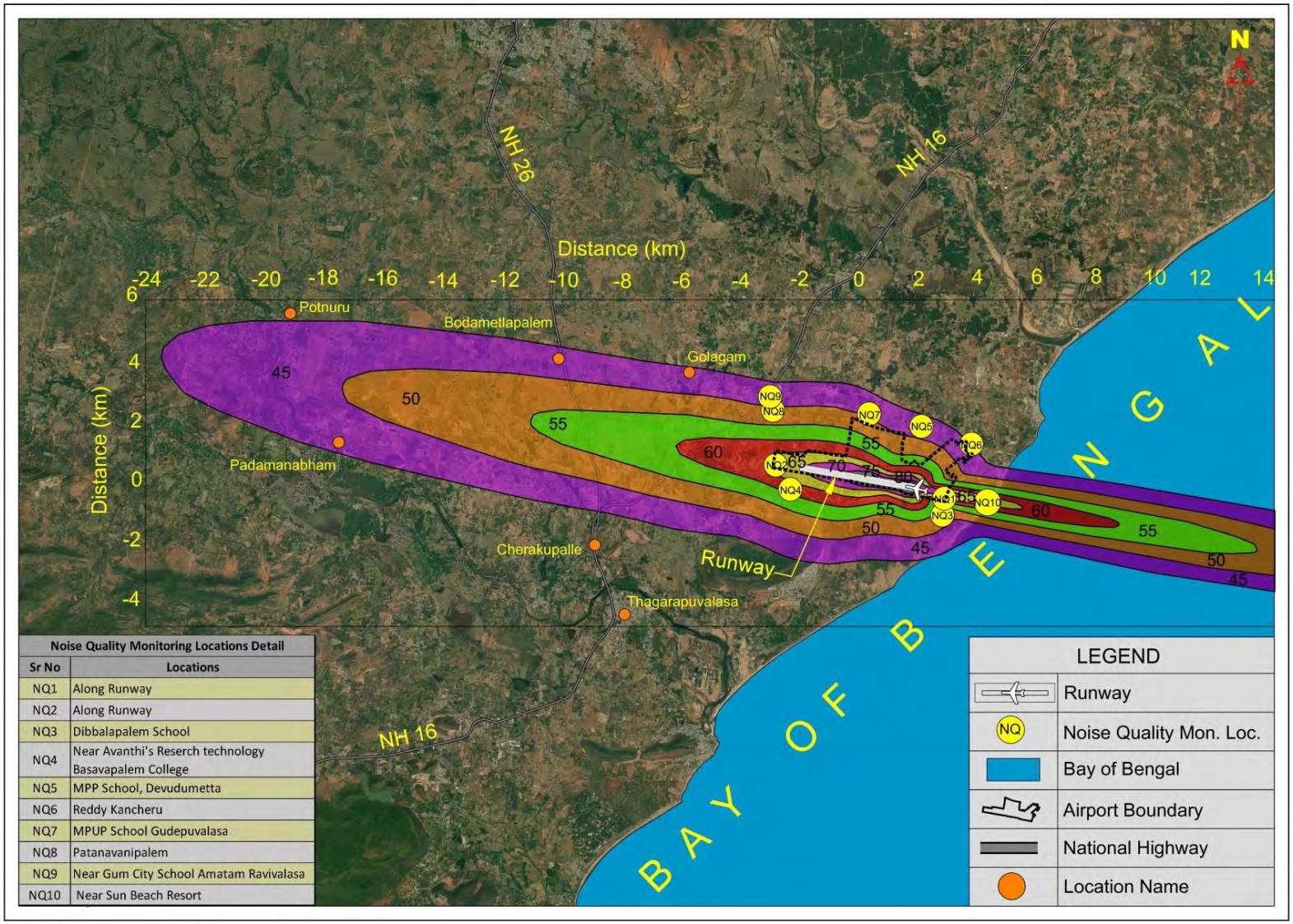


Figure 7-2: Predicted Noise Level Contours: Approach (East)- Departure (West): Flight Scenario-II

Table 7-17: Predicted (2030) and Background (2023) Day-Night Average Noise Level (DNL) At Discrete Receptors

Receptors	Receptor Name/Landuse	Distance from Runway Centre (m)	Predicted Noise Level (dBA) Scenario-I (WE)	Predicted Noise Level (dBA) Scenario-II (EW)	Background Noise Level (dBA)	Resultant Noise Level (dBA) Scenario-I (WE)	Resultant Noise Level (dBA) Scenario-II (EW)
NQ1	Along Runway	2965	65.6	64.8	46.3	65.7	64.9
NQ2	Along Runway	2821	71.7	66.5	43.2	71.7	66.5
NQ3	Dibbalapalem School (Sensitive)	3084	60.3	52.3	46.3	60.5	53.3
NQ4	Basavapalen College (Sensitive)	2330	58.3	61.7	44.1	58.5	61.8
NQ5	MPP School, Devudumetta (Sensitive)	2735	50.8	47.3	46.5	52.2	49.9
NQ6	Reddy Kancheru (Residential)	3964	50.6	44.7	44.4	51.5	47.6
NQ7	MPUP School Gudepuvalasa (Sensitive)	2182	48.9	49.0	44.4	50.2	50.3
NQ8	Patanavanipalem (Sensitive)	3671	46.0	51.1	46.3	49.2	52.3
NQ9	Near Gum City School, Amatam Ravivalasa (Sensitive)	4044	43.5	48.0	47.5	49.0	50.8
NQ10	Near Sun Beach Resort (Residential)	4418	62.6	67.4	46.1	62.7	67.4

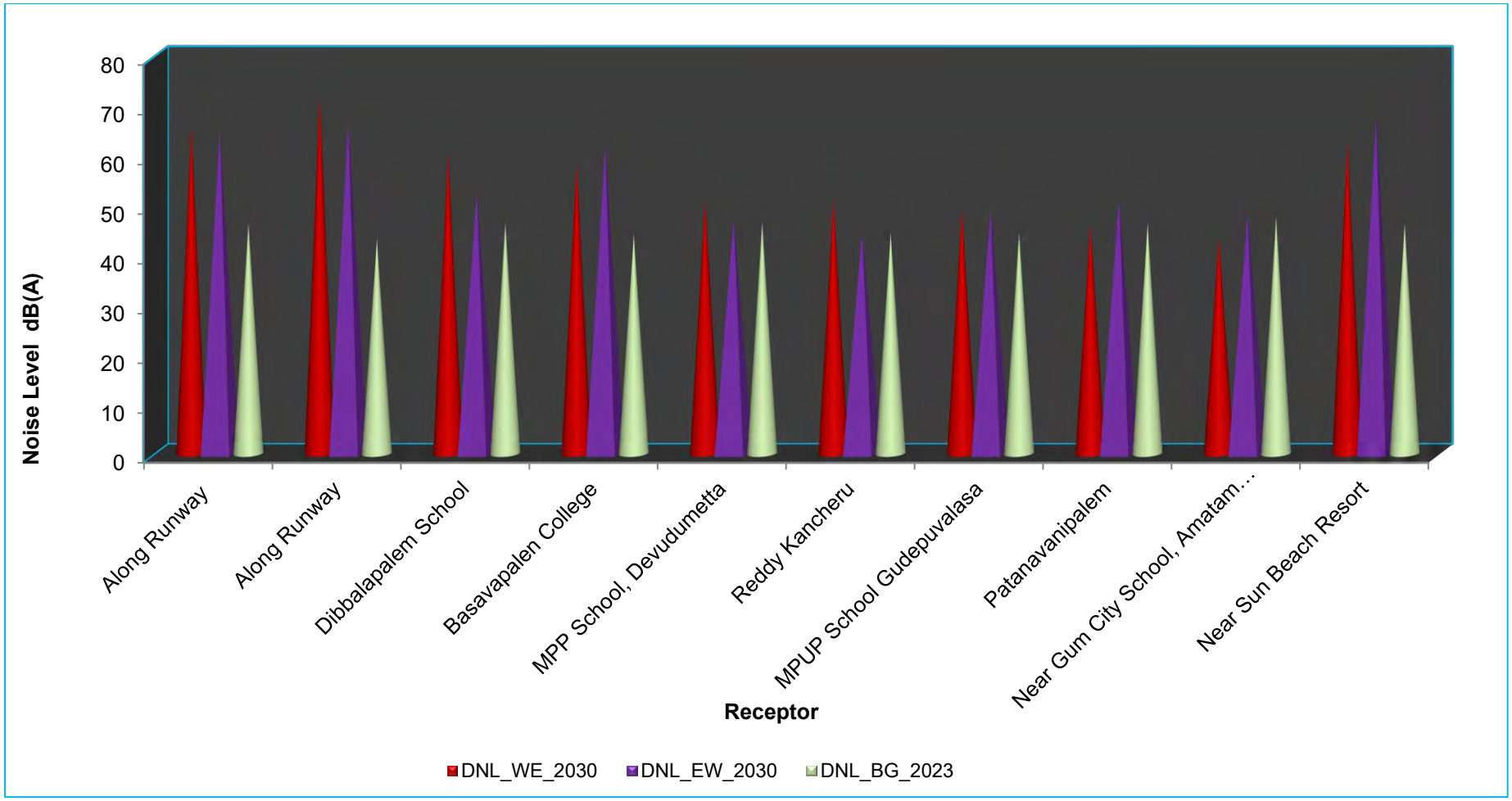


Figure 7-3: Predicted (2030) and Background (2023) Day-Night Average Noise Level (DNL) At Discrete Receptors

Looking down upon a map of the airport, the highest sound levels occur immediately next to the runway and along the aircraft take-off and descent ground tracks. Moving away from these highest levels, decreased noise is found. Such noise maps can be very useful for assessing noise exposure within several kilometers of airports. The predicted noise levels meet the daytime Ambient Noise Quality Standard (ANQS) 55 dB (A) at a distance about 1 km and for the night-time 45 dB(A) about 2 km distance from either side of the runway as shown in noise contours maps.

Predicted Day-Night average noise level metric (DNL) due to homogeneous aircraft flight operations of frequencies 65, 23 and 8 in day, evening and night respectively is presented in the **Table 7-17** and graphically shown in **Figure 7-3.** Noise modelling result shows that DNL at all ten receptor locations (NQ1-NQ10) is expected to fall in the rage of 44.7-71.7 dB(A). Minimum noise level is expected at 3.9 km and maximum at 2.8 km from the centre of runway. Predicted noise level at the receptor locations is subject to aircraft flight operation directivity.

Mitigation Measures

Mitigation measures that will be followed include the following:

- Planning of site for airport location, and orientation of routes for arriving and departing aircraft relative to actual and projected residential development and other noise sensitive receptors in the surrounding area.
- In areas where significant impacts are anticipated, implementation of preferred procedures and routes for landing and take-off (LTO) to minimize potential noise from approaching and departing aircraft for noise-sensitive areas to be considered.
- If necessary, working with local authorities to identify and implement noise prevention and control strategies in noise abatement zones (e.g. sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities;
- GVIAL is required to prepare Noise Management Plan for compliance of the Airport Noise Standards as per CPCB's requirement[51] under GSR 568 (E) dated 18 June 2018.
- GVIAL is required to undertake Airport Noise Mapping as per the requirements specified in the DGCA's requirements considering future aircraft movement and traffic projections of the airport as per the Master Plan of the Airport. Noise mapping shall be displayed at a prominent place of the Airport as well as in the company's website.
- Reducing noise of ground operations at the source through maintenance of vehicles and aircraft;
- Provision of power supply to the aircraft to reduce or eliminate the need for use of APUs.

Significance of Impact

The impact on ambient noise quality will have a local spread, low intensity and is anticipated to result in an overall **minor** impact with mitigation measures in place.

Table 7-18: Impact Significance – Ambient Noise Quality

Aspect		Scenario	Spread	Duration	Intensity	Overall
Ambient Noise Quality	Noise	Without Mitigation	Local	Short	Medium	Moderate
		With Mitigation	Local	Short	Low	Minor

Air Quality

The main sources of airport air emissions include combustion exhaust from aircraft during landing and take-off and ground operation, from ground service vehicles, vapours from fuel storage and handling, and emissions from local ground transportation activities servicing the airport. The main pollutants emitted includes PM, SO_2, NOx, CO and HC.

Mitigation Measures

- Optimizing ground service infrastructure to reduce aircraft and ground vehicle movements on taxiways and idling at the gate;
- Improving ground service vehicle fleets;

[51] https://cpcb.nic.in/uploads/Standerds/Noise-Standards/Airport_Noise_Standards_06.07.2018.pdf

- Minimizing fugitive air emissions from jet kerosene and other fuel storage and handling;
- In fire-fighting drills, selecting cleaner fuels such as liquefied petroleum gas, avoiding the use of waste oil or jet fuel (jet kerosene) where possible;

Significance of Impact

The impact on ambient air quality will have a local spread, low intensity and will last for a short duration primarily limited to construction related activities which is anticipated to result in an overall **minor** impact with mitigation measures in place.

Table 7-19: Impact Significance – Ambient Air Quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ambient Air Quality	Without Mitigation	Local	Short	Medium	Moderate
	With Mitigation	Local	Short	Low	Minor

Water Requirement

During operation phase, the main users of domestic water will include:

- aircraft potable water supply
- catering facilities
- toilets / laundries / cleaning fluids / and other domestic facilities
- aircraft and vehicle washing

During operation phase the water requirement has been estimated to be 1727 KLD whereas potable water requirement will be 821 KLD whereas non-potable water requirement will be 904 KLD. The water demand calculation is presented below.

Table 7-20: Water Demand for the Project

Sl. No.	Purpose	Potable Water Demand, KLD	Non-potable Water Demand, KLD	Sewer Load, KLD
i	PTB	325.5	133.1	361
ii	Ancillary Buildings	236.6	64.5	233.6
	Cooling Tower		500	100
iii	Condensation			170
iv	City side development	259.7	207.7	389.5
	Total	**821.8**	**905.3**	**1254.1**
	Irrigation		**2832.8**	

Note: Water demand for residential development has not been calculated due to unavailability of information at the moment

The source of water in operation phase will be supplied from Vizianagaram Municipal Corporation. The BIA has already received approval from Rural Water Supply and Sanitation (RWS&S), GoAP for the supply of 5 MLD clear water. The waste water generated will be treated in the proposed STP of 1400 KLD capacity based on Moving Bed Biofilm Reactor (MBBR) technology. The treated water will be recycled for HVAC cooling, flushing and/or landscaping and road washing purpose. The proposed water balance diagram is shown in **Figure 7-4.**

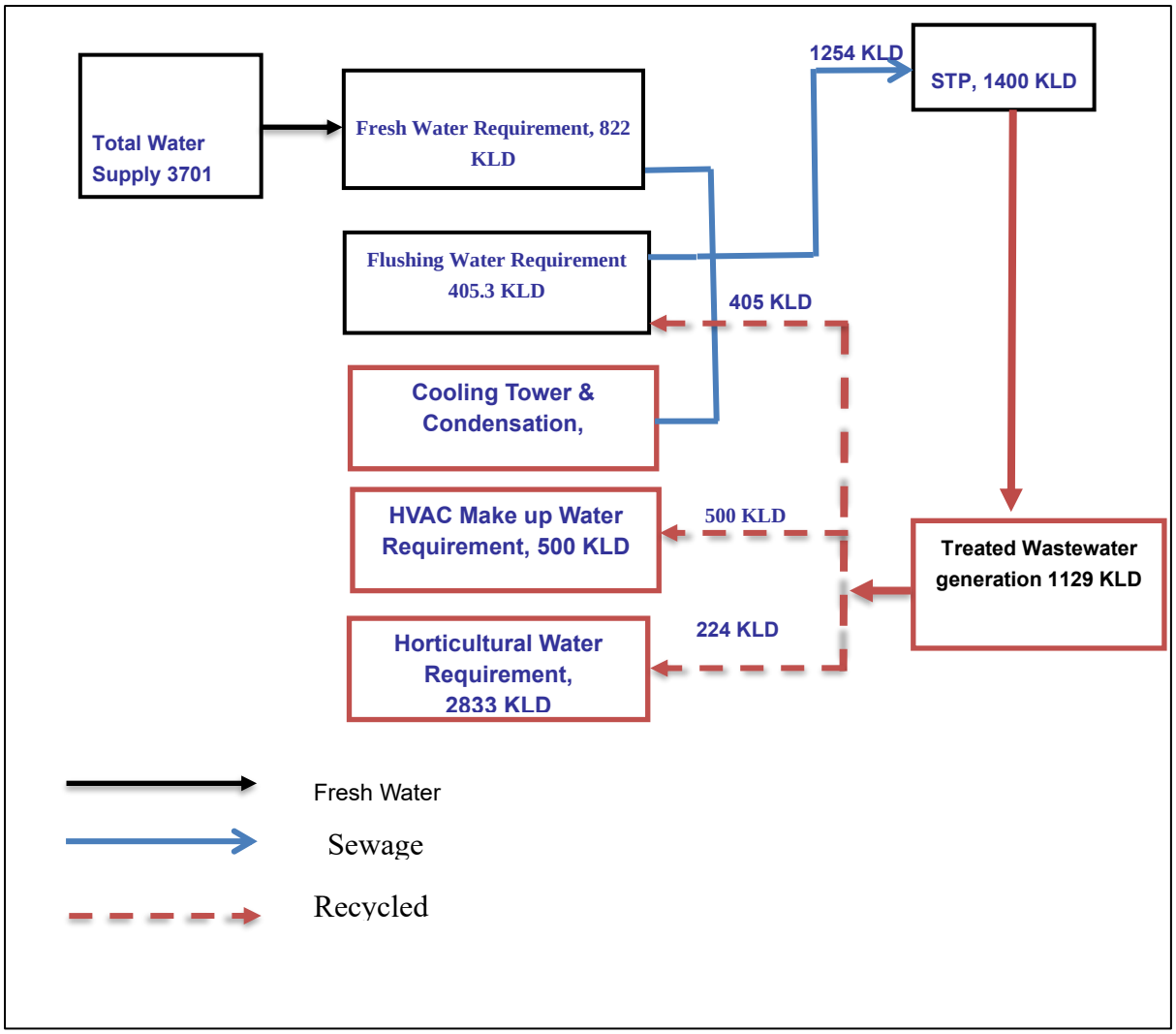


Figure 7-4: Water balance diagram (Non-monsoon Season)

Wastewater Generation and Treatment

Mitigation Measures

- GVIAL to establish water efficient infrastructures to minimize the water demand.
- GVAIL to process waste water (sewage) in the most efficient way possible.
- Treated wastewater shall be recycled for flushing, DG and HVAC colling make up water and landscaping.
- GVIAL to adopt rain water harvesting programs wherever possible to enhance the water availability and sustainability in the region.
- GVIAL to implement/manage water efficient landscaping systems, improved cooling tower water management performance for water conservation.
- GVIAL to implement spill management and land contamination prevention programs to prevent soil and groundwater contamination.

Significance of Impact

The impact on water quality will have a local spread, low intensity and will last for a short duration primarily limited to construction related activities which is anticipated to result in an overall **minor** impact with mitigation measures in place.

Table 7-21: Impact Significance – Water resource and water quality

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resource and Quality	Without Mitigation	Local	Short	Medium	Moderate
	With Mitigation	Local	Short	Low	Minor

Solid Waste

Solid waste generated from airport project includes solid, non-hazardous, waste food from food establishments, packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers from offices and common passenger areas. Airports also receive solid waste from arriving aircraft which may consist of food waste, disposable food containers, and paper / newspaper materials. Airport operations also generate liquid or solid hazardous wastes such as used lubricating oils and solvents from aircraft and ground service vehicle maintenance. Various types of solid waste generated from airport project will include the followings:

Municipal Solid Waste (MSW):

Airport MSW comes from four primary sources as follows:

a. Terminal waste – from public areas and airport administrative offices;

b. Tenant waste – from terminal retail and concessions;

c. Airline waste – from airplanes and airline offices; and

d. Cargo waste – from cargo operations

MSW is made up of everyday items that are used and discarded, such as aluminium and steel cans, glass bottles and containers, plastic bottles and containers, packaging bags, paper products, and cardboard. Waste from airplanes (deplaned waste) is a specific type of MSW that is removed from passenger aircraft. Almost 20% of an airport's total MSW comes from deplaned waste after flights. Deplaned waste includes compactor boxes, waste carts (bags), food carts, and bonded carts.

During operation phase the solid waste has been estimated to be 19.4 MT/day. The solid waste generation calculation is presented below.

Table 7-22: Solid waste generation from the Project

Sl. No.	Purpose	Quantity (MT)
i	Commercial Waste	4.2
ii	Horticulture Waste	14.2
	Street Waste	1.0
	Total	**19.4**

International Waste:

This is generally waste from international flights, but also can include the waste from the terminals that international flights service. When waste originates from countries with different policies and regulations, there is a risk of introduction of plant pests, diseases, and other contaminants. Although international waste is often similar in material type to MSW, but special attention to be paid for international waste. Airports generally handle and process international waste separately from other waste types.

Hazardous Waste

Hazardous nature wastes generated at airport premises are engine oil, hydraulic oil, transformer oil, lube oil and gear oil. These types of waste products are generated from activities such as aircraft and ground vehicle washing and cleaning, fuelling operations, aircraft maintenance and repair including painting and metalwork, engine test cell operations, ground vehicle maintenance, and abandoned aircraft.

Mitigation Measures

Mitigation measures that will be followed include the following:

Municipal Solid Waste Management:

- The domestic solid waste will be segregated into three categories, viz. bio-degradable, non-biodegradable and domestic hazardous.
- Segregation of solid waste will primarily be at source. Waste bins will be placed at all strategic locations. To segregate the waste at source 3 bins collection system will be adopted: Green bins for Biodegradable wastes and Blue bins for non-biodegradable wastes and Black for Domestic Hazardous Waste.
- For Biodegradable wastes, Organic Waste Converters will be installed at the site; manure which will come out of the convertor will be used in the landscaping.
- Recyclable waste will be sent to authorized recycles.

Hazardous Waste Management:

- Hazardous wastes will be stored in a safe place with provision of secondary containments to prevent accidental release into the environment.
- The authorization under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 shall be obtained from Andhra Pradesh Pollution Control Boards.
- Spill kits will be used during maintenance work to avoid oil spills.
- The hazardous and other wastes generated at the airport will be sent or sold to an authorized recycler or to authorized disposal facility.
- Persons working in the site will be provided appropriate training, equipment and the information necessary to ensure their safety and safe and environmentally sound management of hazardous and other wastes.

E- Waste Management:

- E Waste generated at the airport will be stored safe with proper containment and register.
- E waste generated will be handed over only to producer take back system or to authorized dismantler/recycler who is part of producers take back/channelization system.
- The used lamps will not be disposed with municipal waste. Used lamps will be sent to take back system/ collection and channelization system of producer or to a collection center of an authorized recycler who is part of producer channelization system.
- Disposal bins (suitable for the purpose) at site for depositing the end-of-life intact fluorescent and other mercury containing lamp will be provided.

Plastic Waste Management:

- Steps will be taken to minimize generation of plastic waste and segregate plastic waste at source in accordance with the Plastic Waste Management (Second Amendment) Rules, 2022.
- No litter of plastic waste will be allowed. Segregated plastic waste will be handed over to registered recyclers or waste collection agencies;
- Singe Use Plastics notified by government time to time will be complied at the site.
- Segregated plastic wastes from the Municipal Solid Waste will be channelized to authorized recycling units.
- Use of plastic at the airport will be in compliance to its thickness (>120 microns) and as per activity requirements.
- Waste Bins will be provided at the required places for the collection plastic waste.
- Plastic waste will be stored safe and environment friendly manner.

Bio-Medical Waste Management:

- All necessary steps will be taken to ensure that bio-medical waste is handled without any adverse effect to human health and the environment and in accordance with rules.

- Provision will be made for a safe, ventilated and secured location for storage of segregated biomedical waste in colored bags or containers in the manner as specified in the rules.
- Record of bio-medical waste management will be maintained in a separate register.
- Workers and others involved in handling of biomedical waste will be provided appropriate and adequate personal protective equipment.
- Authorization under the rules will be obtained for the generation and storage.
- Biomedical waste generated shall be only given authorized biomedical waste agencies for transport, treatment or disposal.

Battery Waste Management:

- All Batteries shall be store in safe and environment friendly manner. Use Batteries and Waste Batteries will be kept separately.
- The Waste Batteries will be discarded separately from other waste streams especially from mixed waste, domestic waste streams.
- Waste Batteries will be disposed off in an environment friendly manner by giving it to an entity engaged in collection or refurbishment or recycling.

Table 7-23: Impact Significance – Solid waste management

Aspect	Scenario	Spread	Duration	Intensity	Overall
Solid waste management	Without Mitigation	Local	Short	Medium	Moderate
	With Mitigation	Local	Short	Low	Minor

Energy Conservation

Airports are significant resource users in terms of energy consumption during the operational and construction phases. The main use of energy in airports include:

- Aircraft and vehicles,
- Construction activities
- Heating, ventilation and air conditioning systems
- Lighting, both externally, (runway, airfield and roads) and internally (terminals, offices and other buildings)
- Passenger and baggage handling facilities

Mitigation Measures

Mitigation measures that will be followed include the following:

- BIA shall adopt resource efficiency measures including technology and operational improvements to reduce fuel consumption and improve electrical consumption efficiency.
- Minimize the energy demand of their infrastructure and operations and move towards less polluting modes of energy and fuel use, including generating and using energy from renewable sources.
- GVIAL shall explore ISO 50001 systems for Energy Management for effective monitoring and conservation of energy.

Hazardous Materials Management

Airport operations include the storage and handling of fuels (e.g. jet fuel, diesel, and gasoline) primarily associated with aircraft fuelling activities as well as with ground support vehicles. Standard operating procedure shall be developed for hazardous material management.

Occupational Health and Safety of Workers

Occupational health and safety issues associated with airport operation primarily include the following:

- Noise: Airport ground service personnel may be potentially exposed to extremely high levels of noise from taxiing aircraft, the operation of aircraft auxiliary power units (APUs), and ground service vehicles. As most

of these noise sources cannot be prevented, control measures should include the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure.

- Physical hazards: The most significant occupational hazards may include strains due to carrying of heavy loads, repetitive motions from luggage and cargo handling activities / aircraft service operations; collisions with moving ground service vehicles or cargo, or taxiing aircraft; and exposure to weather elements. Workers may also be exposed to jet engine hazards.
- Chemical hazards: Ground service providers may be exposed to chemical hazards, especially if their work entails direct contact with fuels or other chemicals. Work with fuels may present a risk of exposure to volatile organic compounds via inhalation or skin contact during normal use or in the case of spills. It may also present a less frequent risk of fire and explosions.

Mitigation Measures

Mitigation measures that will be followed include the following:

- Regular electrical safety training to workers with safety procedures and other safety requirements that pertain to their respective job assignments;
- Implement Lock out/ Tag Out (LOTO) system;
- Use work equipment or other methods to prevent a fall from occurring. Collective protection systems, such as edge protection or guardrails, should be implemented when working at height.
- Use of personal hearing protection by exposed personnel to noise and implementation of work rotation programs to reduce cumulative exposure;
- Operators should provide safety signs and pavement markings for ground support vehicle circulation and parking areas in ramps, taxiways, and any other areas with a risk of collision between ground vehicles and aircraft.
- Delineated safety areas should include high risk locations such as jet engine suction areas to protect aircraft service workers; ·
- Operators should train and certify all workers with access to airfield operations;
- Workers involved in the operation of aircraft support equipment should be familiar with safety procedures applicable to ramp and taxiway traffic, including communications with the air control tower; ·
- Safety features of ground support vehicles should be maintained, including back-up alarms, moving part guards, and emergency stop switches;
- All workers involved in luggage and cargo handling, whether as a regular or incidental aspect of their work function, should be trained in the use of proper lifting, bending, and turning techniques to avoid back injury or extremities.
- Operators should evaluate the need to implement individual luggage weight restrictions in coordination with airlines, limiting the weight for individual luggage packages to 32 kilograms (70 pounds).
- The frequency and duration of worker assignments to heavy lifting activities should be mitigated through rotations and rest periods; ·
- Operators should consider mechanizing cargo and luggage handling activities, such as the use of conveyors that extend into the cargo holds.
- The transformer yard should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire; and
- An accident reporting and monitoring record shall be maintained.
- It shall be ensured for appointment of Site-specific health and Safety officer;
- Formation of Health and Safety committee for developing and implementing plans and procedure.
- Manuals regrading Operations and maintenance procedures will be developed and maintained to ensure optimum environmental management of the activity will be produced.

Significance of Impact

The impact on occupational health and safety will have medium intensity with a local spread for a long duration (project duration) which will result in an overall moderate impact without mitigation. However, with proper health and safety measures the intensity of impact can be reduced to low resulting in an overall minor impact.

Table 7-24: Impact Significance – Occupational Health and Safety of Workers

Aspect	Scenario	Spread	Duration	Intensity	Overall
Occupational Health and Safety of Workers	Without Mitigation	Local	Long	Medium	Moderate
	With Mitigation	Local	Long	Low	Minor

7.4 Ecological Impacts and Mitigation Measures

The main direct ecological impacts anticipated from the Project consists of loss or degradation of modified and natural habitats at the Project Site, disturbance to wildlife due to noise and light pollution along with the loss of provisioning services, mainly in the form of fodder resources for the local livestock. The significance of these anticipated impacts is deemed to be **Moderate**, owing to the presence of comparable alternative natural habitats and provisioning services in the vicinity of the Project Site.

As per the applicable reference frameworks, significant conversion or degradation of natural habitat is acceptable only if the following conditions are applicable:

- No alternatives are available;
- The overall benefits from the project are expected to substantially outweigh its environmental costs; and
- The conversion or degradation is appropriately mitigated.

As per the IFC Performance standard 6 applicable reference frameworks, for projects in those areas of natural habitat, the corresponding mitigation measures must aim to achieve at least no net loss of biodiversity. The mitigation measures may involve a combination of actions, such as post-project restoration of habitats, offset of losses through the creation or conservation of ecologically comparable areas that are managed for biodiversity, while respecting the ongoing use of such biodiversity by Indigenous Peoples or traditional communities, or compensation to direct users of biodiversity.

As per the IFC Performance standard 6 applicable reference frameworks, projects in those areas of modified habitat that include significant biodiversity value, as determined by the risks and impacts identification process, should minimize impacts on such biodiversity and implement mitigation measures as appropriate.

Owing to the anticipated impacts of the Project being of overall **Moderate** significance, the benefits of the Project arguably outweigh its environmental costs. The inevitable conversion or degradation of the natural habitats at the Project Site is sought to be appropriately mitigated to minimize impacts on biodiversity and implement mitigation measures as appropriate, as well as, to off-set any foreseeable loss of provisioning ecosystem services accruing to the local community.

The following sections present the ecological impacts anticipated directly from the Project in a phase-wise manner, along with corresponding mitigation measures based on international industrial good practices.

7.4.1 Impacts During the Pre-Construction and Construction Phase

Removal of natural vegetation (Loss of Habitat): The removal of vegetation to clear the Project Site for construction will cause loss of modified and near-natural habitat. The habitat loss at the Project Site will directly cause loss of habitat for fauna and loss of provisioning ecosystem services, mainly wild foods and fodder. The removal of natural vegetation would also indirectly cause exposure of soil to desiccation by wind and sunlight, loss of soil anchorage and increased vulnerability of soil to erosion by wind and water, leading to changes in the soil regime and the corresponding loss or degradation of the related ecosystem services.

The Project Site is mainly composed of modified habitat and there is limited presence of natural habitat and near-natural habitat. Therefore, loss of habitat is of relatively moderate significance owing to the limited presence within the site and presence of alternative comparable habitat around the Project Site.

Levelling or grading of land: The current topography of the Project Site is undulating with secondary grassland vegetation found on the now disused arable land. Levelling or grading of land could lead to alteration of the natural topography, and consequently, the natural drainage and habitat distribution. Excavation and landfilling involved in

levelling and grading can also alter the natural soil-profile, change soil properties and disrupt sub-soil habitats. This could affect the natural rainwater percolation into sub-surface layers, thereby impacting the natural groundwater recharge process and degrading the related ecosystem services. It can also potentially change the existing natural drainage system.

The loss of the natural and near-natural habitat of the Project Site is of relatively moderate significance owing to presence of alternative comparable habitat around the Project Site.

Laying of roads and paving of surfaces: The laying of roads or paving of surfaces within the Project Site will hinder or obstruct the percolation of rainwater into the ground. This will cause reduction of groundwater recharge and increase in surface run-off, leading to loss or degradation of soil and sub-soil habitats, as well as the related regulating and supporting services.

This impact is of relatively minor significance owing to already modified nature of the habitat and availability of a large extent of comparable alternative habitats and ecosystem services around the Project Site.

Movement of vehicles and heavy machinery: Movement of vehicles and operation of construction machinery would expose the natural environment to vehicular emissions and unnatural levels of dust, noise, light and vibrations. This would generally lead to pollution of natural resources and possible contamination of food webs. It would cause compaction of soil substrates, leading to injury or death of soil organisms and earth dwelling fauna. It would also reduce percolation of rainwater into sub-soil layers and increase surface run-off, impacting the natural groundwater recharge process and destroying or degrading the related ecosystem services.

This impact is of moderate significance owing to the already modified nature of the habitat. However, the presence of natural and near-natural habitats in the Study Area would be impacted.

Artificial Illumination: Use of artificial lighting to illuminate the Project Site and during night-time will lead to unnatural illumination in the area during the natural dark part of the day. Use of vehicles during night may also lead to artificial illumination. Interruption of the natural night period by light is known to disrupt the natural biological cycles of many floristic and faunal species. No impact of light on marine biodiversity is anticipated during the construction phase owing to large distance (approximately 1.5 km) from the high tide line).

Noise pollution due to use of vehicles and equipment

During construction phase noise is generated from use of heavy machinery and high noise producing operation. Noise pollution has been shown to modify behaviour and physiology of invertebrates and it is suspected to increase infection risks and alter spawning behaviour (Newport, Jenny et al., 2014). Evidence of the adverse impact of noise pollution on ecosystems like the reduction of the presence of songbirds in cities. Animals also use sound for a variety of reasons, including to navigate, find food, attract mates, and to avoid predators. Noise pollution makes it difficult for them to accomplish these tasks, which affects their ability survive. No impact of noise on marine biodiversity is anticipated during the construction phase owing to large distance (approximately 1.5 km) from the high tide line.

Mitigation Measures

- Offset the loss of any natural vegetation removed from the Project Site by planting the similar species in higher numbers in or adjacent to the Project Site.
- Opt for diverse but strictly native species for green area development for the project. Species typical to the natural forest-types of the Study Area, as reported in the baseline data, may be used in plantations. Alternatively, advice may be sought from the local forest department office, which can also provide saplings of local native species for plantation.
- Conserve the natural topography of the Project Site by integrating the natural topographical features into the project construction plans, to the extent possible.
- Minimise the number and the width of all internal roads developed for movement of heavy vehicles.
- Ensure that vehicles and machinery used in the construction activities comply with the prescribed emission standards.
- Restrict movement of construction-related vehicles, especially heavy vehicles or machinery, strictly to pre-designated routes.

- Restrict construction activities requiring high levels of illumination to daylight hours to the extent possible, to prevent disruption of the natural night period by artificial lighting. Ensure that any unavoidable night-time illumination is restricted within the Project Site, directed towards the Project Site, uses low-intensity artificial lighting and is equipped with downward facing shades to minimize dispersion of the light into adjacent habitats.
- Plant relatively tall-growing native vegetation at a suitable distance along the boundary of the Project Site (wherever feasible) to visually screen it from wildlife habitats and human habitations in the surrounding area. This also helps counter the noise and light pollution by acting as green barriers to the noise and light being transmitted out the site.
- Install noise reduction blankets or temporary acoustic barriers around the construction area to contain a reduce noise being generated from the site. Provision of Noise Barrier (in accordance with National Building Code 2005): all around the construction activity area on the site periphery, about 2.5 meter high barrier GI sheet (temporary) shall restrict the noise impact by about 10 dB(A).
- Ensure that all electrical components are adequately insulated to prevent electrocution of fauna through accidental contact with project-installations.
- Minimize artificial illumination during night periods.
- Prepare and implementation a management plan to counter human-animal conflict with respect to venomous snakes.
- Regularly monitor and remove any carcasses from the site, thereby avoiding attracting scavenging raptors, into the project area
- Develop a long-term programme designed to monitor bird and bat activity to reduce bird activity at the project-site. Maintain a log-book to record any faunal mortality observed in the project area.
- Restore the soil and natural vegetation of any construction-phase roads which are not necessary for carrying out operation or maintenance activities, and hence, are not required in the operation and maintenance phase.
- Prohibit the use of herbicides in the facility and opt for manual weeding to control or regulate plant growth in the project site area.
- Institute effective training modules and operational systems to ensure prevention of spillage of toxic substances. Install effective containment systems to prevent any accidental spillage from leaching into the local environment.

Table 7-25 Impact Significance – Ecological Impacts during construction Phase

Aspect	Scenario	Spread	Duration	Intensity	Nature	Significance
Degradation of Habitats	Without Mitigation	Local	Long	Moderate	Adverse	Moderate
	With Mitigation	Local	Medium	Low	Adverse	Minor
Fragmentation of Habitats	Without Mitigation	Medium	Long	Moderate	Adverse	Moderate
	With Mitigation	Local	Long	Low	Adverse	Minor
Loss of Ecosystem Services	Without Mitigation	Medium	Long	Moderate	Adverse	Moderate
	With Mitigation	Medium	Medium	Low	Adverse	Minor

7.4.2 Impacts During the Operation Phase

Physical Hindrance by On-ground Installations: The physical presence of the airport structure and related facilities/installations would hinder faunal movement within and through the area, affecting their current access to habitats and resources. Aerially moving fauna, such as insects, birds and bats, may accidentally encounter aircrafts, electrical components or other high-rise structures of the project installations, leading to injury or death. The regular activity of humans in the airport also deters raptors, thus changing the bird community structure in the nearby areas. Altered land use profile would also affect the existing soil-moisture conditions. Measure to reduce bird activity in the airport and proximity will alter the faunal profile of the region. These effects would collectively degrade or alter the existing floristic profile of the affected area, thus impacting its existing primary production and the associated ecosystem services. This would prevent faunal access to habitats and habitats features such as roosts, feeding grounds, nest sites, tools and nesting materials beyond the solar project.

This impact is of **moderate** significance owing to the Project Site being mainly composed of modified habitat and limited presence of natural habitat and near-natural habitat. Additionally, there is presence of alternative comparable habitat around the Project Site. Marine Habitat is not expected to be impacted due to distance (1.5km) of the Project Site from the coast.

Project-related Traffic: The movement of aircrafts, vehicles and personnel to, from and around the Airport would increase the ambient levels of vehicular emissions, dust, noise, vibrations and artificial illumination in and around the project site. This would lead to pollution of the natural environment. Also, disruption of the night-period by illumination is known to disturb natural floristic and faunal biological cycles.

This impact is of moderate significance owing to the Project Site being located in modified habitat and limited presence significant biodiversity values of natural habitat and near-natural habitat**.**

Project Site Illumination: Use of artificial lighting to illuminate the airport and its associated facilities in the night-time will lead to unnatural illumination in the area during the night. Light pollution from airports and roads can attract animals either directly or indirectly (e.g. they attract insect prey which, in turn, attract bats and birds – and their predators). This can affect migration patterns where animals travel off-course because they are attracted to light. Once they arrive at the light source, birds may circle the source, become disoriented and exhausted, and collide with structures or other disoriented birds.

Interruption of the natural night period by light is known to disrupt the natural biological cycles of many floristic and faunal species. Light pollution can also affect animals' rhythms of waking, sleeping and hibernation (**Rich and Longcore, 2006**).

Illumination of sky at night can lead to alteration of sea finding behaviour of marine turtle species especially olive ridley. As the adult turtles and new born hatchlings use the brighter horizon to find seas, any artificial illumination has adverse effects on sea finding behaviour of sea turtles[52]. Artificial illumination near the nesting beaches impacts adult sea turtles by disrupting nest site selection, abandonment of the nesting process and disruption of sea finding ability following unsuccessful nesting. Hatchling sea turtles emerge from the nests at night and are strongly attracted to visible light sources near the beach. Consequently, hatchlings move toward the source of artificial illumination and away from the sea. According to a study done by Wildlife Institute of India, it was also observed that hatchling disorientation declined with increasing distance from the light source, and beyond the 500 m from the location it was relatively negligible (WII, 2014). The nearest Project boundary being located at 1.5km from the coast. Therefore, the airport and its facilities should not result in any major impact due to site illumination. However, the aircrafts that landing and taking off can potentially act as stimulants for disorientation.

This impact is of high significance owing to the Project Site being located in proximity to natural marine habitats, including habitats used by globally threatened, as well as, migratory and/or congregatory species.

Bird/wildlife Aircraft Strike Hazard (BASH): Bird strikes occur when aircraft hit birds during take-off and landing. Roughly 85% of bird strikes involve aircraft below 800 feet, and up to 40% of bird strikes take place beyond the airport perimeter (CAA, 2001). The number of birds strikes at a given airport is a function of:

- The number of birds near the airport: airports in an area of high bird density are likely to have more bird strikes than airports in areas of low bird density.
- The types of birds near the airport: the likelihood of a bird being struck by an aircraft depends in part on the height at which it flies and its flight patterns. For instance, oystercatchers and starlings are much more likely to be hit by an aircraft than pheasants and grey herons (DfT, 2006a).
- The number of aircraft landings and take offs at the airport: the greater number of aircraft movements, the greater the likelihood of a bird strike.[53]

Because birds are a significant hazard to aircraft, control measures are used at many airports to reduce bird strike. These measures can include landscaping (avoid fruit bearing trees), waste management measures, use of noise and flare guns, and use of falcons. The whole purpose of these measures is to disturb birds in order to avoid flying in and around the airport area.

This impact is of high significance as this can permanently alter the ecological profile of the study area due to measures taken to actively keep avifauna away from the geography. These measures will lead to avoidance of use

[52] Impact of artificial illumination on sea-finding behavior of Olive ridley sea turtle at Gahirmatha rookery, Odisha, Wildlife Institute of India, 2014
[53] https://www.aef.org.uk/uploads/PlanningGuide2.pdf

of the habitat by the avian population thereby leading to reduction of bird population in the Project Site and its vicinity.

Road kill occurs when animals get hit by vehicles, for instance on access roads to airports. Increased traffic movement to the area because of establishment of an international airport can lead increased risk of accidental collision death of fauna in the surrounding geography.

The impact is of low significance as road-kill due to being located in modified habitat and limited presence significant biodiversity values of natural habitat and near-natural habitat. Additionally, the airport lies close to an already existing national highway and no major changes in road kill volumes due to the increased traffic have been anticipated. Within the Project premises, the area will be fenced off and influx of higher fauna from the surrounding habitat will be limited.

Impact of Noise

Noise pollution can cause health problems for people and wildlife, both on land and in the sea. Noise affects the breeding and feeding habits of birds and also encourages unnecessary expenditure of energy as the move towards or away from the sound source, thereby exposing them to predators (White Young Green Planning, 2006). Animals such as bats and owls rely on acoustic sounds when hunting for prey, while others use them to evade predators. Noise pollution has been shown to modify behaviour and physiology of invertebrates and it is suspected to increase infection risks and alter spawning behaviour. Major source of noise includes the aircrafts and the traffic going to and from airports. Aircraft noise is generated by both the engine and the airframe and is most evident during landing and take-off and under frequently-used flightpaths. Other sources of noise include noise generated from aircrafts include the application of reverse-thrust (an optional braking aid on landing), engine tests and on-site vehicular traffic. Also, noise emanates from vehicular traffic to and from the airport, and construction noise[44].

Noise can be particularly problematic for marine organisms. It has been shown for instance that it may modify behaviour and physiology of invertebrates and it is suspected to increase infection risks and alter spawning behaviour of affected species. It is suspected, for instance, to increase infection risks and spawning behaviour of affected species. Evidence of the impact of noise pollution on ecosystems is also growing, like the reduction of the presence of songbirds in cities[54].

This impact is of high significance owing to the Project Site being located in proximity to natural marine habitats, including habitats used by globally threatened, as well as, migratory and/or congregatory species.

Mitigation Measures

- Ensure that all electrical components are adequately insulated to prevent electrocution of fauna through accidental contact with project-installations.
- Restrict maintenance-related activities to the daytime. Avoid use of artificial lighting in and around the project site as far as possible. Opt for low-intensity artificial lighting to prevent insects from being attracted to the airport.
- Use modern airport lighting systems by integrating newer technologies, such as dimmers, sensors, and time switches, allowing operators to control the emitted light. Turn off unnecessary lights to reduce airport light pollution when there are no ongoing operations. These can considerably reduce airport light pollution.
- Incorporate daylighting in airport design strategy which incorporates natural light with artificial airport lighting systems.
- To reduce possible impact of light on turtles, lighting periodicity (On - Off duration) at the airport should be controlled. The effective solution is to increase the duration of the “off” period for non-necessary facilities keeping in mind the principle of safety.
- Ensure that operation or maintenance activities, that require illumination, are restricted to daylight hours to prevent disruption of the natural night period by artificial lighting.
- Ensure that any unavoidable night-time illumination is restricted within the Project Site, directed towards the Project Site, uses low-intensity artificial lighting and is equipped with downward facing shades to minimize dispersion of the light into adjacent habitats.

[54] https://www.horizon-europe.gouv.fr/impact-light-and-noise-pollution-biodiversity-33217

- Ensure that vehicles and machinery used in the project site for operation and maintenance activities comply with the prescribed emission standards.
- Restrict movement of vehicles used in the airport strictly to the pre-designated routes.
- Restore the soil and natural vegetation of any construction-phase roads which are not necessary for carrying out operation or maintenance activities, and hence, are not required in the operation and maintenance phase.
- Prohibit the use of herbicides at the facility.
- Institute effective training modules and operational systems to ensure prevention of spillages of toxic substances.
- Install effective containment systems to prevent any accidental spillage from leaching into the local environment.
- Establish a safe airport operation wildlife control and habitat management procedure. Capture and rehabilitated animals within the Project Boundaries in various Wildlife sanctuaries in coordination with the forest department.
- Distribution of aircraft movement which has been done in the form of mixed-mode operation of the runways that provides benefit from noise experienced by a particular region.
- Adopt operational procedures that reduce aircraft noise such as Continuous Climb and Continuous Decent Approach (CDA) methodology.
- Set up noise complaint system at the airport and associated facilities.
- Set up Aircraft Noise Monitoring terminal with automatic aircraft noise monitoring system in all the approach of runways to monitor noise levels around airport and enable to identify noisy aircrafts.
- Plant relatively tall-growing native vegetation at a suitable distance along the boundary of the Project Site (wherever feasible) to visually screen it from wildlife habitats and human habitations in the surrounding area. This also helps counter the noise and light pollution by acting as green barriers to the noise and light being transmitted out the site. Wherever possible, carry out plantation of native species with consultation with the Forest Department, to maintain the ecosystem services provided by fuelwood, fodder and wild food species.
- Install noise reduction blankets or temporary acoustic barriers around the sensitive area especially during the breeding season of olive ridley to contain a reduce noise being generated from the site.
- Reduce night flights during the breeding season of Olive Ridley Turtles to the extent possible.
- Installation of bird-deflectors and bird spikes on transmission cables and pylons to reduce collision and electrocution risk to aerially moving fauna (as per CEA guidelines)
- Any incidents or bird hits should be reported, and location-specific mitigation measures should be employed.

Table 7-26 Impact Significance – Ecological Impacts during operation and maintenance phase

Aspect	Scenario	Extent	Duration	Intensity	Type	Significance
Degradation of Habitats	Without Mitigation	Medium	Long	High	Adverse	Major
	With Mitigation	Local	Medium	Moderate	Adverse	Moderate
Fragmentation of Habitats	Without Mitigation	Medium	Long	High	Adverse	Moderate
	With Mitigation	Local	Long	Moderate	Adverse	Minor
Loss of Ecosystem Services	Without Mitigation	Medium	Long	Moderate	Adverse	Minor
	With Mitigation	Medium	Medium	Low	Adverse	Insignificant

7.5 Socio- Economic Impacts and Mitigation Measures

7.5.1 Impacts During the Pre-construction and Construction Phase

Impact on Landowners

A total of 2203.26 acres of land was acquired for the Project which consists of 1453.71 acres is private land, 505.42 acres of assigned land and 244.13 acres government land. The private land is acquired from 1465 landowners from 7 villages. Of the 1465 land owners, 1354 have received full and final amount compensation amount. There are 111 landowners who have not received compensation as the matter is under litigations for 39.86 acres area due to issue of title ownership dispute. The amount of compensation is deposited in the designated account by the State Government.

Physical Displacement

About 405 families were displaced due to the acquisition of land from 4 villages namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat.

The displaced families were resettled in two resettlement colonies in Gudepuvalasa and Polipalli villages. The R&R colony spreads over approximately 17 acres and 23 acres respectively. Each PDFs were given 5 cents (240 square yards) of land and INR 9.70 lakh R&R assistance. All community and social amenities like roads and drains, electricity, drinking water facilities, schools and parks, cooperative stores, etc. have been provided in both the R&R colonies.

Impact on Livelihood

The review of data and consultation with impacted people shows that most of the project affected persons are small and marginal farmers and mostly involved in the agriculture, animal husbandry and daily wage labourers. Some of the affected persons are employed in private jobs in nearby town and few have their own business (petty shops). The main crops grown on the agricultural land was coconut, cashew, mangoes, groundnuts etc. During consultations with the PDFs, it was observed that the substantial numbers were engaged in daily wage labourers in agriculture and construction works.

Consultations with the project affected persons, AECOM observed that there are few PAPs who lost entire land and they became landless. However, exact data on landless PAPs are not available for the review.

Mitigation Measures Identified

As landlessness is likely to be envisaged, but the quantum is not assessed due to unavailability of data, the Project may require preparing a supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and take corrective action as necessary. The Project is required to implement LRP to assess the loss of livelihood for the lost land among the impacted families and restoration plan for implementation.

Significance of Impact

The impact on landowners has been identified as **Major** due to physical displacement and impact on livelihood. However, with the implementation of mitigation measures impact can be termed **Moderate** one.

Table 7-27: Impact Significance – Impact on landowners

Aspect	Scenario	Spread	Duration	Intensity	Overall
Impacts on landowners	Without Mitigation	Local	Long	High	Major
	With Mitigation	Local	Short	Medium	Moderate

Impact on Vulnerable Communities

The vulnerable communities such as women headed households (WHH), Elderly people (above 65 years) living alone, and landlessness people were identified who were impacted due to the Project. There are 65 scheduled castes families from Rellipeta hamlet were relocated in the Gudepuvalasa R&R colony. No people from scheduled tribe were impacted due to the Project.

Mitigation Measures

Provision may be made for skill-based training interventions, especially for self-employment to the women, young and unemployed families from the vulnerable families whose land was acquired for the Project. In order to minimise the loss of land on the overall livelihood of the family of the landless persons, efforts should be made to persuade

them to utilise their compensation amount received from GoAP for purchase of land (preferably cultivable land) within close vicinity of the project.

GVIAL through their CSR programme may organise counselling session for judicious use of the compensation received to buy irrigated agriculture land for long term sustenance and better livelihood.

Significance of Impact

The impact on vulnerable community has been identified as **Minor** one.

Table 7-28: Impact Significance – Impact on Vulnerable Communities

Aspect	Scenario	Extent	Duration	Intensity	Significance
Impacts on vulnerable communities	Without Mitigation	Local	Short	Medium	Moderate
	With Mitigation	Local	Short	Low	Minor

Impact on animal grazing

At the time of site visit, the Project site has the presence of grass and shrubs due to the monsoon season. Construction of boundary wall at the Project site was in process. Some grazing activities (sheep and goat) were observed at the acquired land during the site visit. Consultation held with the nomadic shepherd at the site informed that they are from Kongavanipalem village which is about 8 km away. These shepherds are from Yadav community and their primary occupation is rearing of cattle. During consultation, it was observed that grazing is not a big concern as lot of open fields are available for grazing for the livestock in the area.

Mitigation Measures Identified

As a part of its CSR programme, the GVIAL may collaborate with the nearby gram panchayat for livestock development program.

Aspect	Scenario	Extent	Duration	Intensity	Significance
Impact on domesticated animals	Without Mitigation	Local	Short term	Low	Minor
	With Mitigation	Local	Short term	Low	Insignificant

Impact on immovable assets at site

During site visit, all the PDFs have voluntarily vacated the houses and relocated to the R&R colony after construction of houses. All the houses in the Project site were dismantled and no family are residing in the project area. No structures or community property resources observed at the time of site visit.

Mitigation Measures Identified

GVIAL may provide opportunities to local people pertain to wage employment for the construction work, security guards, housekeeping staff and vehicle hiring etc.

Table 7-29: Impact Significance

Aspect	Scenario	Extent	Duration	Intensity	Significance
Impact on Immovable assets at the site	Without Mitigation	Local	Medium	Medium	Major
	With Mitigation	Local	Short	Low	Moderate

Impact due to impeded access roads

The Project is accessible through the Vishakhapatnam- Srikakulam Highway Road which further connects to the Kancheru village road (approximately 3-5 km village road). The width of the village road was observed to be varying throughout its length between 4 and 5 meters. These roads were observed to be used by the villages on a regular basis, and the project could cause impedance in movability of the villagers. GVIAL to ensure that the access roads being used by them us is well maintained for villagers.

Mitigation Measures Identified

GVIAL to provide safe and convenient passage for vehicles, pedestrians, and public to and from roadsides and property accesses, providing temporary connecting road towards villages. GVIAL will also ensure that the existing accesses will not be undertaken without providing adequate provisions.

Table 7-30: Impact Significance – Impact due to impeded access roads

Aspect	Scenario	Extent	Duration	Intensity	Type	Significance
Impact due to impeded access roads	Without Mitigation	Local	Long	High	Adverse	Moderate
	With Mitigation	Local	Long	Low	Adverse	Minor

7.5.2 Impacts During the Operation Phase

Impacts on Local Economy

During the construction and operational phase of the Project, the impact on the local economy is likely to be positive and lead to increase in local employment opportunities, increased demand for materials and services through local contracting.

Employment Opportunities

The Project shall provide employment opportunities to approximately 2500 workers during construction phase through direct and through contractors. The estimated (tentative) work force through EPC contractor will be 5500 labours at peak work time The skilled and unskilled workers are intended to be recruited from the nearby areas. Equal opportunity shall be given to competent workers taking account of site working conditions and requirements. For the operation phase, it is expected that direct employment opportunities at the airport will be about 1000 employees on regular and contract basis.

Effort to be made by the Project or Concessionaire to ensure that the unskilled the manpower during the construction and operation phase is sourced from the local area. It was informed by the site representative that the construction manpower sourced from outside the local area will be accommodated in the labour camp at the project site.

Labour Rights and Welfare

The GVIAL to ensure that contractor comply with the local labour regulations (with respect to minimum wages, social security, gender parity, prevention of illegal labour practices such as child labour, forced labour, bonded labour etc.) and IFC PS 2 on labour and working conditions while managing onsite labour during the Project lifecycle.

The workers, local and migrants, should be made aware of their rights and benefits due to them so that no issues regarding their employment emerge. Toilet facilities, drinking water etc. should be provided to all the workers on site as well. Grievance Redressal Mechanism (GRM) for workers should be developed and communicated to the workers so that the workers can approach the management if any concerns or issues are faced by them without any fear of retribution or intimidation.

Mitigation Measures Identified

The Project through the contract agreement shall ensure that contractors are committed and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws etc. The Project shall ensure that no child or forced labour is engaged by contractors and all wage payments are done without any discriminations or delays by the contractors. Similarly, adequate sanitation and waste disposal facility shall be ensured at the site. While engaging contractors and sub-contractors during the operation phase agreements shall be made with local contractors and vendors. The labour accommodation provided to migrant labour in rental accommodation should comply with the provisions of PS 2 of IFC's Policy on Environment and Social Sustainability relating to worker accommodation.

7.6 Climate Change Risk Assessment

Beyond natural climate variability, widespread adverse impacts, losses, and damages have been occurring to nature as well as people due to human-induced climate change, such as more intense and frequent extreme events[55]. As per Intergovernmental Panel on Climate Change, Sixth Assessment Report, 2022 (IPCC AR6 latest report)[56], the most vulnerable systems and people are observed to be disproportionately affected across sectors and regions due to climate change. Impacts and risks generated due to climate change through hazards can surpass limits to adaptation resulting in losses and damages as per IPCC AR6 report. As the Earth's global average temperature rises, natural disasters such as increased extreme heat days, more frequent and intense extreme

[55] https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_HeadlineStatements.pdf
[56] https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/

weather events, extended periods of drought and floods, and rising sea levels are becoming increasingly common[57]. In addition, policy, market, and legal shifts are causing disruption to the products, services and systems that are fundamentally relied upon by infrastructure assets, as nations around the world transition to a low-carbon economy.

Numerous challenges such as likelihood flooding of airfield due to sea level rise, storm surge, cyclone, extreme heavy precipitation, and navigation and terminals disturbance due to high wind and high temperature caused by climate change have been faced by airports. The increasing intensity and frequency of these extreme weather events have been damaging aviation system including airport operations and infrastructure with safety, economic (business continuity) and social activities.

As per IPCC, aviation is responsible for 2-3% of global carbon emissions but the industry has started taking actions to reach Net Zero Carbon Goal by 2050[58]. The Assembly of International Civil Aviation Organisation (ICAO) has adopted a goal of net-zero emissions for international aviation by 2050 which aligned international aviation with the Paris Agreement[59]. Airports Council International (ACI) members adopted a resolution on airport infrastructure and operation's resiliency and adaptation to climate change impacts by conducting risk assessment and to develop mitigation measures[60].

Compiling every potential impact of extreme weather events along with carbon emission on every airport business and operational aspect would enable better response to all the likely risks that could be faced by airport. The climate change resiliency and adaptation work should include safety, security, environmental, legal, business, and financial effects on airport operations. A resilient airport not only would protect operational assets and infrastructure from climate change impacts but also enable airports towards a sustainable airport to continue thriving in future. Vulnerabilities of long-term and short-term projected climate changes on ongoing services must be identified as an airport is an essential service provider.

The total projected annual emissions from this project during the operational phase of the project may trigger the need for a Climate Change Risk Assessment (CCRA) in line with the requirement of Equator Principles and the Task Force on Climate Related Financial Disclosures (EP4/TCFD)[61].

7.6.1 Approach

Following desk-based research to obtain future climate change projections data from SSP2-4.5 and SSP5-8.5 (SSP: Shared Socio-economic Pathways) for the Project location, a staged approach was used to identify the potential physical climate-related risks for the Project.

The scope of the physical risk assessment covers the potential physical climate-related risks associated with operation of the Project including those on the local community, businesses and customers impacted beneficially or adversely by the Project. Due to high electrical energy demand in airport facilities, buildings, and other systems; and as per TCFD requirements, it also covers the transition risks and opportunities for the Project, and its supply chain in relation to the low-carbon economy based on RCP2.6 and RCP4.5 scenarios (RCP: Representative Concentration Pathway).

The report has been prepared in accordance with the EP4 requirements and project's compatibility with India's national climate commitments and considering the following:

- The current and anticipated climate change risks (transition and physical) as defined by TCFD
- Plans and processes are proposed to manage these risks, i.e., to mitigate or control, and
- Project's compatibility with India's climate commitments.

RCPs are the emission scenario ranges or trajectories over time developed by the IPCC that present possible physical states of the future climate where GHG concentration is dependent on the level of mitigation action undertaken between now and then. Four RCPs (2.6, 4.5, 6.0 and 8.5) reflect different concentration of global GHG emissions reached by 2100. Out of these RCPs, RCP2.6, RCP4.5 and R P8.5 have been used. RCP2.6 is

[57] Intergovernmental Panel on Climate Change, 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the IPCC, https://www.ipcc.ch/report/ar5/syr/
[58] https://www.icao.int/environmental-protection/Documents/GHG%20Management%20and%20Mitigation%20at%20Airports.pdf
[59] https://www.icao.int/environmental-protection/Documents/GHG%20Management%20and%20Mitigation%20at%20Airports.pdf
[60] https://store.aci.aero/wp-content/uploads/2018/10/Policy_brief_airports_adaption_climate_change_V6_WEB.pdf
[61] See Equator Principles Guidance Note on Climate Change Risk Assessment: https://equator-principles.com/wpcontent/uploads/2020/09/CCRA_Guidance_Note_Ext_Sept_2020.pdf

considered the most appropriate climate scenario for considering transition risks as it assumes drastic action in terms of climate policy, emissions regulation/reduction, and technological growth. It also represents the climate scenario most closely aligned with delivering the Paris Agreement targets related to limiting the level of global temperature change (atmospheric concentration levels of 430-480 ppm CO_2 by 2100). RCP4.5 present a scenario where some GHG mitigation is in place with a stabilized scenario i.e., atmospheric concentration level of 580-720 ppm CO_2 by 2100, and RCP8.5 is the pathway with the highest emissions concentration that would most likely lead to increased intensity and severity of extreme weather events with little effort to reduce emissions i.e., atmospheric concentration levels of >1,000 ppm CO_2 by 2100.

In addition to the above previous scenarios (RCP's) mentioned, Shared Socio-economic pathways (SSPs), newly developed scenarios for IPCC AR6, a set of possible trajectories for human development and global environmental change during 21st century[62], are used. Five SSP scenarios which includes SSP1, SSP2, SSP3, SSP4 and SSP5 are developed. SSP1 indicate low challenges to both mitigation and adaptation due to a combination of substantial income growth, a reduction in inequality, strong institutions, and a sustained value shift over time that prioritises sustainable development[63] . SSP2 follows middle-of-the-road trends leading to intermediate challenges to both mitigation and adaptation. SSP3 indicates high challenges to both mitigation and adaptation resulting from slow growth in income and slow technological change, ineffective institutions, and slow technological change, ineffective institutions, and low investment in human capital. SSP4 is mixed scenario in which a particular set of challenges dominates but may not be too difficult to mitigate climate change, but it would be quite difficult to adapt to it. SSP5 is very high scenario that enables many development goals to be achieved within short time frames so that challenges to adaptation are relatively low but demand on fossil fuels will grow rapidly leading to high challenges to mitigation. As per IPCC, AR6 report, projections are computed based on SSP integrating with RCP.

Climate projections for SSP2-4.5 and SSP5-8.5 were assessed to determine potential impacts and consequences to the construction and operation of the project. SSP5-8.5 is the pathway with the highest emissions concentration that would most likely lead to increased intensity and severity of extreme weather events; marked by inadequate policy response and increased potential for physical asset damage, whereas SSP2-4.5 present a scenario where some GHG mitigation is in place.

As per IPCC, AR6 report, shared socioeconomic pathways with respect to CO2 emissions are as follows: SSP1-1.9: Very low GHG emissions where CO_2 emission is cut to net zero around 2050. SSP1-2.6: Low GHG emissions where CO_2 emissions is cut to net zero around 2075. SSP2-4.5: Intermediate GHG emissions where CO_2 emissions around current levels until 2050, then falling but not reaching net zero by 2100. SSP3-7.0: High GHG emissions where CO_2 emissions double by 2100. SSP5-8.5: Very high GHG emissions where CO_2 emissions triple by 2075.

7.6.2 Physical Risk Assessment

Time horizons: Physical climate-related risks during the construction and operation of the Project were considered for following time frames as specified in IPCC (Working Group I) WGI Interactive Atlas:

- Projections for the next 20 years represent a range of averages between 2021-2040[64] which cover beginning of the operational design life.
- Projections covering the remainder of the operational design life representing a range of averages up to 2060[65] to reflect the 30-year operational design life of the project.

Project specific location data has been used from IPCC (Working Group I) WGI Interactive Atlas and ThinkHazard developed by the Global Facility for Disaster Reduction and Recovery. These are two globally recognised databases for climate data projections. Climate projections data have been obtained from IPCC (Working Group I) WGI Interactive Atlas, which uses multi-model ensembles, as they represent the range and distribution of the most plausible projected outcomes when representing expected changes. Climate change variables (e.g., mean temperature, maximum daily temperature, precipitation, etc.) have been collected from IPCC (Working Group I) WGI Interactive Atlas to identify potential hazards, such as:

- Higher mean temperatures
- Higher maximum temperatures, more frequent hot days, and more frequent heatwaves

[62] https://www.researchgate.net/publication/326016152_Innovation_Pathways_to_Transition
[63] http://doi.org/10.1016/j.gloenvcha.2016.06.004
[64] Note that IPCC data is projected staring from the year 2021. Hence, the period 2021 to 2040 taken for the assessment.
[65] Note that IPCC data is projected for a period of 2041 to 2060. Hence, taken upto 2060 though the operational design is for 30 years (2050).

- Changing pattern in long-tern rainfall
- More heavy rainfall days
- More frequent and longer floods
- Sea level rise

Furthermore, for the identification of certain acute climate hazards (such as heatwaves, wildfire, droughts, water scarcity, and flooding, etc.), hazard ratings have been used from ThinkHazard, to identify the vulnerability of the Project to these hazards. These climate hazards present the immediate vulnerability to certain acute climate hazards.

7.6.3 Transition Risk and Opportunities

An assessment of the key transition risks and opportunities associated with the transition to a low carbon economy for the Project has been undertaken. For this assessment, RCP2.6 and RCP4.5 were used. As per TFCD and World Energy Outlook, 2021 published by International Energy Agency, the climate related disclosures for risk and opportunities should consider two scenarios, at least, including a lower scenario and higher than 2°C for better understanding the probable impacts or implications related to climate change on the corresponding organization.

RCP 2.6 is considered the most appropriate climate scenario for considering transition risks as it assumes drastic action in terms of climate policy, emissions regulation/reduction, and technological growth. It also represents the climate scenario most closely aligned with delivering the Paris Agreement targets related to limiting the level of global temperature change.

RCP4.5 is considered because the projected temperature in this scenario is more than 2°C ranging between ~2.5 °C to ~3 °C[66] unlike other higher emission scenarios emitting more than 3°C, and therefore unrealistic for the study.

The assessment focused on risks and opportunities over the following timeframes[67]:

- 2023-2027
- 2028-2037
- Beyond 2037

Risks and opportunities were ranked and assessed according to Likelihood (based on research into carbon policy, legislation, and pricing) and Consequence (based on professional knowledge and judgement and existing evidence and data on vulnerabilities, thresholds, and criticalities) and to determine priority risks and opportunities.

7.6.4 Physical Climate Context

The project location is the coastal area of Vizianagaram District of Andhra Pradesh which is on the north-eastern side of the state and very close to Bay of Bengal. The district experiences moderate and high humidity climate throughout the year with good amount of seasonal rainfall[68]. The normal annual rainfall is 1131 mm during summer monsoon season which contributes around 71% of rainfall to the state during June to September. Around 11% is being contributed by northeast monsoon during October to November month. Mean daily maximum temperature is about 35 ºC and mean daily minimum temperature is about 27 ºC. After the onset of monsoon, relative humidity increases with mean monthly relative humidity is about 79%.

Table 7-31: Mean annual temperature and total precipitation (1980 – 2015)[69] over the project location

	Annual	Winter (December, January, February)	Pre-monsoon (March, April, May)	Summer Monsoon (June, July, August)	Post-Monsoon (September, October, November)
Mean temperature	26.9	23.3	29.4	28.6	26.4

[66] Pielke, R., Jr, Burgess, M. G., & Ritchie, J. (2021, March 23). Most plausible 2005-2040 emissions scenarios project less than 2.5 degrees C of warming by 2100. https://doi.org/10.1088/1748-9326/ac4ebf
[67] This time frame is taken because the project starts from 2020 and for every five years, Nationality Determined Contribution (NDC) report for energy requirement & emission etc. for every country have been updated.
[68] Groundwater Report, Vizianagaram District, 2022.
[69] Note that the nearest observation datasets which is close to historical model simulations are available for this period (1980-2015). Nearest period should be taken to validate model ability against the observation.

	Annual	Winter (December, January, February)	Pre-monsoon (March, April, May)	Summer Monsoon (June, July, August)	Post-Monsoon (September, October, November)
(ºC)					
Total precipitation (mm/day)	2.7	0.4	0.9	4.6	4.6

Source: IPPC AR6 Atlas

Table 7-32. Existing Planned Mitigation and Control Measures

Physical Impact	Mitigation/Control Measures
Potential loss or damage to assets caused by high wind	Wind speed of about 55 m/s is considered for the Project, construction, equipment, and airport structures. Air traffic due to changes in wind pattern will be managed by Air Traffic Control (ATC). For runway utilization and schedules against high wind or change in wind pattern, Standard Operating Procedures of flights will be adopted. All cables will be laid underground, and no deterioration will take place. Pavement structural design and electrical systems and other equipment will be designed considering the mentioned wind speed. For any types of failures such as electrical spike/shortage, damage to aircraft structural and avionics, increase in maintenance and repair due to high wind, scheduled maintenance will be done as per Airport and DGCA requirements. Approach routes for landing and take-off due to change in flight path will be controlled by ATC and flight landing will be aborted in case of extremely windy conditions. The air traffic control and ramp control will be handled by the tower. For the effective provision of airport control service, a clear unobstructed view of the entire movement area of the airport and of air traffic in the vicinity of the airport is necessary. The position and height of the tower should allow a clear visibility to runways, taxiways, and the surrounding airspace, especially the approach and take-off areas. To the maximum extent possible, a direct view should be provided from the tower to all apron areas and aircraft stands. When aircraft stands cannot be seen directly from the tower cabin, the control will be assisted by CCTV. Reduced visibility in case of greater turbulence affecting visual and signal line of sight would be handled as per DGCA requirements.
Potential heat stress/heat exhaustion of workers caused by higher temperatures and more hot days over 35ºC	Three working shifts of 8 hours per day shall be adopted during construction phase. GRM of airport and Concessionaire will be put in place before commencement of construction in case of emergency/injury/accidents. During disruptive events, vehicles will be used to transfer the staff to workstation. Appropriate PPEs will be provided to minimize heat stress on workers and outdoor ground staffs. During hot season, water spraying, drinking water and breaks will be provided to workers and employees. Training programs will be provided to employees as part of EMP/ERP against heat stress following standard guidelines and regulations of ICAO.
Potential damage to heat sensitive equipment caused by higher temperatures and more hot days over 35ºC	High voltage trips, MCBs, and electrical failure trip arrangements will be provided against any electrical faults. Airport will be designed as per ICAO and DGCA standard for safety requirements. The design principles including efficiency, flexibility, sustainability, and operational ease will be taken into consideration when designing airport infrastructure against warmer temperature. To withstand the impact of heat stress, runway will be oriented east-west (10-28) and the primary runway is 3,800 meters long which is intended for Code 4E operations with occasional landing/ take-off of Code F aircraft. A dual

Physical Impact	Mitigation/Control Measures
	parallel taxiway will be provided at 107.5 from the emergency runway/ full length parallel taxiway with length about 2607 m. The pavement design periods of RWY, TWY, Apron and remote stands is of 20 years. Periodic inspection (daily and weekly) will be done for pavement during hot days. The pavements of the runway and taxiways are designed in such a way as to support the loads imposed by aircraft without excessive distortion or failure. Furthermore, they shall provide a smooth, stable, and firm surface with good friction characteristics to be usable in all seasons and weather conditions. Low carbon cooling strategy shall be applicable for airport buildings where several terminal concepts have one and half level central processor and piers for the contact gates. The building envelop will be improved through fenestration, white roofing materials, cladding material, vapor barriers, and retarders etc. In case of additional cooling requirements, cooling tower is proposed. A total of about three days of water demand will be stored in a main water storage tank. Tanks will be provided with an automatic flow control system based on the water tank level. Tanks will be compartmentalized to store raw water, treated potable water, flushing water, irrigation water etc.
Potential loss or damage of assets disruptions and contamination of surrounding soil /water resulting from waterlogging or potential flooding due to heavy precipitation/cyclonic storm surge/sea level rise	Prior geo-tech soil investigations will be carried out before the commencement of construction work. The airport area falls ~1.5 km away from Bay of Bengal. During construction phase, soil will be stacked within site with bunding. Adequate drainage will be provided to drain out standing water in case of waterlogging. Flood management plan will be prepared with proper installation of flood barriers and pumping systems. To manage storm water runoff, plantation of vegetation around the airport buildings will be done. To address the risks from water ingress and flooding, the building will be designed based on the International Civil Aviation Organization (ICAO) guidelines and regulations and International Air Transport Association (IATA) guidelines including The Airport Design Reference Model (ADRM). Passenger Terminal Building (PTB) has a design capacity of 6 MPPA.
Potential loss or damage of assets/workers and supply disruption caused by other weather phenomenon/ emergency plans	As per International Civil Aviation Organisation guidelines, risks and contingency plans shall be prepared and adopted. To accommodate lightning strikes to aircraft and other aviation infrastructure, complete electrical earthing, fuse system, electrical cut-outs will be provided. The International Civil Aviation Organization (ICAO), standard for emergency planning will be developed with respect to Standards and Recommended Practices (SARPs) for the safety, efficiency, and regularity of international civil aviation, has published specific SARPs to address the necessity and importance of emergency response planning and coordination for various stakeholders of the aviation system. DG will be provided as an alternative back up power supplies for continuous operation and power switching for critical systems. Onsite workers and site staff shall be provided with adequate number of personal protective equipment (PPEs) to deal with emergency situations. Collaborative Design Making by ICAO will be applied across the timeline of activities from strategic planning to real-time operations in case of extreme events. Fire extinguishers shall be provided at critical areas.

Source: GVIAL information and compiled from various sources

7.6.5 Results

Climate projections for SSP2-4.5 and SSP5-8.5 were assessed to determine potential impacts and consequences related to the operation of the project.

Table 7-33: Climate-related data pertaining to mean temperature for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5					SSP5-8.5			
Mean Temperature: increase in ºC from the 1981-2010 baseline								
	2021-2040		2041-2060		2021-2040		2041-2060	
	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)
Annual	0.6	27.7	1.1	28.2	0.6	27.8	1.4	28.6
Pre-monsoon	0.6	28.8	1.1	29.3	0.6	28.8	1.4	29.7
Summer Monsoon	0.6	29.7	1.1	30.1	0.7	29.8	1.4	30.5
Post-Monsoon	0.6	27.8	1	28.2	0.5	27.9	1.4	28.6
Winter Monsoon	0.5	24.8	1	25.3	0.5	24.8	1.4	25.7

Source: IPCC AR6 Atlas

Under both scenarios (**Table 7-33**), mean temperature over the project location is projected to increase both annually as well as seasonally in all the periods as compared to 1981 to 2010 baseline. The annual change in mean temperature varies from 0.6 ºC to 1.1 ºC per decade under SSP2-4.5 scenario while 0.6 ºC to 1.4 ºC per decade under SSP5-8.5 scenario during the period 2021 to 2060 indicating an increase in temperature over the project location. Annual mean temperature value is also projected to increase from 27.7 ºC to 28.2 ºC per decade under SSP2-4.5 scenario while from 27.8 ºC to 28.6 ºC per decade under SSP5-8.5 scenario. The seasonal change in temperature projects maximum change in mean temperature during summer-monsoon season followed by pre-monsoon, post-monsoon, and winter monsoon season. During summer-monsoon season, the rate of change varies between 0.6 ºC to 1.1 ºC per decade under SSP2-4.5 scenario while between 0.7 ºC to 1.4 ºC per decade under SSP5-8.5 scenario during the period 2021 to 2060. The maximum mean temperature value is also projected during summer-monsoon season ranging between 29.7 ºC to 30.1 ºC per decade under SSP2-4.5 scenario while from 29.8 ºC to 30.5 ºC per decade under SSP5-8.5 scenario. It is followed by pre-monsoon, post-monsoon, and winter monsoon season.

Table 7-34: climate-related data pertaining to maximum of daily maximum temperature for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5					SSP5-8.5			
Maximum of daily maximum temperature: increase in ºC from the 1981-2010 baseline								
	2021-2040		2041-2060		2021-2040		2041-2060	
	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)	Change (ºC)	Value (ºC)
Annual	0.4	36	1.1	36.7	0.6	42.6	1.6	43.7
Pre-monsoon	0.4	34.4	1	35	0.4	41.1	1.5	42.1
Summer Monsoon	0.5	35.7	1.1	36.3	0.6	41.9	1.5	42.8
Post-Monsoon	0.3	31.5	0.9	31.9	0.3	33.7	1.2	34.5
Winter Monsoon	0.5	28.9	1	29.4	0.5	32.4	1.5	33.3

In **Table 7-34**, maximum of daily maximum temperature under both scenario is projected to increase annually as well as season wise under both scenarios indicating rise in daily maximum temperature. Annual rate of change in maximum daily temperature varies between 0.4 ºC to 1.1 ºC per decade under SSP2-4.5 scenario while between 0.6 ºC to 1.6 ºC per decade under SSP5-8.5 scenario during the period 2021 to 2060. The annual increased of maximum daily temperature value varies between 36 ºC to 36.7 ºC per decade under SSP2-4.5 scenario while between 42.6 ºC to 43.7 ºC per decade under SSP5-8.5 scenario. Seasonally, the highest rate of change in

maximum temperature is projected during summer monsoon season followed by pre-monsoon, winter monsoon and post-monsoon season. During pre-monsoon season, it varies between 0.5 ºC to 1.1 ºC per decade under SSP2-4.5 scenario while between 0.6 ºC to 1.5 ºC per decade under SSP5-8.5 scenario. Daily maximum temperature value is projected to be highest during summer monsoon season varying between 35.7 ºC to 36.3 ºC per decade under SSP2-4.5 scenario while between 41.9 ºC to 42.8 ºC per decade under SSP5-8.5 scenario. It is followed by pre-monsoon season, post-monsoon season and winter monsoon season.

Table 7-35: Climate-related data pertaining to number of hot days over 35º C for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5			SSP5-8.5	
Number of hot days (over 35º C): increase in number of hot days from the 1981-2010 baseline				
	2021-2040	2041-2060	2021-2040	2041-2060
	Value (days)	Value (days)	Value (days)	Value (days)
Annual	17.9	21.7	18.8	24.7
Pre-monsoon	7.7	9.7	8.2	11.4
Summer Monsoon	9.2	10.8	9.5	11.6
Post-Monsoon	0.8	1	0.8	1.3
Winter Monsoon	0.2	0.3	0.3	0.4

Source: IPCC AR6 Atlas

Number of hot days over 35 ºC (**Table 7-35**) is expected to increase in all the seasons as well as annually under both scenarios indicating increase in hot spells over the project location during the period 2021 to 2060. Annually, number of hot days is projected to increase by 17.9 days per decade to 21.7 days per decade under SSP2-4.5 scenario while from 18.8 days per decade to 24.7 days per decade under SSP5-8.5 scenario from 2021 to 2060. Seasonally, summer monsoon season projects the maximum number of hot days varying between 9.2 days per decade to 10.8 days per decade under SSP2-4.5 scenario while 9.5 days per decade to 11.6 days per decade under SSP5-8.5 scenario. It is then followed by pre-monsoon season, post-monsoon season and winter monsoon season.

Table 7-36: climate-related data pertaining to total precipitation for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5					SSP5-8.5			
Total precipitation (mm/day): increase in mm/day from the 1981-2010 baseline								
	2021-2040		2041-2060		2021-2040		2041-2060	
	Change*	Value**	Change	Value	Change	Value	Change	Value
Annual	-0.2	3	5	3.1	1.1	3.1	6.7	3.2
Pre-monsoon	-5.9	0.6	1	0.6	-6.4	0.6	1.5	0.7
Summer Monsoon	-0.5	6.5	4.5	6.9	0.9	6.7	4.5	6.9
Post-Monsoon	3	4.3	8.5	4.5	4.1	4.4	13.5	4.8
Winter Monsoon	-11.4	0.5	-7	0.5	-10.1	0.6	-8.8	0.5

Source: IPCC AR6 Atlas

**Change in % and **Value in mm/day*

Projected total precipitation (**Table 7-36**) is expected to increase annually as well as seasonally under both scenarios over the project location except for few. The annual rate of change of total precipitation during 2021 to 2040 is projected to decrease by -0.2% per decade while increases by 5% per decade during 2041 to 2060 under SSP2-4.5 scenario. However, the annual rate of change of total precipitation is projected to increase by 1.1% to

6.7% per decade during 2021 to 2060 under SSP5-8.5 scenario. Annual total precipitation value is also projected to increase from 3 mm/day to 3.1 mm/day per decade under SSP2-4.5 scenario while from 3.1 mm/day to 3.2 mm/day is expected under SSP5-8.5 scenario. Seasonally, post-monsoon is expected to project the highest rate of change of precipitation varying from 3% to 8.5% per decade under SSP2-4.5 scenario while from 4.1% to 13.5% per decade under SSP5-8.5 scenario. It is followed by summer monsoon, pre-monsoon and winter monsoon season. Although most of the seasons are projected to decrease as compared to baseline during 2021 to 2040 but projected to increase towards 2041 to 2060. Maximum seasonal total precipitation is projected to increase in summer monsoon season varying between 6.5 mm/day to 6.9 mm/day per decade under SSP2-4.5 scenario while between 6.7 mm/day to 6.9 mm/day per decade under SSP5-8.5 scenario. It is followed by post-monsoon, pre-monsoon, and winter monsoon season.

Table 7-37: climate-related data pertaining to maximum 1-day precipitation for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5					SSP5-8.5			
Maximum 1-day precipitation from the 1981-2010 baseline								
	2021-2040		2041-2060		2021-2040		2041-2060	
	Change*	Value**	Change	Value	Change	Value	Change	Value
Annual	1.1	82.5	9.3	89.2	2.2	84.1	12.3	92.3
Pre-monsoon	-0.8	12.8	7	13.8	-3.2	13	13.4	15.2
Summer Monsoon	1.3	67.9	8.1	72.3	0.6	70.6	8.1	72.4
Post-Monsoon	1.6	57.5	10.6	62.8	5.4	57.6	10.8	63.4
Winter Monsoon	-8.8	14	-6.1	14.4	-11.4	14	-2.4	15.5

Source: IPCC AR6 Atlas

**Change in % and **Value in mm*

Maximum 1-day precipitation (**Table 7-37**) is projected to increase throughout the period both annually as well as seasonally under both scenarios indicating longer wet spells except for few. The annual increased rate of change varies from 1.1% to 9.3% per decade under SSP2-4.5 scenario and from 2.2% to 12.3% per decade under SSP5-8.5 scenario during the period 2021 to 2060. Maximum 1-day precipitation annual value is also projected to increase from 82.5 mm to 89.2 mm per decade under SSP2-4.5 scenario and from 84.1 mm to 92.3 mm per decade under SSP5-8.5 scenario indicating rise in wet spells over the project location. Post-monsoon season is expected to project the highest change in maximum 1-day precipitation throughout the period. The increased rate of change during this season is projected to increase from 1.6% to 10.6% per decade under SSP2-4.5 scenario and 5.4% to 10.8% per decade under SSP5-8.5 scenario. It is followed by summer monsoon, pre-monsoon, and winter monsoon season. Though rate of change of precipitation in pre-monsoon and winter monsoon season are projected to decrease as compared to baseline, it is projected to increase by mid-century. Highest maximum 1-day precipitation value is projected during summer monsoon season, followed by post-monsoon, winter monsoon season, and pre-monsoon season. Summer monsoon season is expected an increase of maximum 1-day precipitation value varying from 67.9 mm to 72.3 mm per decade under SSP2-4.5 scenario and from 70.6 mm to 72.4 mm per decade under SSP5-8.5 scenario.

Table 7-38: climate-related data pertaining to maximum 5-day precipitation for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5					SSP5-8.5			
Maximum 5-day precipitation from the 1981-2010 baseline								
	2021-2040		2041-2060		2021-2040		2041-2060	
	Change*	Value**	Change	Value	Change*	Value**	Change	Value
Annual	-1.3	192.6	5.3	205.4	-1.2	193.2	6.6	208.2

	SSP2-4.5				SSP5-8.5			
Pre-monsoon	-4.6	29.5	2.7	31.8	-5.2	30.5	3.1	33.6
Summer Monsoon	0	164.8	3.5	170.2	0.1	164.1	5.4	168.9
Post-Monsoon	0.2	137.1	8.4	148.6	0.2	137.8	8.3	149.1
Winter Monsoon	-11.7	28	-4.6	30.3	-6.7	30.3	-2.9	31.7

Source: IPCC AR6 Atlas

**Change in % and **Value in mm*

In **Table 7-38**, maximum 5-day precipitation is projected to increase both annually as well as seasonally under both scenarios indicating longer wet spells except for few. Annual maximum 5-day precipitation is projected to decrease by -1.3% per decade under SSP2-4.5 scenario and -1.2% per decade under SSP5-8.5 scenario during 2021 to 2040. However, it is projected to increase by 5.3% per decade under SSP2-4.5 scenario and 6.6% per decade under SSP5-8.5 scenario. Maximum 5-day annual precipitation value is projected to increase significantly varying between 192.6 mm to 205.4 mm per decade under SSP2-4.5 scenario while from 193.2 mm to 208.2 mm per decade under SSP5-8.5 scenario. Seasonally, post-monsoon season projected the highest rate of change of maximum 5-day precipitation varying between 0.2% to 8.4% per decade under SSP2-4.5 scenario while between 0.2% to 8.3% per decade under SSP5-8.5 scenario. It is followed by summer monsoon, pre-monsoon, and winter monsoon season. Though there have been few projected declines in precipitation in pre-monsoon and winter monsoon season during 2021 to 2040 as compared to baseline, it is projected to increase by mid-century. As for seasonal maximum 5-day precipitation value, summer monsoon season projected the highest precipitation varying between 164.8 mm to 170.2 mm per decade under SSP2-4.5 scenario while between 164.1 mm to 168.9 mm per decade under SSP5-8.5 scenario. It is followed by post-monsoon, pre-monsoon, and winter monsoon season. From the table, longer wet spells are expected to increase significantly over the project location under both scenarios.

Table 7-39: climate-related data pertaining to maximum number of consecutive dry days (pr <1 mm) for scenario SSP2-4.5 and SSP5-8.5

SSP2-4.5			SSP5-8.5	
Consecutive dry days: Maximum number of consecutive dry days (pr <1 mm) from the 1981-2010 baseline				
	2021-2040	2041-2060	2021-2040	2041-2060
	Value (days)	Value (days)	Value (days)	Value (days)
Annual	88	88.4	87.4	89.2

Source: IPCC AR6 Atlas

Maximum number of consecutive dry days (pr <1mm) in **Table 7-39** is projected to increase in all the periods under both scenarios as compared to 1981 to 2010 baseline over the project location indicating rise in dry spell during the period 2021 to 2060. It is projected to slightly increase towards mid-century. Under SSP2-4.5 scenario, number of dry days is expected to increase by 88 days per decade during 2021 to 2040 and by 88.4 days per decade during 2041 to 2060. During 2021 to 2040, 87.4 number of days per decade and 89.2 number of days per decade during 2041 to 2060 is expected to increase under SSP5-8.5 scenario as well.

Table 7-40: Sea Level Rise (m)

SSP2-4.5				SSP5-8.5			
2020	2030	2040	2050	2020	2030	2040	2050
0.03	0.06	0.1	0.14	0.03	0.07	0.11	0.17

By the end of 30 years, the following changes to the climate in the project location are expected:

- Temperatures will increase significantly along with number of hot days. However, projected increase in number of hot days is very less.
- Dry days is expected to increase significantly in coming years.

- Precipitation is projected to increase with longer wet days.
- Sea level rise is projected to increase.

Furthermore, according to ThinkHazard, the districts fall under high category of extreme heat stress, drought, cyclone, and moderate category of coastal and river flood. Extreme heat is also expected to occur at least once in the next five (5) years resulting in heat stress. Droughts are expected to occur on average of every five (5) years. More than 20% chance of cyclone associated potentially damaging wind speed is expected in the next 10 years. The frequency and intensity of these hazards is expected to increase because of climate change.

Physical climate-related risks were assessed for construction and operational design life of the project. Risk ratings take planned mitigation measures to reduce, control and respond to risks, into account. No physical risks were identified as high.

However, following moderate risks during construction phase were noted:

- Potential heat stress and heat exhaustion of construction workers due to increased temperatures.
- Potential disruption and damage to infrastructure, equipment, movement, and activities due to increased frequency of cyclones.
- Following moderate risks during operational phase were noted:
- Potential heat stress and heat exhaustion of workers and outdoor staffs due to increased temperatures.
- Potential disruption and damage to operational infrastructure, equipment, movement, and activities due to increased frequency of cyclones.

The full physical risk assessment can be found in **Appendix A**. The in-combination impacts of climate change and the project on the community, business, or customers could therefore be severe, however the impacts would not likely affect the operation of the plant if appropriate mitigation measures were prepared to reduce the risk and severity of the impacts.

No transition risks were identified as high as clean energy power shall be explored and energy requirement will be procured. The full transition risk and opportunity assessment can be found in Appendix B. Note that only transition risks and opportunities relevant to the project have been included in **Appendix B**.

7.6.6 Climate Change Adaptive Measures

Though the impacts of climate change on the project activities is mild, considering the uncertainty nature of climate change and to mitigate the associated risk caused by climate change, the following measures could be adopted:

- To withstand against heat stress, heat management measures should be considered for both workers, outdoor staffs mainly ground staff, aircraft operator, and equipment. For example, low carbon cooling strategy shall be explored. Cool colours such as white or pale should be painted on external wall to reduce temperature. Any equipment susceptible to fire or heat stress should be properly taken care of with the use of fire extinguishers or fire-fighting system. Any material which is prone to ignition should be handled properly by eliminating the presence of potential sources that could lead to ignition. Personal Protective Equipment (PPE) and safety gadgets should be strictly provided to all the workers for their safety. Proper cooling or ventilation system should be installed in rooms or areas where heat stress is expected. First aid facility and provision of health and safety policy covering all safety aspects during both construction and operational phase should be adopted. Green infrastructure such as plantation of vegetation should be adopted to reduce heat and provide shade. Improve building envelop with roofing materials, fenestration, vapor barriers and retarders, etc. to reduce heat absorption and heat stress.
- Drainage networks should be ensured with clear functioning and sufficient water retention capacity to hold the expected waterlogging impacts. Latest and adequate pumps should be kept in good condition. Storm water management should be adopted with green infrastructure including plantation of vegetation around the airport buildings acting as natural barriers, green roofing to minimize runoff. Other flood barriers should also be installed to protect flood prone areas.
- Early warning systems, and emergency response management plans should be developed for storm events. Management measures should be kept ready, with a classified emergency team, in case of occurrence of natural calamities to provide safe, timely, effective, and coordinated response in consultation with the local people and government agencies. Weather forecasting data availability and quality should be improved and engaged for planning and execution of flight and other airport operational

activities. Secure airport assets prior to storm events. Diversion and pre-emptive cancellation of flights in case of storm warning. Hybrid based (green and grey infrastructure) Nature-based Solutions should be adopted to strengthen and reinforce of airport infrastructure towards more climate resilient infrastructure against high wind speed and cyclone related risks.

- Adequate engineering-based design should be considered to withstand against any climate change impacts for example high wind speed, heat stress, and waterlogging etc.
- During the construction and operational phase of the project, relevant norms or standard codes should be followed in case of any damages or emergency.
- Sufficient back up power should be made available during any event. DG equipment used for power back up should be maintained properly for efficient operation and to reduce GHG emissions. Air Traffic Management should be improved for precision approaches and strategic traffic flow to adjust the demand and capacity imbalances for planning.

Although no transition risks have been identified as high, as the likelihood of these risks occurring, as well as opportunities are based on current policy in India and market signals, it is recommended that India's climate change legislation and national energy policy, as well as changes in market demand are monitored on a regular basis. In addition, clean energy should be explored and adopted to meet the energy requirement for operational purpose due to high electrical energy demand in airport facilities, buildings, and other systems.

7.7 Quantitative Risk Assessment (QRA) Study

The main objective for conducting this Quantitative Risk Analysis (QRA) Study is to determine the potential risks and their consequences to the facility due to storage and transferring of hazardous chemicals at various locations and other equipment. This is achieved by the following:

- Identification of hazards that could be realized from hazardous material.
- Identify the potential failure scenarios that could occur within the facility.
- To asses, the potential risks associated with identified hazards to which the plant and its personnel and community outside may be subjected. Consequence analysis of various hazards is carried out to determine the vulnerable zones for each probable accident scenario.
- Evaluate the process hazards emanating from the identified potential accident scenarios.
- Analyse the damage effects to the surroundings due to such accidents.
- Conclusion and Recommendations in order to mitigate the hazard.
- Calculation of physical effects of accidental scenarios, which includes frequency analysis for incident scenarios leading to hazards to people and facilities (flammable gas, fire, and smoke, explosion overpressure and toxic gas hazards) and consequence analysis for the identified hazards covering impact on people and potential escalation.
- Damage limits identification and quantification of the risks and contour mapping on the plant layout.
- Individual risk quantification and contour mapping.
- Evaluation of risks against risk acceptable limit.
- Risk reduction measures to prevent incident to control the accident.
- Hazard mitigation recommendations based on QRA.
- To provide thermal radiation curves in different types of fire scenarios.

Methodology

The consequences of released toxic or flammable material are largely dependent on the prevailing weather conditions. Consequences of loss of containment can lead to hazardous situation in any industry handling potentially hazardous materials. Following factors govern the severity of consequence of the loss of containment.

- Intrinsic properties: flammability, toxicity and reactivity.
- Dispersive energy: pressure, temperature and state of matter.

- Quantity present
- Environmental factors: weather (wind speed, wind direction, atmospheric temperature &pressure).

Consequence analysis and calculations are effectively performed by computer software using models validated over a number of applications. Consequence modelling is carried out by PHAST of DNV Software, UK.

PHAST uses the Unified Dispersion Model (UDM) capable of describing a wide range of types of accidental releases. The Model uses a particularly flexible form, allowing for sharp-edged profiles, which become more diffuse downwind.

PHAST contains data for a large number of chemicals and allows definition of mixtures of any of these chemicals in the required proportion. The calculations by PHAST involve following steps for each modelled failure case:

- Run discharge calculations based on physical conditions and leak size.
- Model first stage of release (for each weather category).
- Determine vapor release rate by flashing of liquid and pool evaporation rate.
- Dispersion modelling taking into account weather conditions.
- In case of flammable release, calculate size of effect zone for fire and explosion.
- The hazardous materials considered in this study are mostly flammable liquids.

Flow chart for consequence analysis is shown in the form of event tree for release of flammable liquid.

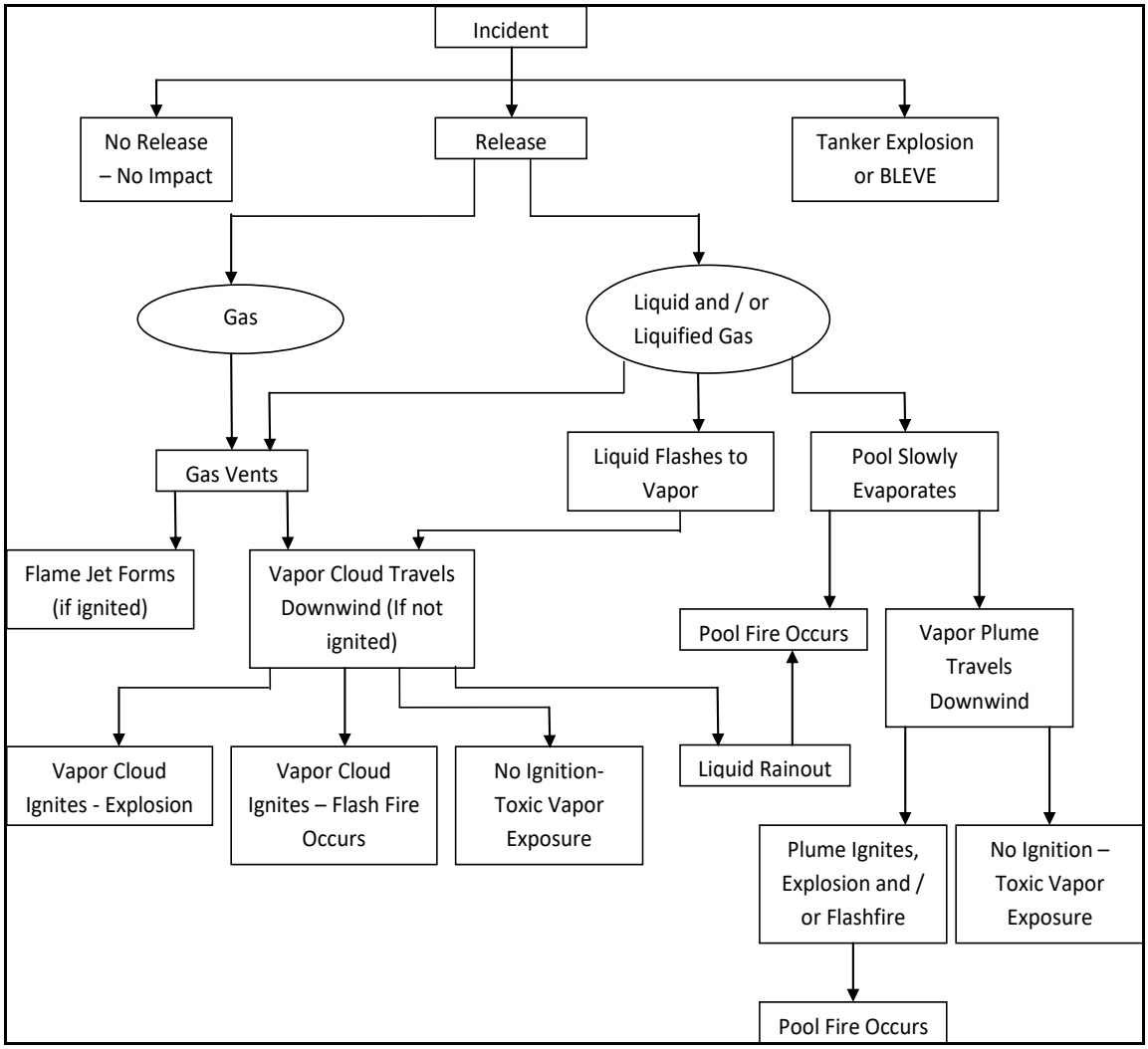


Figure 7-5: Methodology Adopted for QRA

Meteorological Condition

The consequences of released flammable material are largely dependent on the prevailing weather conditions. For the assessment of major scenarios involving release of flammable materials, the most important meteorological parameters are those that affect the atmospheric dispersion of the escaping material. The crucial variables are wind direction, wind speed, atmospheric stability and temperature. Rainfall does not have any direct bearing on the results of the risk analysis; however, it can have beneficial effects on absorption / washout of released materials. Actual behaviour of any release would largely depend on prevailing weather condition at the time of release.

Table 7-41: Details of Atmospheric Parameters

Atmospheric Parameters	Details
Atmospheric Temperature	45° C
Relative humidity	70%
Average Wind Speed	1.5 m/s, 5 m/s
Stability Class	F[70] and D[71]
Wind Direction	All 360 degree

Hazards Associated with Flammable Materials

The release of flammable liquid can lead to different types of fire or explosion scenarios. These depend on the material released, mechanism of release, temperature and pressure of the material and the point of ignition. Types of flammable effects are as follows:

Pool fire: The released flammable material which is a liquid stored below its normal boiling point, will collect in a pool. The geometry of the pool will be dictated by the surroundings. If the liquid is stored under pressure above its normal boiling point, then a fraction of the liquid will flash into vapor and the remaining portion will form a pool in the vicinity of the release point. Once sustained combustion is achieved, liquid fires quickly reach steady state burning. The heat release rate is a function of the liquid surface area exposed to air. An unconfined spill will tend to have thin fuel depth (typically less than 5 mm) which will result in slower burning rates. A confined spill is limited by the boundaries (e.g. a dyke area) and the depth of the resulting pool is greater than that for an unconfined spill.

Flash fire: It occurs when a vapor cloud of flammable material burns. The cloud is typically ignited on the edge and burns towards the release point. The duration of flash fire is very short (seconds), but it may continue as jet fire if the release continues. The overpressures generated by the combustion are not considered significant in terms of damage potential to persons, equipment or structures. The major hazard from flash fire is direct flame impingement. Typically, the burn zone is defined as the area the vapor cloud covers out to half of the LFL. This definition provides a conservative estimate, allowing for fluctuations in modeling. Even where the concentration may be above the UFL, turbulent induced combustion mixes the material with air and results in flash fire.

Jet Fire: Jet flames are characterized as high-pressure release of gas from limited openings (e.g. due to small leak in a vessel or broken drain valve).

Boiling Liquid Expanding Vapor Explosion (BLEVE) or fireball: A fireball is an intense spherical fire resulting from a sudden release of pressurized liquid or gas that is immediate ely ignited. The best-known cause of a fireball is a boiling liquid expanding vapor explosion (BLEVE). Fireball duration is typically for 5 – 20 seconds.

Vapor Cloud Explosion (VCE): When a large quantity of flammable vapor or gas is released, mixes with air to produce sufficient mass in the flammable range and is ignited, the result is a vapor cloud explosion (VCE). Without sufficient air mixing, a diffusion-controlled fireball may result without significant overpressures developing. The speed of flame propagation must accelerate as the vapor cloud burns. Without this acceleration, only a flash fire will result.

Vapour cloud explosions (VCE) are one of the most serious hazards in chemical process industries. When a large quantity of flammable gas or vapor is accidentally released in to atmosphere it may form a vapour cloud and if its ignition is delayed (5-10 min) could produce a vapour cloud explosion. The damage effects of a vapour cloud

[70] Weather stability class F represents Moderately Stable Condition.
[71] Weather stability class D represents Neutral Condition.

explosion are mostly due to the overpressure that is created from the fast expansion of the combustion products. The overpressure is the most important causes of damage to people, equipment and facilities.

Tank farm details for fuelling of Aircraft and Ground Support Vehicles

At the airport, HSD is stored and handled for DG sets operation while ATF is stored for refuelling of aircraft. Petroleum Oil Public Sector Companies like IOCL, BPCL and HPCL are engaged in fuelling of Aircraft and Ground Support Vehicles. Storage and handling of ATF and High-Speed Diesel (HSD) are carried by following OISD guidelines.

The details of tanks are given in below table.

Table 7-42: Details of fuel storage facility

Particulars	Details
Storage Capacity	7500 KL (ATF) 999 KL X 6 (Diesel)
Fuel Usage (cum/month)	5000

Process Description

The techniques used for risk prediction within the QRA have inherent uncertainties associated with them due to the necessary simplifications required. In addition, QRA incorporates a certain amount of subjective engineering judgment, and the results are object to levels of uncertainty. The results should be used as a tool to aid engineering judgment and, if used in this way, can provide valuable information during the decision-making process.

Consequence Analysis

The consequence analysis is carried out to determine the extent of spread (dispersion) by accidental release which may lead to jet fire, pool fire, catastrophic ruptures resulting in generation of heat radiation, overpressures, explosions, etc.

In order to form an opinion on potentially serious hazardous situations and their consequences, consequence analysis of potential failure scenarios is conducted. It is qualitative analysis of hazards due to various failure scenarios. In consequence analysis, each failure case is considered in isolation and damage effects predicted, without taking into account the secondary events or failures it may cause, leading to a major disastrous situation. The results of consequence analysis are useful in developing Disaster Management Plan and in developing a sense of awareness among operating and maintenance personnel. It also gives the operating personnel and population living in its vicinity, an understanding of the hazard they are posed to.

Upon release of flammable / toxic gas & liquids, the hazards could lead to various events which are governed by the type of release, release phase, ignition, etc. PHAST has an inbuilt event tree for determining the outcomes which are based on two types of releases namely continuous and instantaneous. Leaks are considered to be continuous releases whereas, ruptures are considered to be instantaneous releases. These types of releases are further classified into those which have a potential for rain-out and those which do not. Whether the release would leak to a rain-out or not depends upon droplet modelling which is the main cause of formation of pools. Following figure presents the event trees utilized by PHAST to generate the event outcomes:

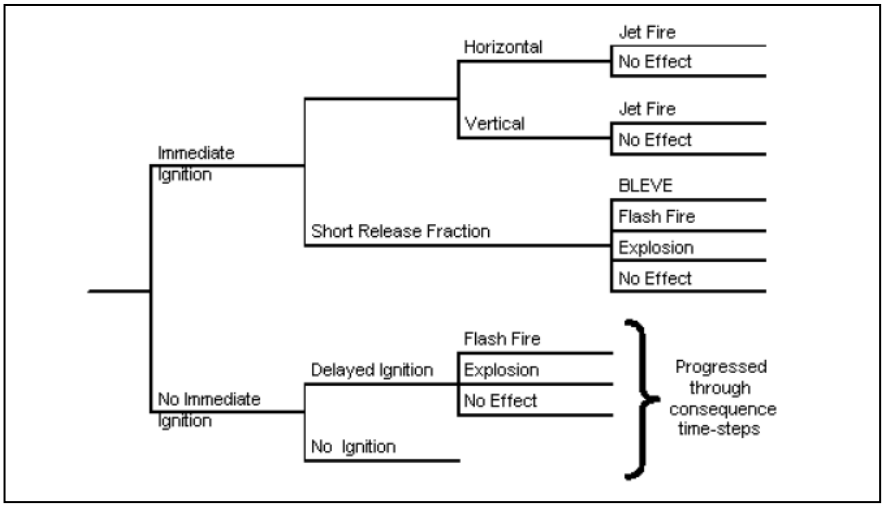


Figure 7-6: Event Tree for release use by PHAST

The behaviour of material released by loss of containment depends on the following factors:

i. Physical properties of the material,

ii. Conditions of material in containment (pressure and temperature),

iii. Phase of material released (liquid or gas),

iv. Inventory of material released,

v. Weather parameters (temperature, humidity, wind speed, atmospheric stability),

vi. Material with boiling point below ambient condition.

Consequence Analysis results

The results of consequence analysis is given in table below:

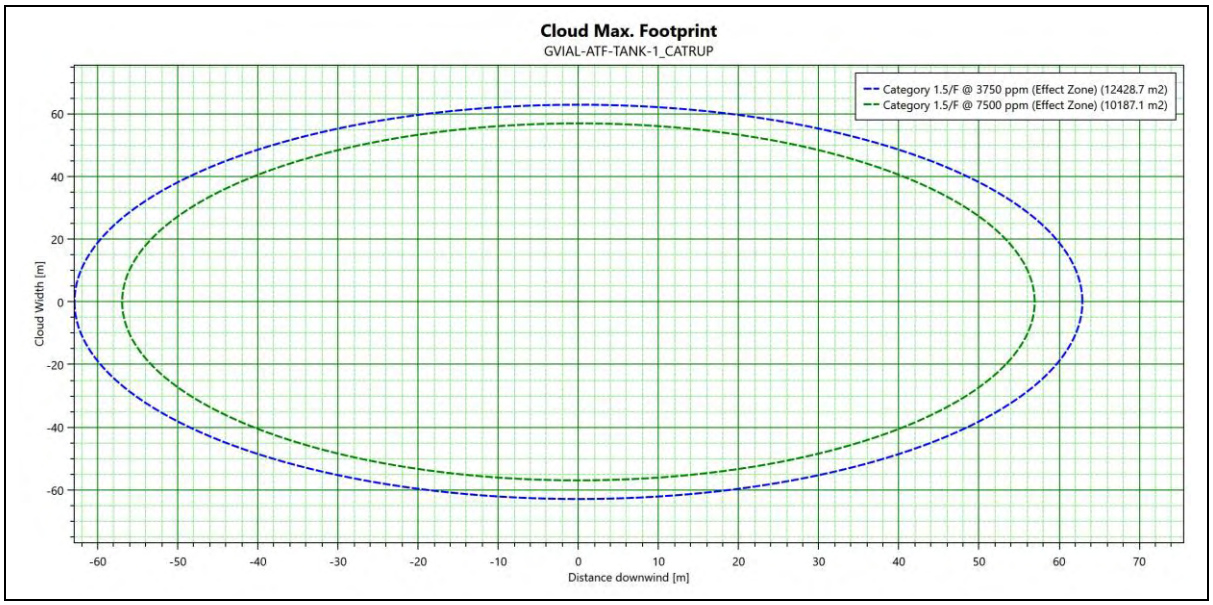
Table 7-43: Results of Consequence Analysis

Scenario details		5 mm leak			25 mm leak			100 mm leak			Catastrophic Rupture		
Weather Category		1.5 F	1.5 D	5D	1.5 F	1.5 D	5D	1.5 F	1.5 D	5D	1.5 F	1.5 D	5D [72]
Flash Fire Envelope (m)													
ppm	**UFL[73]**	2	1	1	13	10	3	15	12	10	22	22	25
	LFL[74]	7	5	3	32	33	18	38	42	35	57	53	55
	50% LFL	11	10	3	43	46	29	52	51	55	60	62	65
Thermal Damage Distance by Jet fire (m)													
Radiation Intensity [75] (KW/m^2)	**4**	NR[76]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	12.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	37.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Thermal Damage Distance by Late Pool fire (m)													
Overpressure [77] (bar)	**4**	32	32	34	32	32	34	32	32	34	850	842	792
	12.5	18	18	19	18	19	23	18	19	23	580	565	535
	37.5	10	10	11	10	10	11	10	10	11	NR	NR	NR

The consequence graphs and contours for worst case results i.e. for catastrophic ruptures are presented in below figures.

[72] 5D is considered weather is reasonably neutral condition. The weather category 5F is not captured as software does not consider this parameter.
[73] Upper flammability Level.
[74] Lower flammability Level.
[75] The intensity of radiation refers to the energy associated with photons emitted from the surface area in unit time.
[76] Not Reached (no Impact).
[77] Overpressure is released due to rupture of tank.

Flash fire envelope for ATF storage Tank

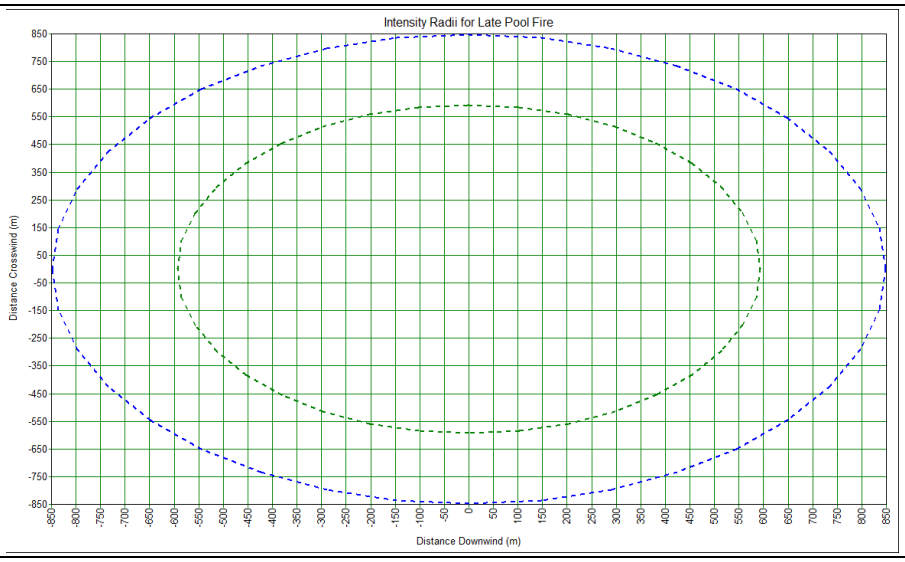


Pool fire results for ATF storage Tank

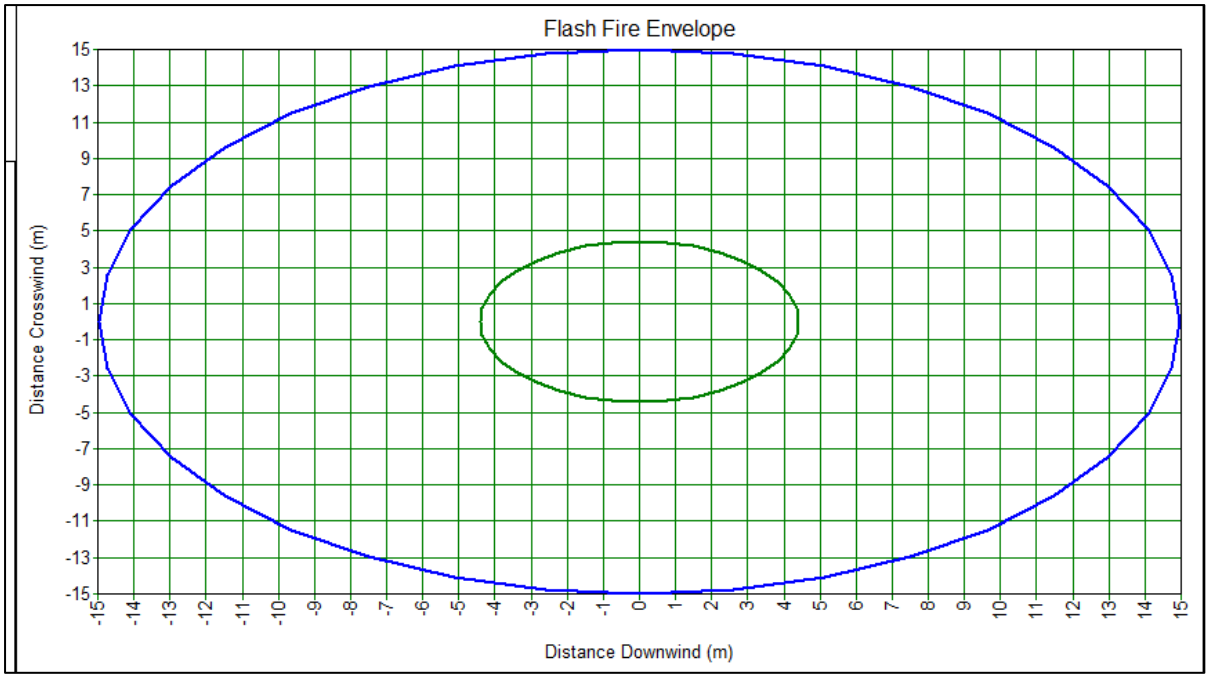
Legend

12.5 kW/m2

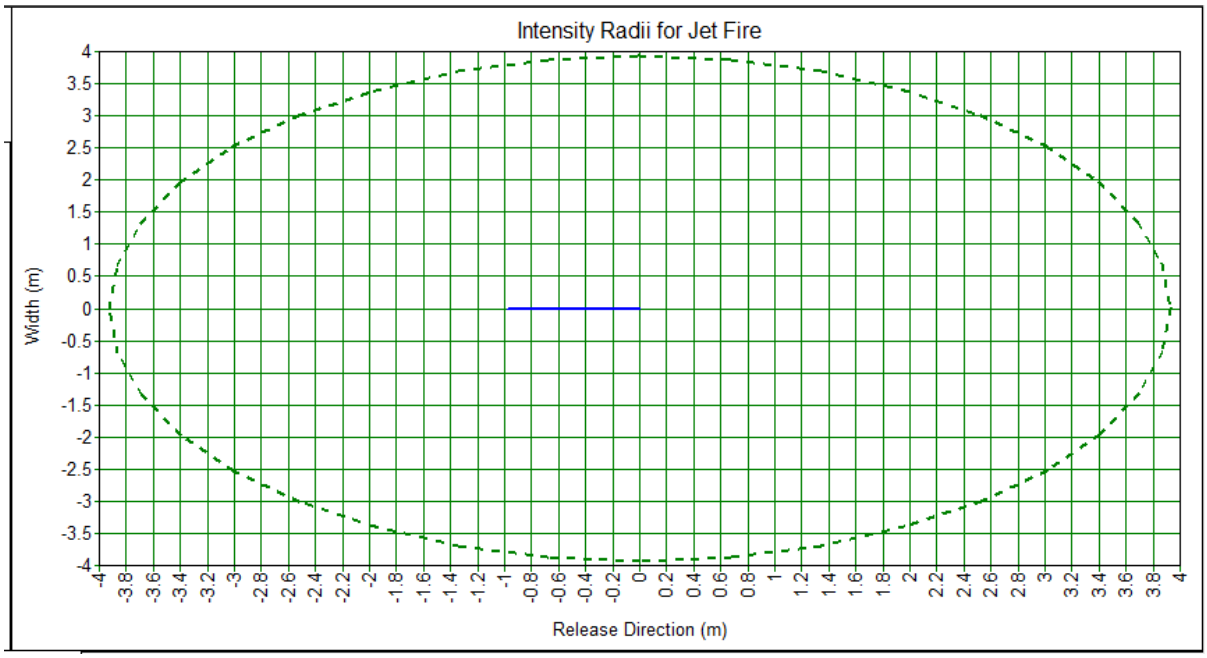
4 kW/m2



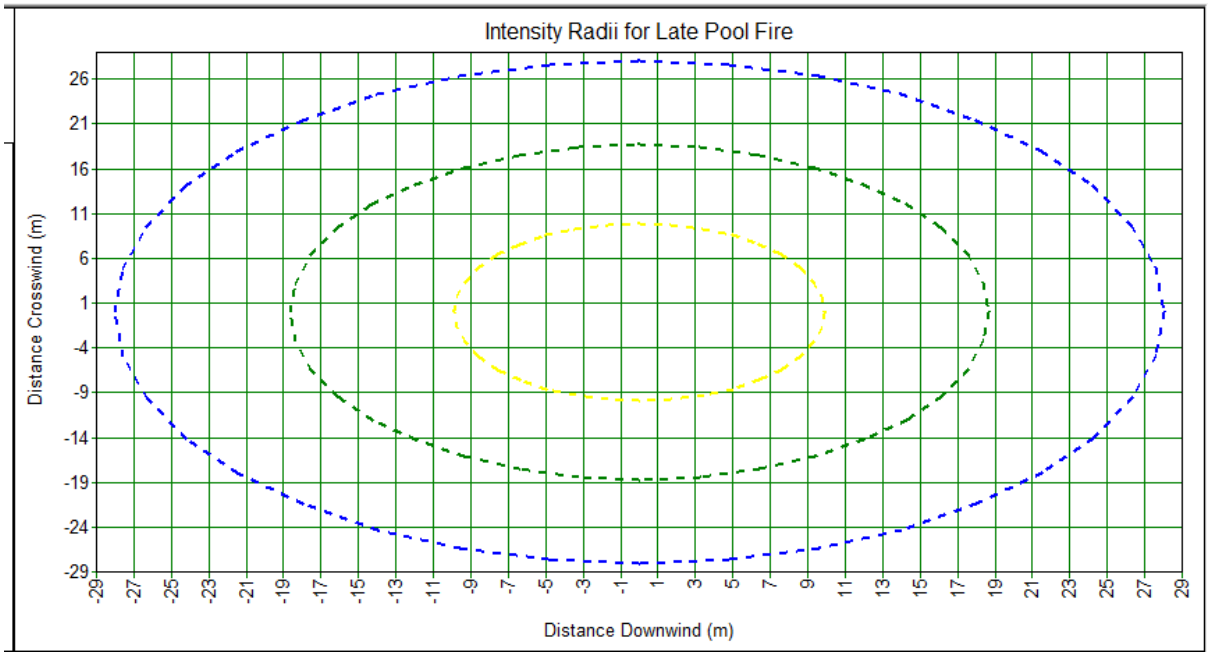
Flash Fire radii in case of 10 MM Leak



Jet Fire radii in case of 10 MM Leak

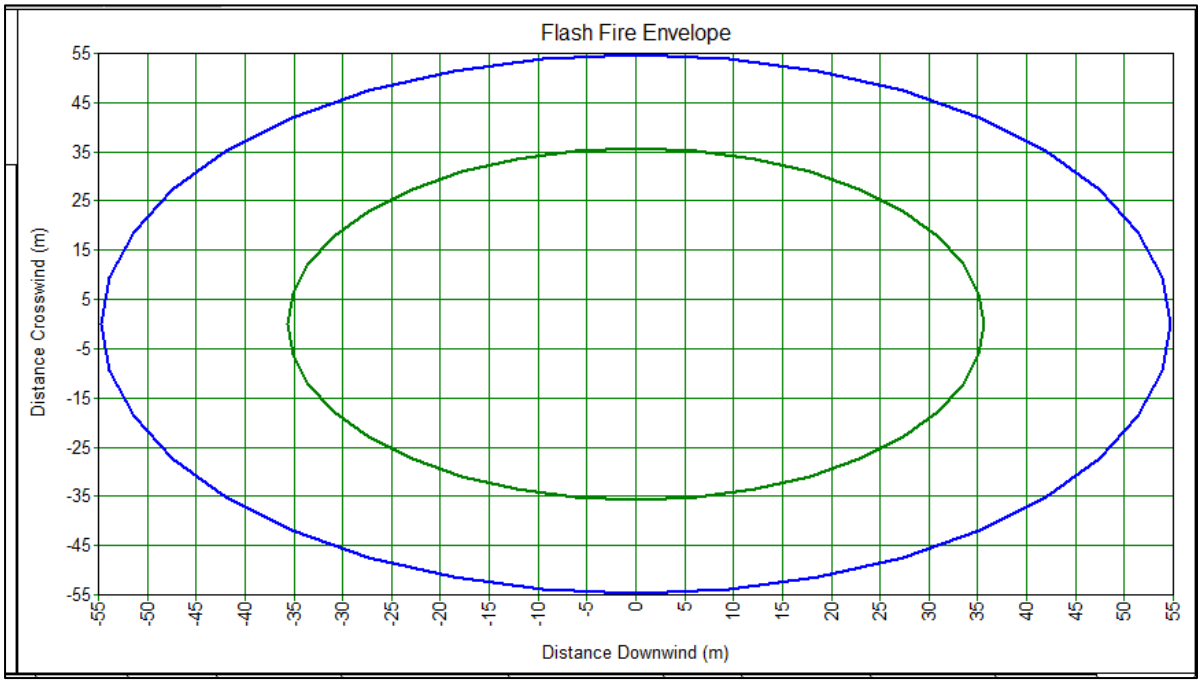


Late pool Fire radii in case of 10 MM Leak

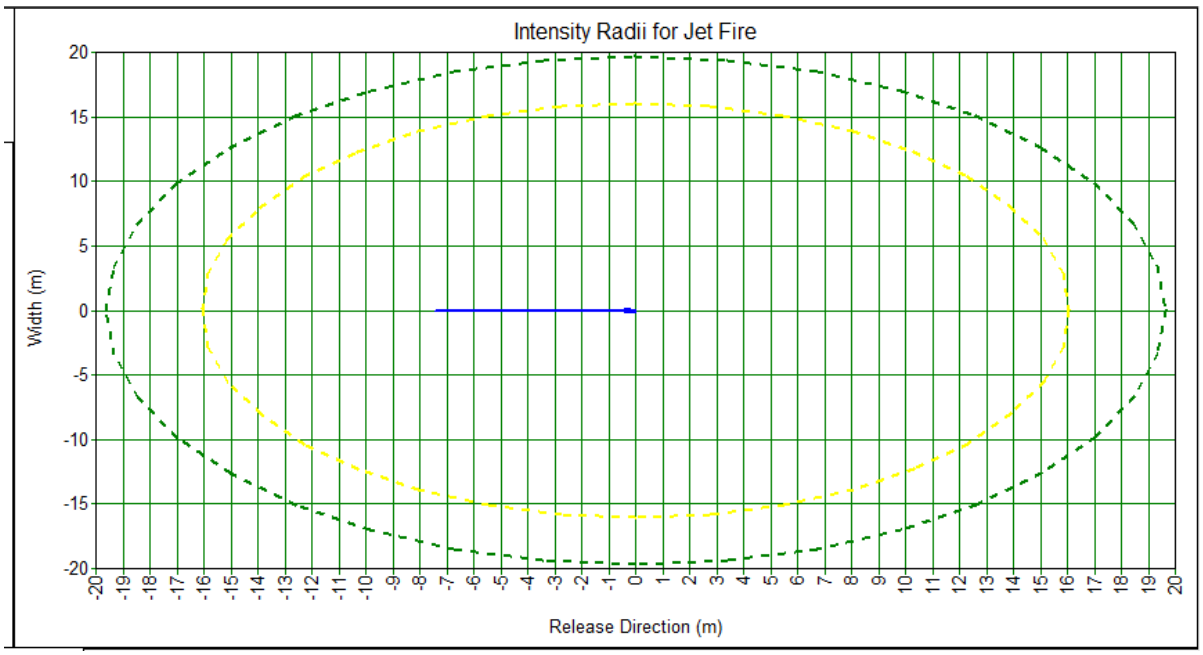


Yellow line: Fatal case; Green line: Physical injury/ damage for property and person; Blue line: Temporary damage, nausea, vomiting, minor injury but no fatality

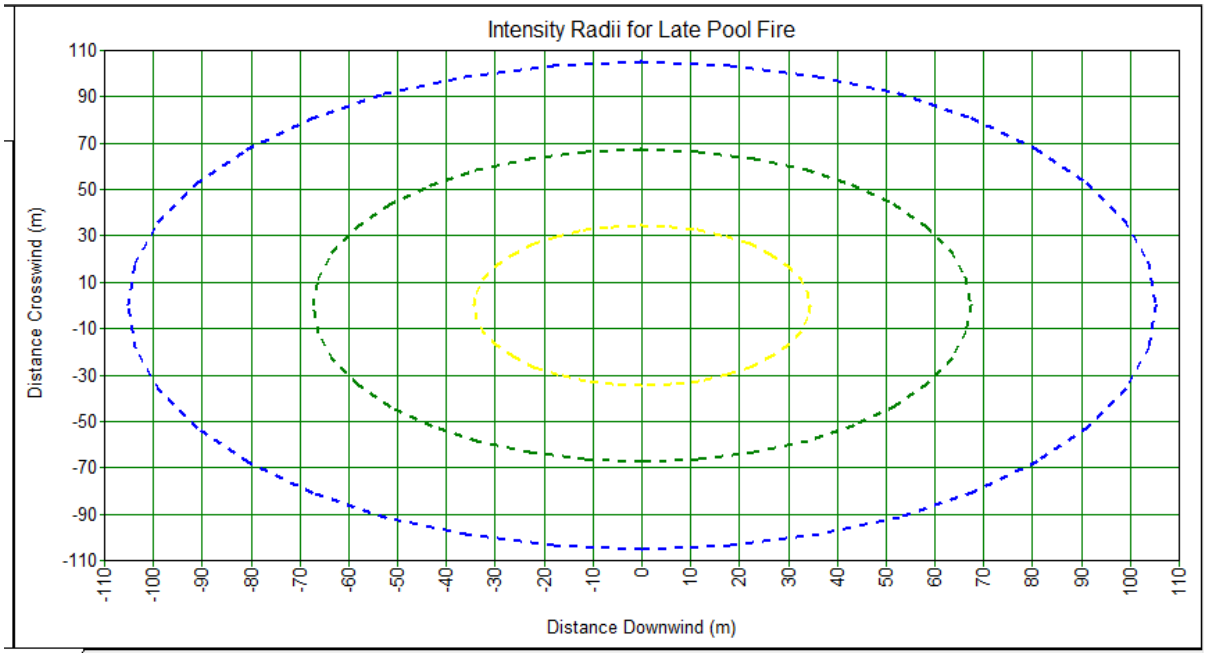
Flash Fire radii in case of 50 MM Leak



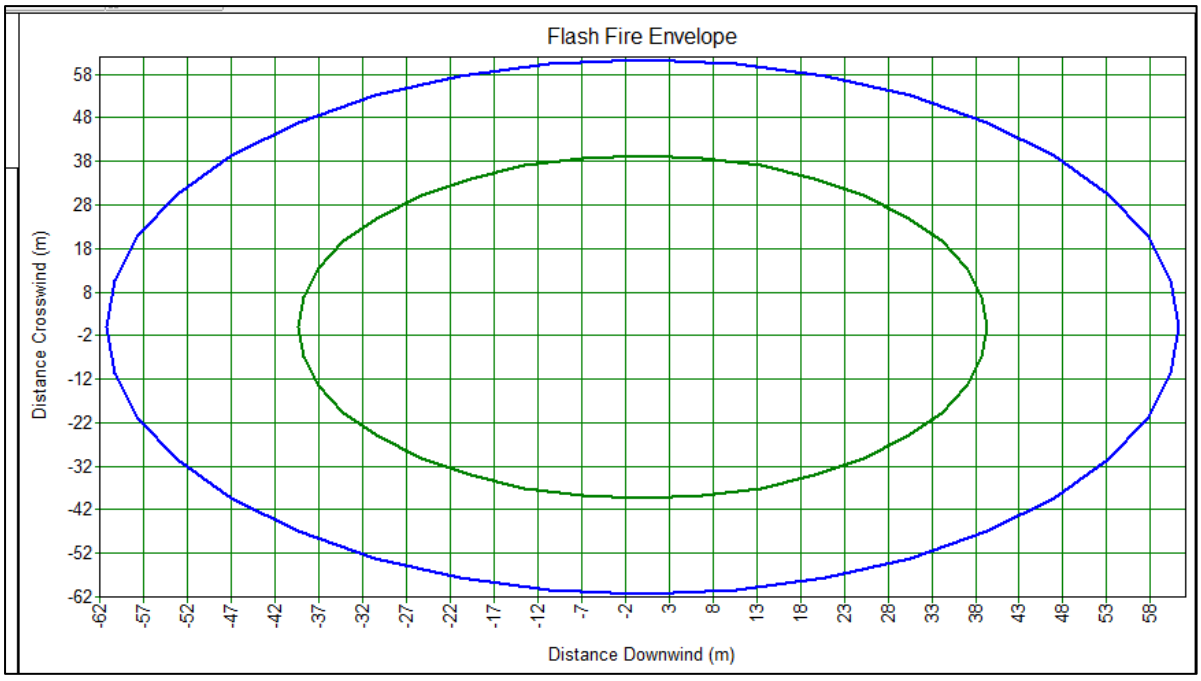
Jet Fire radii in case of 50 MM Leak



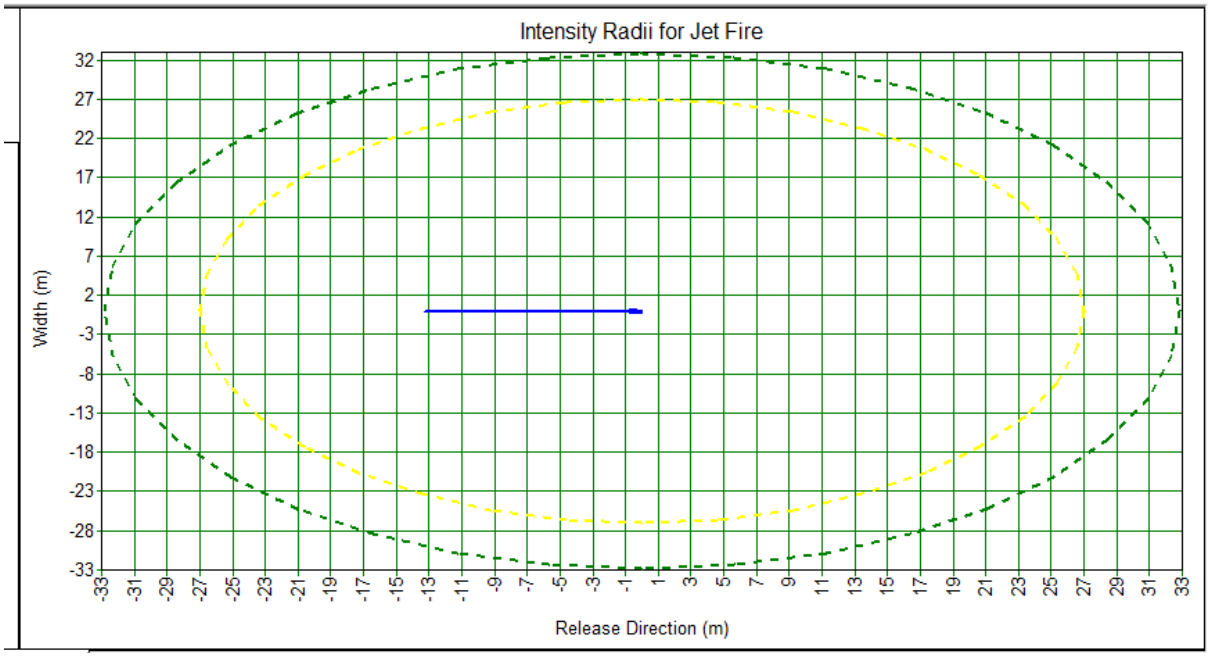
Late pool Fire radii in case of 50 MM Leak



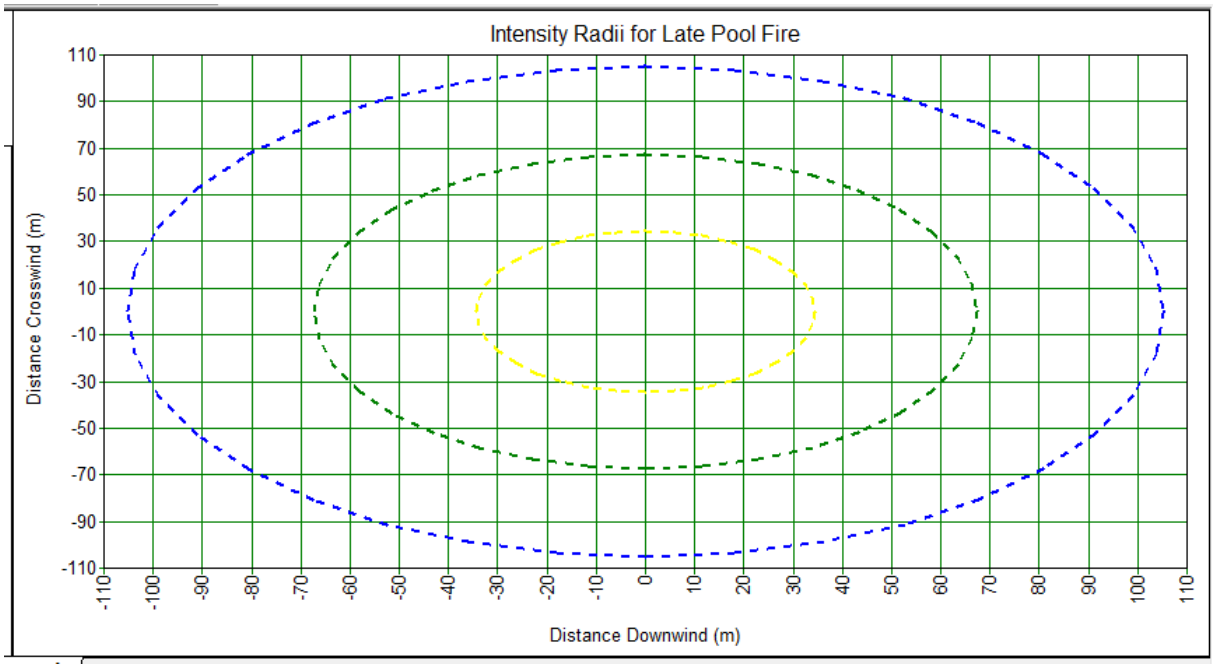
Flash Fire radii in case of 100 MM Leak



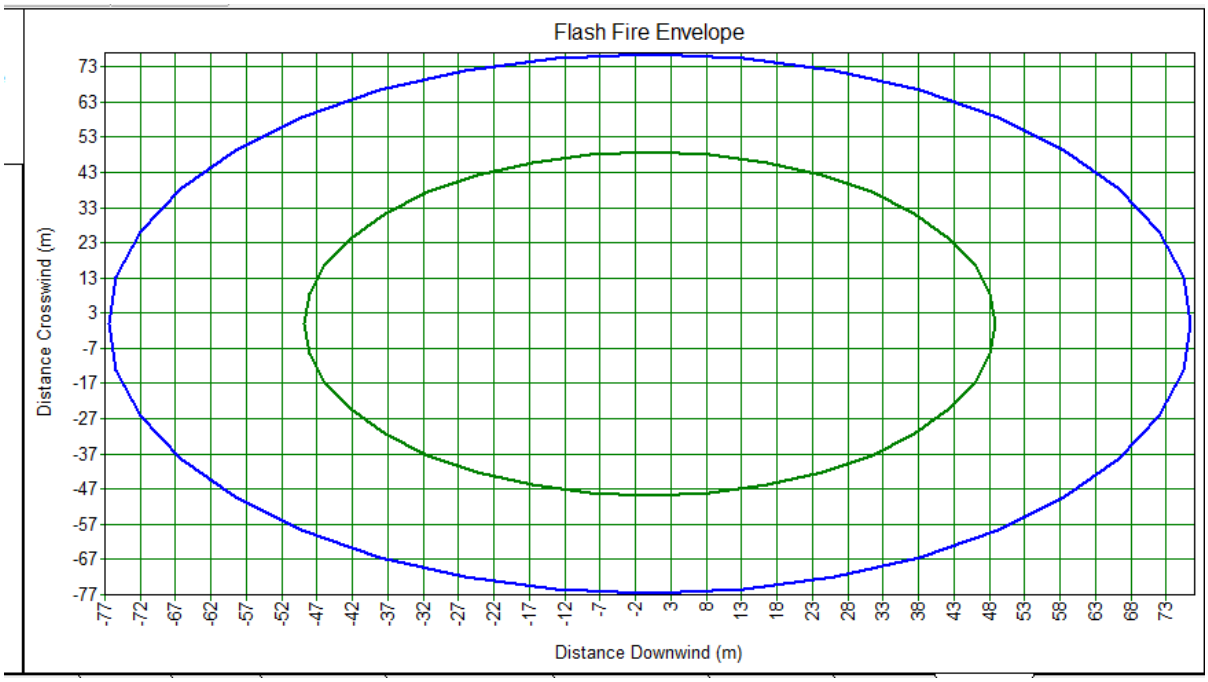
Jet Fire radii in case of 100 MM Leak



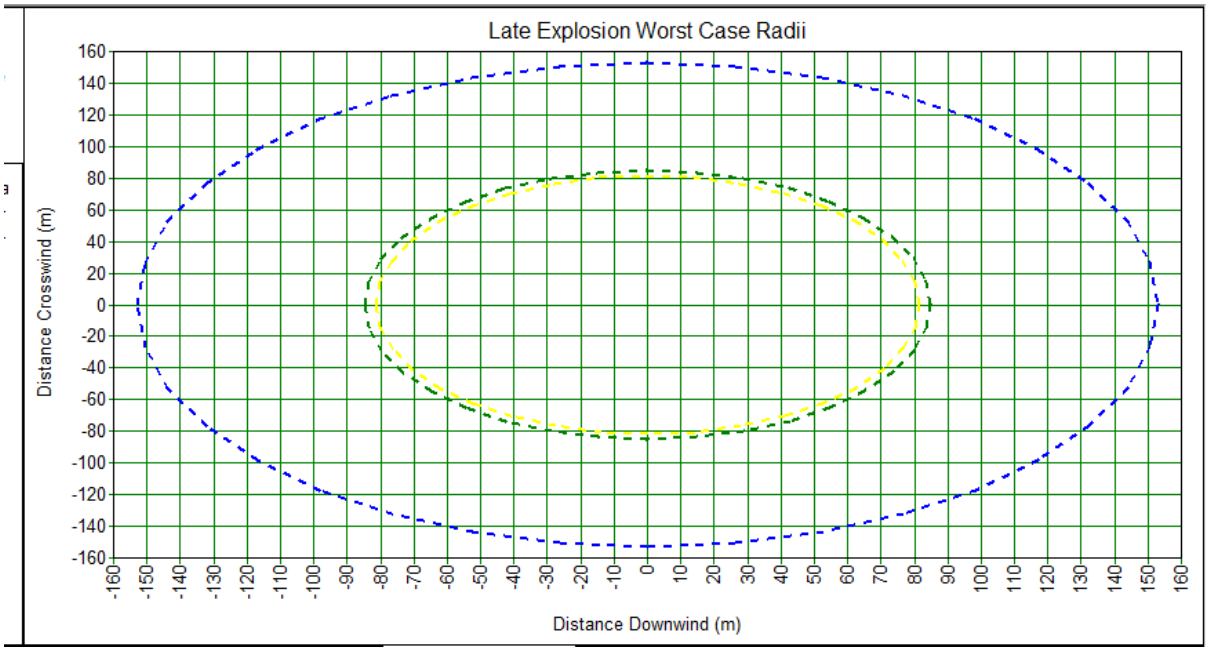
Late pool Fire radii in case of 100 MM Leak



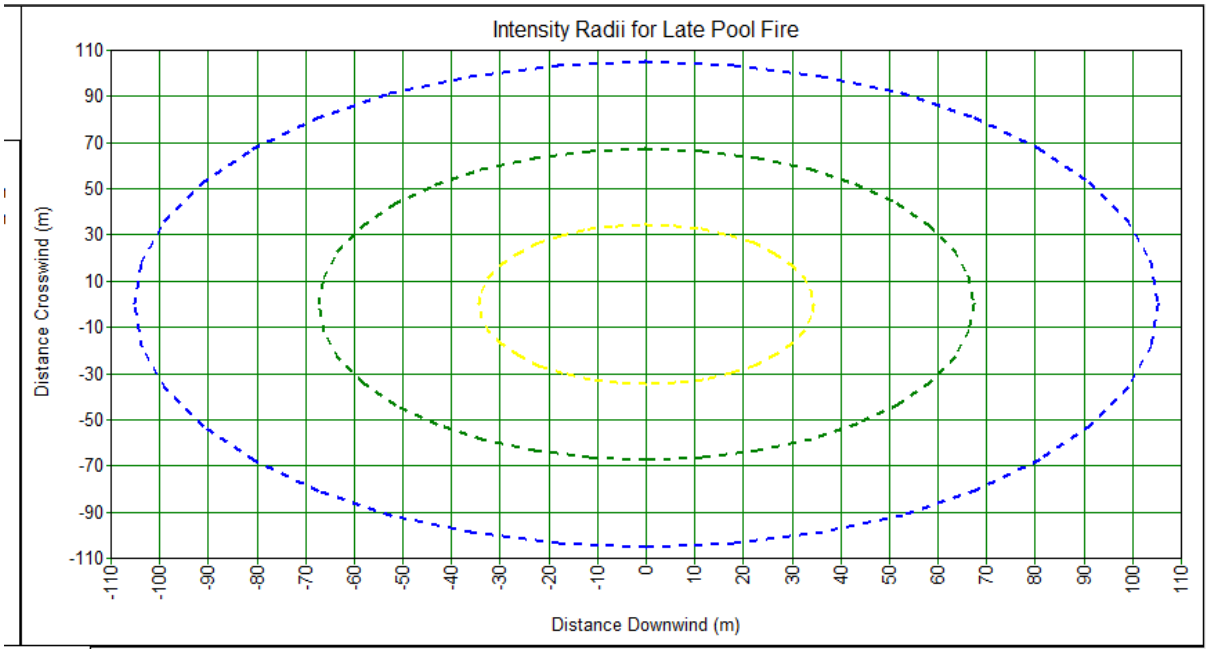
Flash Fire radii in case of Catastrophic rupture of ATF Tank



Late Explosion worst case radii in case of Catastrophic rupture of ATF Tank



Late pool Fire radii in case of Catastrophic rupture of ATF Tank



Mitigation Measures Identified

Recommended risk mitigation measures for fuelling of aircrafts.

i. Earthing and bonding connections are attached and mechanically firm.

ii. Equipment performing aircraft servicing function is not positioned within 3 m radius of aircraft fuel vent openings.

iii. Equipment other than that performing aircraft servicing functions are not positioned within 15 m of aircraft during fuel servicing operations.

iv. The accessibility to the aircraft by fire vehicles are established during aircraft fuel servicing.

v. Handheld intrinsically safe communication devices used within 3 m from the fuel vent is intrinsically safe.

vi. For open hose discharge capacity of the aircraft fuelling system, at least one listed wheeled extinguisher having a rating of not less than 80-B.

vii. Presence of at least 2 x 9kg ABC dry powder fire extinguishers at both sides of the refuelling browser / dispenser is ensured.

viii. Spark plugs & other exposed terminal connections are insulated.

ix. All vehicles, other than those performing fuel servicing, are not driven or parked under aircraft wings.

x. Electric tools, drills or similar tools likely to produce sparks or arcs are not used.

xi. The ground service activities do not impede the egress should there be an emergency.

xii. A clear area for emergency evacuation of the aircraft is maintained at the rear (or front) aircraft exit door.

7.8 Human Rights Risk Assessment

The Human Rights Impact Assessment (HRIA) presents analysis of desktop information, pre-existing studies with on-ground information collected through engagement with different stakeholders. Crucially, independent data was collected through interviews with Project Affected Persons (PAPs), District Revenue Department, community members, Women members, Village representatives, nomadic Shephard and site representative to assess and suggest the required mitigation measures associated with the Project.

The HRIA was conducted based on the rights enumerated in International Labour Organization (ILO) Fundamental Conventions; the United Nations' Universal Declaration of Human Rights; the International Covenant on Civil and Political Rights; and the International Covenant on Economic, Social and Cultural Rights, Equator Principle 4 and applicable national laws were also considered for human right assessment.

A baseline information of human rights in the larger context of India as well as for the specific/ local context issues in Project area were considered as the baseline data for determining the salient human rights risks. The baseline information depicts a larger issue that may potentially impact although not directly on account of the Project. The information from the baseline data and stakeholder's consultation provides insights to further screened the salient human rights at risk for further assessment.

7.8.1 Applicable National Regulatory Framework on Human Rights

Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013

This act regulates land acquisition and lays down the procedure and rules for granting compensation, rehabilitation and resettlement to the affected persons in India. The Act has provisions to provide fair compensation to those whose land is taken away, brings transparency to the process of acquisition of land to set up factories or buildings, infrastructural projects and assures rehabilitation of those affected.

Workmen Compensation Act, 1923 and Rules 1924

The act requires if personal injury is caused to a workman by accident arising out of and in the course of his employment, his employer should be liable to pay compensation in accordance with the provisions of this Act.

The Contract Labour (Regulation and Abolition) Act, 1970 as amended in 2017

This act has been enacted to regulate the employment of contract labour in certain establishments and to provide for its abolition in certain circumstances and for matters connected therewith.

The Contract Labour (Regulations & Abolition) Act, 1970 requires every principal employer of an establishment to make an application to the registering officer in the prescribed manner for registering the establishment. As per Section 12 of the Contract Labour (Regulation and Abolition) Act, 1970 a contractor executing any contract work by engaging 20 or more contract labourers has to obtain a license under the Act. It does not apply to establishments where the work performed is of intermittent or seasonal nature. An establishment wherein work is of intermittent nature will be covered by the Act and Rules if the work performed is more than 120 days in a year, and where work is of a seasonal nature if work is performed more than 60 days in a year.

Minimum Wages Act, 1948

The object of this Act is to promote the welfare of workers by fixing minimum rates of wages in certain industries where labour is not organised, and sweated labour is most prevalent. The Act seeks to prevent exploitation of workers by ensuring that they are paid the minimum wages which would provide for their subsistence and preserve their efficiency.

Section 12 of the Minimum Wages Act, 1948: The employer shall pay to every employee engaged in a scheduled employment under him wages at a rate not less than the minimum rate of wages fixed by the appropriate Government Authority for that class of employees in that employment without any deductions except as may be authorized within such time and subject to such conditions as may be prescribed. Every employer shall be responsible for the payment to persons employed by him of all wages required to be paid under this Act.

Andhra Pradesh Shops & Establishments Act - 1988

The main objectives of the Andhra Pradesh Shops and Establishments Act – 1988 are to protecting the rights of employees. The Act provides regulations of the payment of wages, terms of services, work hours, rest intervals, overtime work, opening and closing hours, closed days, holidays, leaves, maternity leave and benefits, work conditions, rules for employment of children, records maintenance, etc. The same will be applicable during the operation phase to all areas in which the Andhra Pradesh Shops and Establishments Act, 1966 was in force immediately before the commencement of this Act.

The Child Labour (Prohibition and Regulation) Act, 1986

Section 3 under the Child Labour (Prohibition and Regulation) Act, 1986 (CLA, 1986) including amendment in 2016. No child below the age of 14 years shall be employed in any establishment mentioned in Schedule Part A and Part B of the CLA, 1986.

Bonded Labour (Abolition) Act 1976

Rule 4 of the Bonded Labour System (Abolition) Act, 1976 specifies "After the commencement of this Act, no person shall- make any advance under, or in pursuance of, the bonded labour system, or compel any person to render any bonded labour or other form of forced labour."

Equal Remuneration Act 1976

It is the duty of an employer to pay equal remuneration to men and women workers for same work or work of a similar nature.

The Inter-State Migrant Workmen (Regulation of Employment and conditions of service) Act, 1979

The Act seeks to regulate the employment of inter-State migrants and their conditions of service. It is applicable to every establishment that employs five or more migrant workmen from other States; or if it had employed five or more such workmen on any day in the preceding 12 months.

Section 4 of the Act mandates that the Principal Employer registration should be obtained for engaging migrant labour through third party.

7.8.2 Human Right Convention Ratified by India

The following table provides and overview of the core Human Rights Conventions that have been ratified by India.

Table 7-44: Core Human Right Conventions Ratified by India

Sl. No.	Convention	Description
1	Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT)	The purpose of the Convention is to prevent and eradicate the use of torture and other cruel, inhuman or degrading treatment or punishment and to ensure accountability for acts of torture. The Convention provides for each State to take effective measures to prevent torture and other similar treatment or punishment from being practised within its jurisdiction; criminalize all acts of torture or those which constitute participation, complicity, incitement etc.
2	International Covenant on Civil and Political Rights (ICCPR)	The covenant commits its parties to respect the civil and political rights of individuals, including the right to life, freedom of religion, freedom of speech, freedom of assembly, electoral rights and rights to due process and a fair trial.
3	Convention for the Protection of All Persons from Enforced Disappearance	The convention provides the protection of all persons from enforced disappearance such as arrest, detention, abduction or any other form of deprivation of liberty by agents of the State or by persons or groups of persons acting with the authorization, support or acquiescence of the State, followed by a refusal to acknowledge the deprivation of liberty
4	Convention on the Elimination of all forms of Discrimination against Women (CEDAW)	The Convention provides the basis for realizing equality between women and men through ensuring women's equal access to, and equal opportunities in, political and public life -- including the right to vote and to stand for election -- as well as education, health and employment. States parties to the agreement should take all appropriate measures, including legislation and temporary special measures, so that women can enjoy all their human rights and fundamental freedoms.
5	Convention on the Elimination of all Forms of Racial Discrimination (CERD)	The Convention on the Elimination of All Forms of Racial Discrimination ("CERD") is an international treaty designed to protect individuals from discrimination based on race that is both intentional or the result of neutral policies. The International Convention on the Elimination of All Forms of Racial Discrimination commits states to change their national laws and policies which create or perpetuate racial discrimination. The Convention defines “racial discrimination” as “any distinction, exclusion, restriction or preference based on race, colour, descent, or national or ethnic origin which has the purpose or effect of nullifying or impairing the recognition, enjoyment or exercise, on an equal footing of human rights and fundamental freedoms in the political, economic, social, cultural or any other field of public life.”
6	Covenant on Economic, Social and Cultural Rights (CESCR)	The covenant commits to work toward the granting of economic, social, and cultural rights, including labour rights and the right to health, the right to education, and the right to an adequate standard of living. The ICESCR, "comprises of two parts (i) civil and political rights and the other to contain (ii) economic, social and cultural rights.
7	Convention on the Rights of the Child (CRC)	The United Nations Convention on the Rights of the Child is a human rights treaty which sets out the civil, political, economic, social, health and cultural rights of children. The Convention generally defines a child as any human being under the age of eighteen unless an earlier age of majority is recognized by a country’s law.
8	Optional Protocol to the Convention on the Rights of the Child on the sale of children, child	The Convention on the Rights of the Child requires parties to prohibit the sale of children, child prostitution and child pornography. The protocol requires parties to protect the rights and interests of child victims of trafficking, child prostitution and child pornography, child labour and especially the worst forms of child labour. In

Sl. No.	Convention	Description
	prostitution and child pornography	addition, the protocol outlines the standards for international law enforcement covering diverse issues such as jurisdictional factors, extradition, mutual assistance in investigations, criminal or extradition proceedings and seizure and confiscation of assets as well.
9	Convention on the Rights of Persons with Disabilities (CRPD)	The Optional Protocol to the Convention on the Rights of Persons with Disabilities is a side- agreement to the Convention which allows its parties to recognise the competence of the Committee on the Rights of Persons with Disabilities to consider complaints from individuals.

Table 7-45 provides and overview of the ILO conventions ratified by India.

Table 7-45: ILO Conventions Ratified by India

Sl. No.	ILO Convention	Description
1	C029-Forced Labour Convention, 1930	The convention defines the term forced or compulsory labour shall mean all work or service which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily.
2	C105-Abolition of Forced Labour Convention, 1957	Convention obligates each member ratified to this convention to prohibit the use of forced labour as a punishment. Furthermore, it prohibits the use of forced labour for mobilising labour for economic development or as a measure of labour discipline.
3	C100- Equal Remuneration convention, 1951	The Equal Remuneration Convention,1951 lays down the general principle that each State which ratifies it shall promote and in so far as consistent with the methods in operation in its country for determining rates of remuneration, ensure the application to all workers of the principle of equal remuneration for men and women workers for work of equal value.
4	C111- Discrimination (Employment and Occupation) convention, 1958	The Convention provides for the protection of all workers against discrimination, exclusion or preference based on race, colour, sex, religion, political opinion, national extraction, or social origin. Each member to the Convention is required to set up and align national policies to guarantee equality of treatment and opportunity.
5	C 138- Minimum Age Convention	Each member of this convention to ensure the effective abolition of child labour and to raise progressively the minimum age for employment or work to a level consistent with the fullest physical and mental development of young persons.
6	C182-Worst Forms of Child Labour, 1999	The Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour prohibit and eliminate the worst forms of child labour. These include for instance slavery, sexual exploitation, the use of children for illegal activities as well as work which is likely to harm the health or safety of a child.
7	C 87- Freedom of Association and Protection of Right to Organised Convention (Not ratified by India)	Each Member of this Convention requires to take all necessary and appropriate measures to ensure that workers and employers may exercise freely the right to organise. In this Convention the term organisation means any organisation of workers or of employers for furthering and defending the interests of workers or of employers.
8	C 98- Right to Organise and Collective Bargaining Convention (Not ratified by India)	Each Right to Organise and Collective Bargaining Convention lays out rules for the freedom of unionisation and collective bargaining. The Convention ensures workers protection from discrimination for their membership or engagement in union activities.

7.8.3 Key International Guidelines on Human Rights

The key international standards on human rights applicable to the Project are presented below:

US DFC Environmental and Social Policy and Procedures (ESPP), January 2020

ESPP outlines how DFC will put into practice its commitment to the development goals through its environmental and social review and monitoring processes. DFC ensure through its processes that projects receiving support to avoid prejudice and discrimination and respect Human Rights, including the rights of Workers and the rights of Project Affected People.

Applicants are required to establish an ESMS that meets the requirements in IFC PS 1. An acceptable framework for an ESMS is one that provides for the effective management of the environmental and social risks and impacts associated with a project, including risks related to Labor Rights and Human Rights.

United Nations Guiding Principles on Business and Human Rights (UNGPs), 2011

As per the United Nations Guiding Principles on Business and Human Rights, the responsibility to respect human rights requires that business enterprises avoid causing or contributing to adverse human rights impacts through their own activities, and address and prevent such impacts when they occur; as well as seek to prevent or mitigate adverse human rights impacts that are directly linked to their operations, products or services by their business relationships, even if they have not contributed to those impacts.

HRIA is required where a business enterprise causes or may cause an adverse human rights impact, it should take the necessary steps to cease or prevent the impact. In the case a business enterprise contributes or may contribute to an adverse human rights impact, it should take the necessary steps to cease or prevent its contribution and use its leverage to mitigate any remaining impact to the greatest extent possible. Leverage is considered to exist where the enterprise has the ability to effect change in the wrongful practices of an entity that causes a harm.

In the case business enterprise has not contributed to an adverse human rights impact, but that impact is nevertheless directly linked to its operations, products or services by its business relationship with another entity, the situation is more complex.

It is also important for businesses to conduct appropriate human rights due diligence to address the risk of legal claims against them by showing that they took every reasonable step to avoid involvement with an alleged human rights abuse. However, business enterprises conducting such due diligence would not assume that, by itself, this will automatically and fully absolve them from liability for causing or contributing to human rights abuses.

The UNGPs also specify that businesses would establish operational-level grievance mechanisms for individuals of communities who may be adversely impacted.

IFC Good Practice Note (GPN): Managing Risks Associated with Modern Slavery, 2018

The IFC Good Practice Note on Managing Risks Associated with Modern Slavery supports the private sector in the fight against modern slavery. and social due diligence The GPN does not set new standards, but aims to provide practical tools to support environmental, as well as monitoring processes. It also aims to provide an understanding of why action is necessary, how to manage and address issues, and the need for cooperation with others. The GPN is of relevance and practical use for a range of company functions, including management, human resources, sustainability, and procurement.

Voluntary Principles on Security and Human Rights, 2020

The Voluntary principles is a set of tools designed to help companies maintain the safety and security of their operations within an operating framework that ensures respect for human rights and fundamental freedoms and, when applicable, for international humanitarian law. The tools serve as a helpful reference guide to any company seeking to ensure that its operations are undertaken in a manner that ensures respect for human rights and fundamental freedom.

IFC Good Practice Handbook: Use of Security Forces, 2017

The IFC Good Practice Handbook on the Use of Security Forces provides practical, project-level guidance for companies to better understand and implement the requirements outlined in Performance Standard 4 with a focus on risk assessment, managing private security, managing the relationship with public security, preparing a security management plan, and assessing allegations or incidents related to security personnel.

Salient Human Right at Risk Relevant to the Project

The assessment has identified a number of potential human rights risks and impacts associated with the Project activities. The key risks and rights at risk is presented below.

Table 7-46: Salient Human Rights Identified at Risk and Impacted Stakeholder

Sl. No.	Aspect	Risk	Human Right Risk Assessment	Remarks/ Mitigation Measures
1	Potential risk of displacement due to land loss	Right to property and Right to housing	Project affected family-owned land in the project.	**Applicable** The land was procured as per RFCTLARR act 2013 and Andhra Pradesh RFCTLARR Rules, 2014. The private land is acquired from 1465 landowners from 7 villages. Total 405 families are displaced due to the acquisition of land from 4 village habitations.
2	Potential livelihood displacement and pushed towards extreme poverty due to agriculture land take	Right to adequate standards of living		**Applicable** Considering the land acquisition from 1465 landowners and displacement of 405 families may likely to have potential impact on livelihood and standards of living.
3	Potential unsafe and discriminatory labour and working conditions	Right to safe and health working condition. Right to forced and child labour	Workers of GVIAL and workers engaged by its sub-contractors, who will abide by proponent HR policy	**Applicable** Health and sanitation facilities for labour accommodation facilities will be developed following IFC guideline and best practices. GVIAL shall develop corporate ESMS for EHS and OHS management for labours.
4	Protest and unionisation	Right to freedom of association and collective bargaining		GVIAL should provide options for collective bargaining as per the HR Manual/ESMS procedure.
5	Potential community health and safety risks: • Discharge of wastewater • Noise generation • Dust generation • Accident	Right to health and right to clean air	Local community of project site	**Applicable** Community health and safety risk should be managed as per the IFC PS 4 and ESMS procedure developed by GMR group at corporate level and shall be developed at site level by GVIAL.
6	Stakeholders' inability to participate and/ or access remedy	Access to remedy right to equal access to justice	Project affected person and local communities around project site as well as workers.	**Applicable** Project specific SEP plan to be developed and implemented that will address such issues.

8 Environment and Social Management Plan

The purpose of an Environmental and Social Management Plan is to ensure that social and environmental impacts, risks and liabilities identified during the ESIA process are effectively managed during the operation and closure of the project. An Environmental and Social Management Plan (ESMP) is an important component of an ESIA as it provides an important tool that can be used to measure and check, in a continuous mode, the efficacy of the mitigation measures and project commitments incorporated in the ESIA to minimize or eliminate identified negative impacts. The ESMP also aligns the schedule for implementation of management plans.

The key objectives of the ESMP are to:

- Formalize and disclose the program for environmental and social management;
- Provide a framework for the implementation of environmental and social management initiatives;
- Monitor the project proponent's compliance with all the mitigation measures and commitments in the ESIA report;
- Monitor the project proponent's compliance with legal standards and limits for waste discharge and emissions;
- Provide early warning signals on potential environmental changes, so that appropriate actions can be taken to prevent or minimize environmental and social impacts;
- Put in place a sound and cost-effective contingency plan that can be activated for prompt response to any accidental occurrence;
- Encourage and achieve the highest environmental and socio-economic performance and response from individual employees and contractors throughout the duration of the project; and
- Routinely check all measures/devices put in place for effective monitoring of project functions and activities.

The ESMP delineates the monitoring and management measures to avoid and/or minimize such impacts by allocating management responsibility and suggesting skill requirement for implementation of these measures. Also, the ESMP shall ensure a continuous communication process between project proponent, workers (including sub-contractors), local community and other stakeholders.

In addition, the ESMP may also be used to ensure compliance with statutory requirements, and corporate safety & environmental and social management policies.

An ESMP is, therefore, a tool which ensures continuous assessment of the environmental and social impact of a project operation as well as proactive response to the impacts to reduce their overall effect on the identified environmental and social parameters. It makes an organization to do the right thing at the right time rather than responding to situations borne out of statutory or legal compulsion.

In this section, an ESMP is presented to be used for the operation phase of the project. This ESMP will facilitate environmental and social management of the project and procedures are provided to help prevent, avoid or minimize negative environmental impacts that may occur during project operations and decommissioning phase.

8.1 Organizational Structure (Environment, Social, Health and Safety)

The enforcement and implementation of the project specific ESMP requires a robust manpower network working towards the common goal of ensuring compliance to the commitments towards ESHS standards for the project.

The **Head HSE** is responsible to review, monitor and control the HSE related activities whereas HSE Manager and the site engineer act as supervisor for the site. The contractors are controlled by the Site Manager. The project does not attract any significant adverse social impacts or risks as indicated in the previous sections. The project footprint area is limited to its immediate vicinity and a particular range of stakeholders.

8.1.1 Roles and Responsibilities

The HSE department take the overall responsibility for coordination of the actions required for environment and social management and mitigation and for monitoring the progress of the proposed ESMP for the project.

In general, the HSE department shall perform the following activities:

- Preparation of required documents on environmental and social management;
- Ensuring availability of resources and appropriate institutional arrangements for implementation of ESMP;
- Implementation of the health and safety measures;
- Awareness and implementing safety programmes;
- Providing job specific induction training;
- Compliance of regulatory requirements;
- Carrying out environmental audits;
- Identify unsafe acts & conditions and suggest remedies;
- Develop safety culture and comply with company's HSE policy & standards requirements;
- Encourage and enforce the use of PPE's;
- Educate all employees for the use of PPE's & safe practices;
- Promulgate the spread of policy, objectives, rules and/or regulations;
- Perform a thorough investigation of all accidents and review the recommendations to avoid any repetition;
- Monitoring the progress of implementation of ESMP; and
- Reviewing and updating the ESMP as and when required for its effective implementation.

8.1.2 Monitoring and Audit

In order to implement the Environment and Social Management Plan (ESMP), the on-site team should adhere to a time-bound and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP should be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process should cover all stakeholders including contractors, labourers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. Proponent should ensure compliance of requirements of conditions for all applicable permits, suggested action plans and scheduled monitoring. The inspections and audits should be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits should be documented and key findings of which should be implemented in true spirit.

8.1.3 Documentation and Record Keeping

Documentation is an important step in implementing ESMP. The Company will establish a documentation and record keeping system to ensure recording and updating of documents as per the requirements specified in ESMP. The documents should be kept as hardcopies as well as in electronic format. Responsibilities have to be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured through access by and distribution to, identified personnel in form of the following:

- Documented Environment Management System;
- Legal Register;
- Operation control procedures;
- Work instructions;
- Incident reports;
- Emergency preparedness and response procedures;
- Resource consumption Records;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register, and issues attended/ closed.

8.1.4 Training

Training is one common method of supplying individuals with additional skills and knowledge. In order to be successful in EHSS management, training programs need to be thought out carefully and systematically. A robust social and environmental, health and safety training plan is important for effective implementation of ESMP.

The EHS Engineer along with recommendations from EHS Projects and EHS Head (at corporate) will ensure that the job specific training and EHS induction training needs are identified based on the specific requirements of the ESMP and existing capacity of site and project personnel (including the Contractors and Sub-contractors) to undertake the required actions and monitoring activities. Some of the specific trainings that will be carried out routine basis are as follows:

- Procedural guidance;
- Occupational Health & Safety;
- Fire Safety and Prevention;
- Emergency Response Preparedness;
- Operational Training;
- HR Induction Training;
- PPE Training;
- Driver Safety; and
- Implementation of Environmental and Social Management/Action plans

Other training will be identified and implemented during the project lifecycle as per the need assessment, as part of mitigation measure and also capacity building of the staffs.

An environmental and social management training programme will be conducted to ensure effective implementation of the management and control measures of the project. The training programme will ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities;
- Requirements of the specific Action Plans;
- Understanding of the sensitive environmental and social features within the study area; and
- Aware of the potential risks from the project activities.

8.2 Environment and Social Management Plan

The mitigation measures suggested during operation should be part of regular maintenance and monitoring schedule. The ESMP includes the following:

- Mitigations suggested for adverse environmental and social impacts and associated risks;
- Institutional arrangement - management tools and techniques for the implementation of environmental impacts and risk mitigations;
- Monitoring and reporting of requirements and mechanisms for the effective implementation of the suggested mitigations;

Detailed ESMP proposed for the project is given in the ***Table 8-1***.

Table 8-1: Environment and Social Management Plan

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
PRE-CONSTRUCTION PHASE							
1.	Site clearance	• Impact of site clearance on people and standing trees	**Major**	• People require physical displacement to rehabilitated prior to start of site preparation and construction. • Cutting of trees to be completed before start of construction.	**Moderate**	• R&R activities Completed. • Tree cutting yet to be completed	APADCL
2.	Preparation of Campsite	• Campsite Development for workers	**Major**	• Development of labour accommodation standards to adhere to EBRD / IFC guidelines. • Labour accommodation should be provided with all the basic facilities like proper bedding, proper sanitation facility (toilets, bathroom & washing area), clean kitchen area, potable drinking water, waste & sewage management facility, LPG fuel for cooking. No firewood shall be used for cooking. Refer Appendix L for "Living Condition Checklist for Workers Accommodation and Campsite Management" checklist. • The following E&S aspects will be considered for drainage of the labour camp. - Washing and bathing areas in the workers camp to be provided with proper drainage system so that wastewater is not accumulated in the project site. The disposal of wastewater will be routed to the septic tanks and soak pits (or temporary STP) constructed in the labour camp. - The labour camps to be developed as per EBRD/ IFC guidelines and	**Moderate**	Construction of campsite as per the checklist	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				provided with adequate drainage system to drain out the wastewater to avoid any kind of contamination or spread of disease. - The drainage system at the vehicle repairing workshop to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff. Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc.			
3.	Obtaining E&S Approvals	• Notice, penalties due to absence of approvals	**Major**	• The EPC contractor and GVIAL will obtain required E&S approvals such as CTE, CTO, HWM approval, PESO license, water drawl approval, permission for mining, CLRA license, ISMW license and PLI etc. The EPC contractor to maintain compliance of these approvals along with reporting to authorities. • GVIAL to periodically audit and confirm that the compliance to all approvals are maintained throughout the Project.	**Moderate**	E&S Approvals	EPC Contractor and GVIAL
CONSTRUCTION PHASE							
4.	Landuse, Topography, Soil Erosion, soil contamination	• Change in land use, soil erosion and soil contamination	**Moderate**	• Site preparation and development can preferably be planned after a detailed drainage plan has been prepared for the Project site. The following E&S aspects will be considered while for drainage of the site. - There is no natural major drains flowing inside or close to the project site so that the development of airport could majorly alter the drainage pattern of the project site. During the development of	**Minor**	Preparation of drainage plan Preservation of topsoil, erosion control, avoid soil contamination	GVIAL

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				roads and site preparation the drainage courses/ natural gradient to be properly maintained to drain the runoff water from the airport. Adequate drains will be provided within the airport area to drain out standing water in case of waterlogging. The drainage plan to consider highest rainfall of the area, engineering design with respect to natural gradient of the site, ground water aquifer recharge data, stormwater network and impact on the upstream and downstream areas to avoid flooding and inundation. - There is a small village located about 500m from the proposed airport site (Gudepuvalasa village on northward) and planned development of plots/ resorts (500m on western side and about 100m on eastern side) which needs to be taken care while developing the airport drainage plan to ensure that the runoff water from the airport does not impact the village/ community. - Drainage network should be maintained to ensure clear functioning and sufficient water retention capacity to hold the expected waterlogging impacts (in case of extreme/ heavy rainfall). - The Concession Agreement (CA) stipulates at least 50% of all the storm water run-off generated will be harvested which will be used to recharge the aquifer or used as irrigation water. A rainwater harvesting			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				pond is proposed along the main drain alignment path. - If channels/drains get blocked, it will be ensured that they are cleaned regularly especially during monsoon season. • Accidental spills of contaminants on soil should be managed using standard engineering practices. • Fuel and lubricant, chemical, hazardous waste etc. should be stored in impervious storage area. • Disposal of waste should be carried out as per the various waste management rules under the Environmental Protection Act. • Re-vegetation to be done in the area after the completion of construction, in order to reduce the risk of soil erosion.			
5.	Air Quality	• Health impact due to increase load of air pollution. • Exceedance of pollutant concentration in comparison to NAAQS.	**Moderate**	• As construction phase of the Project involved major construction activities, the EPC contractor is required to prepare air pollution prevention plan by adhering to regulatory requirements and industry best practices. These include the following: • Providing with air pollution control devices, acoustic enclosures as per pollution control board guidelines, maintaining appropriate stack heights, regular monitoring etc. • The batching plant, hot-mix plant, WMM plant will be provided with air pollution control devices as per the rules laid down by pollution control board, so as to minimize the release of particulate matter into the atmosphere. • The chimneys of the Diesel Generators to be kept at appropriate height (as per the	**Minor**	Air pollution prevention plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				CPCB guidelines). The DG sets to be properly maintained. • Regular water sprays at the construction sites, dumping sites as well as on roads should be ensured. Necessary clause shall be incorporated in the contractor's agreement. • It shall be ensured that all stockpiles are covered, and storage areas provided with enclosures to minimize dust from open area source. Stock piling and storage of construction material shall be oriented after considering the predominant wind direction. • Loading and unloading of raw materials to be carried out in the most optimum way to avoid fugitives. • Vehicles engaged for the Project will be required to obtain "Pollution under Control" (PUC) certificates. • Sufficient stack height needs to be provided to D.G. sets (if used) as per the CPCB norms. • Raw material to be covered with tarpaulin sheet during transportation and in storage area. • Speed of vehicles on the access road and on the internal site roads shall be limited to 10-20 km/hr in order to reduce fugitive dust emissions. • Cease or phase down work if excess fugitive dust is observed, or there are any community grievances related to dust. Investigate the source of dust and ensure proper dust suppression.			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
6.	Ambient Noise Quality	• Noise pollution due to construction activities	**Major**	• As construction phase of the Project involved major construction activities, the EPC contractor is required to prepare noise pollution prevention plan by adhering to regulatory requirements and industry best practices. These include the following: • Diesel Generator sets to have acoustic enclosures to reduce the noise as per the CPCB guidelines. • Ear protection aids such as ear plugs, earmuffs, must be provided to the workers who have to continuously work in the high noise area. • Proper and regular maintenance/lubrication of machines to be done. • Quieter machines and vehicles with high quality silencers to be used. • Afforestation around the residential colonies and office complexes to be done as proposed under the Green Belt Development Plan. • Mobile noise sources such as cranes, earth moving equipment shall be routed in such a way that there is minimum noise disturbance to receptors. • All the construction machinery and equipment used to be provided with adequate noise mufflers and noise suppression equipment. Proper lubrication and maintenance of the machinery & equipment and vehicle to be carried out to minimize the noise generation due to abrasion.	**Moderate**	Noise pollution prevention plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Honking to be prohibited/ minimized at the site. • Adequate traffic management practices to be followed to avoid any traffic congestions due to the project vehicles. It is also to be ensured that use of local roads is during daytime only and outside busiest hours when the roads are not frequently used by local communities. • Periodic monitoring of noise level to be conducted and compared with the baseline levels of ambient noise. • OSHAS and world bank guidelines to be followed for maintaining noise exposure levels of the construction workers as per occupation standards, workers" exposure to 90 dB(A) noise level to not be more than 8 hours. OSHAS guidelines to be followed for exposure to specific noise levels for workers. • In case of complaints of uncomforting noise received from the inhabitants of nearby settlements possibility of putting noise barriers near to the receptor or alteration of working hours to be considered.			
7.	Water Resource and Quality	• Possibility of contaminated runoff from the site entering the nearby water bodies. • Domestic water runoff from the portable toilets into neighboring water bodies can lead to	**Moderate**	• As construction phase of the Project involved major construction activities, the EPC contractor is required to prepare water pollution prevention plan by adhering to regulatory requirements and industry best practices. These include the following: • Washing and bathing areas to be provided with proper drainage system so that	**Minor**	Water pollution prevention plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
		degradation of water quality.		wastewater is not accumulated in the project site. • Using a secondary container during transfer of oils, grease etc. • During Construction phase provision of septic tank with soak pit/portable STP of adequate capacity for labour camp to be ensured. • Construction of settling tank to settle the suspended impurities from various sources i.e. APP/BM plant, construction sites, etc. before discharging into the main stream. • The drainage system at site to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff. • Oil interceptors shall be provided for refueling areas, vehicle parking, washing areas etc. • Any discharge from the project site to comply with CPCB/APPCB and IFC discharge standards. • Use RMC for pile concreting as well as other building construction work to minimize water consumption. • Explore alternative methods of civil construction work to minimize water consumption.			
8.	Solid and Hazardous Waste	Disposal of Solid & hazardous waste	**Moderate**	• The Project is required to develop a waste management plan including for hazardous wastes as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.	**Minor**	• Prepare Waste Management Plan (WMP) • Records of waste generation and	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				The following recommendations are made for waste management plan. • The contractors shall ensure that the labour camp at the project site have adequate waste disposal facilities. Arrangements for collection of garbage in dustbins and daily disposal to the nearest dumpsite shall be made. • Solid waste to be collected and segregated to the possible limit. A 2-bin system to be used so that food waste and recyclables viz. paper, plastic, glass, scrap metal waste etc. are segregated and stored in designated waste bins/ containers. • The recyclables to be periodically sold to local recyclers while food waste will be disposed through waste handling agency. • Waste/used oil generated from generators and construction machinery and equipment to be stored on paved surface in a secure location at the project site. Appropriate secondary containment to be provided for hazardous waste. • Hazardous waste should not be stored for more than 90 days as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Hazardous waste to be disposed off through authorized vendor only. • Construction debris and excavated material to be stored in a confined area to prevent spread by wind or water. The construction debris to be recycled within the site as far as possible.		disposal to be maintained. • Periodic EHS audits to be conducted to ensure implementation of WMP.	

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
9.	Traffic and Transport	Traffic hazards due to increase in slight traffic volume	**Moderate**	• The EPC contractor to prepare a traffic and transportation management plan to ensure provision of safe and convenient passage for workers, vehicles, pedestrians and general public while using the common access roads and within the construction site. The plan will include the following: • Trucks should not be loaded beyond their load carrying capacity. • Proper access road should be developed for smooth movement of traffic. • Provide necessary training to the drivers for speed restrictions and on do's and don'ts. • Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles. • When practicable, construction traffic movements (equipment and materials) should be scheduled to avoid the peak traffic periods at the beginning and end of each day and other sensitive periods, in order to minimize any potential disturbance to local traffic. • During the development of roads and site preparation all the drainage courses should be properly channelized to maintain the drainage pattern of the area.	**Minor**	Traffic Management Plan	EPC Contractor
10.	Community Health and Safety	Impact on nearby communities	**Moderate**	• The EPC Contractor to prepare a community health and safety plan to ensure health and safety to surrounding villages/ community during construction of Project. The following mitigation measures are suggested.	**Minor**	• Community Health and Safety Plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• All contractors should be bound through contractual provisions to observe environmental, health and safety regulations of the Company, including compliance with local security requirements. Violations of these regulations should result in fines and/or cancellation of contracts. • The proponent to ensure no conflict with community due to different cultural behaviour and sharing of local resources occurs between the labours and residents. • All construction site, activity area, fuel storage area, workshop area etc. should be barricaded and the entry should be restricted to authorized personnel only. ID cards should be issued to all the authorized personnel including the workers, labour, employee, staff, inspectors and visitors. • GVIAL to ensure provision of safe and convenient passage for vehicles, pedestrians and general public to and from roadsides and property accesses, providing temporary connecting road towards villages. • the construction workers to be trained for on social behaviour and community interaction and should be cautioned for not indulging in any unfair means, crime or similar activity at site. • Load carrying vehicle should move at slow speed only to prevent accidents like toppling over, collisions etc. Speeds should be designated for these vehicle as			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				per the load and vehicle violating the rules shall be penalized. • Workers will be advised not to cut/ damage any tree from nearby areas or plantation areas. • No killing / hunting of wildlife to be ensured. • Water should be used from source allotted and no other water sources to be used. • No activities like defecting in open, disposal of garbage in non-allocated area, etc. to be ensured which may lead to land or water pollution. • No damage to any community property should be done like roads, medical center, school, public lights, etc. • Usage of public resources like religious structures, public health centers, school, etc. should be done as per usage norms / guidelines of that facility. • For any clarification, project team should be consulted prior. • GRM procedures to be developed and made aware to all labours and community. The grievances should be resolved on emergency basses and without any biases			
11.	Labour Influx	• Conflict with local people	**Moderate**	• The EPC contractor is required to develop a labour influx management plan to ensure no conflict with local community due to different cultural behaviour and sharing of local resources occur between the migrant labour and community. The following recommendations and mitigation measures are suggested. • To the extent possible, locate the labour camp inside the site boundary.	**Minor**	• Labour Influx Management Plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• EPC Contractor to ensure to restrict the interaction of migrated labour with local community to avoid any conflict. • Adequate supply of safe potable water; • Sanitation facilities for contract labourers: Proper functional toilets will be provided in the labour camp. The disposal of wastewater will be routed to the septic tanks and soak pits constructed in the camp. • Proper and adequate drainage system to drain out the wastewater to avoid any kind of contamination or spread of disease thereby; • Implement onsite vector control measures. • Security Staff will have instructions to ensure women's safety. • All contractors will be bound through contractual provisions to observe environmental, health and safety regulations of the Company, including compliance with local security requirements. Violations of these regulations should result in fines and/or cancellation of contracts. • Undertake health awareness amongst the local community. • Provide necessary training to the drivers for speed restrictions and on do's and don'ts. • Identify route for movement of project vehicles which, should not include narrow village road and road passing through cluster of settlements.			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles. • GRM procedures to be developed and made aware to all labours and community. The grievances should be resolved on emergency basis and without any biases			
12.	Occupational Health and Safety	• Possible Physical injuries associated with Construction work • Other occupational hazards • Accidents during cutting, chipping and piling • Diseases due to unhygienic condition	**Moderate**	• The EPC contractor is required to develop and implement an Occupational Health and Safety Plan throughout the construction phase. The following recommendations and mitigation measures are suggested. • Appropriate OHS programme and procedures to be in place to align with the local regulations, as well as IFC PS-2. • The EPC contractor is required to prepare a job safety assessment and provide adequate PPEs to workforce as per the nature of job and impart periodic OHS training to ensure safety of workforce. • This should include management plans for proper water supply, sanitation, drainage, health care and human waste disposal facilities at construction site. In addition to these, efforts need to be made to avoid water spills, adopting disease control measures, awareness programmes etc. • Labour accommodation should be provided with all the basic facilities like proper bedding, proper sanitation facility (toilets, bathroom & washing area), clean kitchen area, potable drinking water, waste & sewage management facility, LPG fuel for cooking.	**Minor**	Occupational Health and Safety Plan	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Rest area should be provided for the workers at site and workers should not be allowed to rest or lay down on the floor/machine or any other area at the construction site. Provide a cool rest area in which workers can take their meal breaks and tea breaks; • It should be ensured that all contractors and sub-contractors follow the OHS programme and procedures. Provide occupation health and safety orientation training to all employees and workers consisting of basic hazard awareness, site-specific hazards, safe working practices, and emergency procedures. • The contractors will provide training, awareness and supervision to ensure all of its construction workers comply with the OHS procedures; • Transportation vehicle should be in good conditions and should comply with all safety conditions. Transportation vehicle should carry the load according to its capacity. • Person involved for lifting and installation works and those working in heights should be properly trained for the work assigned. • Safety officers and supervisors should be present all the time at site during construction activities. • Firefighting facility should be available at the site. Fire extinguishers should be provided at all areas as per suitability defined in IS: 2190. Fire evacuation plan should be explained to all the workers, staff and visitors.			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• First aid trained personnel should be available at the site and tie ups with the nearby hospital should be made so as emergency situation can be handled. Ambulance or safety motorized vehicle should be available at the site 24 X 7. • An emergency response procedure and infrastructure should be available on Site. Emergency contact nos. (HSE head, SHE officers, Traffic managers, First Aid Personnel, Ambulance, Fire Brigade, Hospital) should be displayed at the site. • Safety guidelines, safety policy, safety slogans should be displayed at the site in English and local language of the area.			
13.	Biodiversity and Ecosystem Services	• Loss, degradation and fragmentation of habitat area • Loss of flora/ fauna • Loss of or loss of access to priority provisioning ecosystem services	**Moderate**	• The following recommendations and mitigation measures are suggested as part of biodiversity and ecosystem services. • Conservation of traditional land-use and vegetation of the Project Site to the maximum extent possible. • Conservation of the natural topography and drainage in and around the Project Site. • Minimization of number, length and width of access roads, with restoration of any access roads not required beyond the construction phase. • Restriction of movement of vehicles and operation of heavy machinery to pre-designated routes. • Restriction of construction activities to daytime hours to minimize impact on local ecology.	**Minor**	• Preservation of local ecological environment through plantation • Implementation of management plan to counter human-animal conflict with respect to venomous snakes.	EPC Contractor

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Avoidance of artificial illumination during night-time • Use low-intensity artificial lighting equipped with downward facing shades to minimize dispersion of the light into adjacent habitats. • Avoidance or damping of construction noise and vibrations to the maximum extent possible. • Plantation of diverse and strictly native vegetation to compensate that lost to site clearance, to off-set project-related impact. As there is no notified grazing area lost hence the impact on grazing land is minimized. • Use of seamed paving instead of contiguous concrete surfaces to reduce hindrance to rain-water percolation. • Install temporary noise reduction or temporary acoustic barriers around the construction area. • Install snake deterrent mechanism at locations of high movement to reduce man animal conflict with (respect to snakes) within the project premises and labour camp. • Implementation of a management plan to counter human-animal conflict with respect to venomous snakes. • Regularly monitoring and remove any carcasses (close to airport boundary), thereby avoiding attracting scavenging raptors, into the project area.			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
B	**Social Management Plan**						
14.	Residual Impact on Land Acquisition	Residual Impact on Land Acquisition due to lost land, resettlement and loss of livelihood	**Major**	• As no Social Impact Assessment (SIA) study was conducted for the Project, hence a comprehensive data is not available (or shared to AECOM) for review to estimate the exact impact on the project affected persons. As the land acquisition resulted into physical and/or economic displacement, and the land was acquired through expropriation in accordance with the legal system of the country, hence the provision of PS 5 is applicable to this Project. In absence of SIA and a comprehensive land database, AECOM recommends prepare/ generating a baseline data of project impacted persons to arrive at the magnitude of actual impact. • As landlessness is envisaged (due to complete physical and economic displacement), but the quantum of livelihood lost couldn't not be assessed due to unavailability of data, the Client may require preparing a supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and take corrective action as per the findings of RAP/ LRP. The Client is required to implement the findings of RAP/ LRP to assess the loss of livelihood among the impacted families. • If any landowner is identified as becoming landless, they should be provided preference in the matters of employment. • If any landowner are identified as becoming landless, they should be counselled to procure cultivable land	**Moderate**	Preparation of Supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and its implementation	GVIAL

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				within close vicinity of the project using compensation money received.			
15.	Impact due to procurement of land (including Vulnerable community land)	• Vulnerability due to landlessness or loss of livelihood • Lack of awareness of usage of compensation amount	**Moderate**	• GVIAL to prepare and implement Livelihood Restoration Plan by identifying the following risks and impacts. • GVIAL to identify the vulnerable PAFs such as landless, WHH, elderly etc. through livelihood assessment study. • The PAFs who are identified to have become landless (if any) after selling their land to the Project need to be provided priority with respect to employment/ engagement during the construction and operations phase of the Project as far as practicable. • GVIAL to explore option for skill-based training interventions, especially for self-employment to women, young and unemployed persons who sold land to the Project. • Procure resources from local suppliers to induce more employment in the supply chain (which may benefit the land sellers). • GVIAL through its contractors should ensure that the construction workforce are being adequately paid by contractors. Also ensure that wages are being paid as per the requirement of minimum wages act. • GVIAL suggest conducting counselling for judicious use of the compensation received for the land sold such as buying irrigable land parcels etc. • A structured awareness programme may include awareness on banking, savings, and investment opportunities.	**Minor**	Preparation of Supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and its implementation	GVIAL

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
16.	Stakeholder engagement and external grievance management	Grievances may arise during the construction and operation phase from the communities and external stakeholders.	**Moderate**	• GVIAL is required to prepare and implement a site specific Stakeholder Management Plan (SEP) for both construction and operation phase of the project and engage with the stakeholders (EPC contractors, regulators, lenders/ investors, impacted persons, community and media perrons etc). • GVIAL and the EPC contract are required to prepare and implement a site specific grievance management plan and made aware to all construction workforce and nearby community. The grievances should be resolved on priority basis. • GVIAL to build organizational capacities as recommended in the management plans and ensure effective implementation of the same.	**Minor**	Prepare project specific SEP and GRM	GVIAL EPC Contractor
OPERATION PHASE							
1.	Noise	• Noise pollution due to Aircraft Operation and different ground activities	**Moderate**	• GVIAL to implement operation phase ambient noise and work zone noise by implementing the following: • The engineering design has taken adequate planning of site for airport location, and orientation of routes for arriving and departing aircraft relative to actual and projected residential development and other noise sensitive receptors in the surrounding area. • In areas where significant impacts are anticipated, implementation of preferred procedures and routes for landing and take-off (LTO) to minimize potential noise from approaching and departing aircraft for noise-sensitive areas to be considered.	**Minor**	• Monitor ambient noise and work zone noise level and mitigation in case of exceedance	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• If necessary, working with local authorities to identify and implement noise prevention and control strategies in noise abatement zones (e.g., sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities. • GVIAL shall prepare Noise Management Plan for compliance of the Airport Noise Standards. • GVIAL shall undertake Airport Noise Mapping as per the requirements specified in the DGCA's requirements considering future aircraft movement and traffic projections of the airport as per the Master Plan of the Airport. Noise mapping shall be displayed at a prominent place of the Airport as well as in the company's website. • Reducing noise of ground operations at the source or through the use of sound barriers and deflectors, as described in the General EHS Guidelines. • Provision of power supply to the aircraft to reduce or eliminate the need for use of APUs;			
2.	Air Quality	• Health impact due to increase load of air pollution.	**Moderate**	• GVIAL to implement operation phase ambient air quality monitoring by implementing the following: • Optimizing ground service infrastructure to reduce aircraft and ground vehicle movements on taxiways and idling at the gate. • Improving ground service vehicle fleets. • Minimizing fugitive air emissions from jet fuel other fuel storage and handling;	**Minor**	• Ambient air quality monitoring to be conducted and mitigation in case of exceedance.	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• In fire-fighting drills, selecting cleaner fuels such as liquefied petroleum gas, avoiding the use of waste oil or jet fuel where possible.			
3.	Water Resource & Water Quality	• Competing water usage • Wastewater generation	**Moderate**	• GVIAL to implement operation phase water quality monitoring by implementing the following: • GVIAL to establish water efficient infrastructures to minimize the water demand. • GVAIL to process wastewater (sewage) in the most efficient way possible. • Treated wastewater shall be recycled for flushing, DG and HVAC colling make up water and landscaping. • GVIAL to adopt rainwater harvesting programs wherever possible to enhance the water availability and sustainability in the region. • GVIAL to implement/manage water efficient landscaping systems, improved cooling tower water management performance for water conservation. • GVIAL to implement spill management and land contamination prevention programs to prevent soil and groundwater contamination	**Minor**	• Water consumption record to be maintained. • Influent and effluent water quality from STP to be monitored.	EHS team (GVIAL)
4.	Solid Waste	• Disposal of solid waste	**Moderate**	• GVIAL to implement operation phase waste management by implementing the following: • Instituting a solid waste recycling program, depending on the existence of local facilities, that should involve placing labeled waste containers in passenger terminals for metals, glass, paper, and plastics. Food establishments should	**Minor**	• Record of waste generation and disposal to be maintained.	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				segregate compostable and other food waste for recycling as agricultural fertilizer and animal feed; Airline operators and airplane cleaning contractors should be encouraged to segregate waste in the airplane by separating the collection of newspapers / papers, plastic, metallic containers, and used pillows. Used pillows should be recycled in furniture manufacturing or as insulation. • Food catering waste from aircraft should be managed according to applicable local regulations. Possible local requirements may include rendering, incineration, or landfilling of food catering waste and mixed waste containing catering waste. • All aviation stakeholders should avoid the utilization of single use plastics. All stakeholders shall explore eco-friendly alternatives to plastics such as use of compostable plastic. • All aviation stakeholders shall work closely with government agencies, local bodies for effective waste management around the airport to ensure reduced bird hazards and safe airport operation.			
5.	Energy Considerations	• High resource consumption	**Moderate**	• GVIAL to prepare and adopt resource efficiency measures including technology and operational improvements to reduce fuel consumption and improve electrical consumption efficiency. • Minimize the energy demand of their infrastructure and operations and move towards less polluting modes of energy and fuel use, including generating and using energy from renewable sources.	**Minor**	• Prepare resource efficiency plan and record of energy consumption and minimization.	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• GVIAL shall explore ISO 50001 systems for Energy Management for effective monitoring and conservation of energy.			
6.	Hazardous Material Management	• Soil and groundwater pollution due to accidental leakage	**Moderate**	• GVIAL to prepare and adopt standard operating procedures for handling hazardous materials. • Waste/used oil generated from generators and construction machinery and equipment should be stored on paved surface in a secure location at the project site. Appropriate secondary containment should be provided for hazardous waste. • Hazardous waste should not be stored for more than 90 days as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Hazardous waste should be disposed off through authorized vendor only	**Minor**	• Record of Hazardous waste generation.	EHS team (GVIAL)
7.	Occupational Health and Safety	• Noise • Physical Hazards • Chemical Hazards • OHS	**Moderate**	• GVIAL to develop and implement an Occupational Health and Safety Plan for the phase by adhering following recommendations and mitigation measures. • Regular electrical safety training to workers with safety procedures and other safety requirements that pertain to their respective job assignments. • Implement Lock out/ Tag Out (LOTO) system. • Use work equipment or other methods to prevent a fall from occurring. Collective protection systems, such as edge protection or guardrails, should be implemented when working at height.	**Minor**	• Develop and implement an Occupational Health and Safety Plan. • Record incident and accident records • Monitoring and implementation. of OHS plans and procedures and provide OHS training.	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Use of personal hearing protection by exposed personnel to noise and implementation of work rotation programs to reduce cumulative exposure. • Operators should provide safety signs and pavement markings for ground support vehicle circulation and parking areas in ramps, taxiways, and any other areas with a risk of collision between ground vehicles and aircraft. • Delineated safety areas should include high risk locations such as jet engine suction areas to protect aircraft service workers; • Operators should train and certify all workers with access to airfield operations. • Workers involved in the operation of aircraft support equipment should be familiar with safety procedures applicable to ramp and taxiway traffic, including communications with the air control tower; • Safety features of ground support vehicles should be maintained, including back-up alarms, moving part guards, and emergency stop switches. • All workers involved in luggage and cargo handling, whether as a regular or incidental aspect of their work function, should be trained in the use of proper lifting, bending, and turning techniques to avoid back injury or extremities. • Presence of at least 2 x 9kg ABC dry powder fire extinguishers at both sides of the refueling browser/ dispenser,			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• All vehicles other than those performing fuel servicing, are not driven or parked under aircraft wings, • Electric tools, drills or similar tools likely to produce sparks or arcs are not used, • The ground service activities do not impede the egress should there be an emergency, • A clear area for emergency evacuation of the aircraft is maintained at the rear (or front) aircraft exit door. • Operators should evaluate the need to implement individual luggage weight restrictions in coordination with airlines, limiting the weight for individual luggage packages to 32 kilograms (70 pounds). • The frequency and duration of worker assignments to heavy lifting activities should be mitigated through rotations and rest periods; · • Operators should consider mechanizing cargo and luggage handling activities, such as the use of conveyors that extend into the cargo holds. • The transformer yard should be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire; and • An accident reporting and monitoring record shall be maintained. • It shall be ensured for appointment of Site-specific health and Safety officer. • Formation of Health and Safety committee for developing and implementing plans and procedure.			

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Manuals regrading Operations and maintenance procedures will be developed and maintained to ensure optimum environmental management of the activity will be produced.			
8.	Biodiversity and Ecosystem Services	• Bird Aircraft Strike Hazard (BASH)	**Major**	• GVIAL has developed a Bird Aircraft Strike Hazard (BASH) for operational airports and recommended to take following actions. • Restriction of movement of vehicles to pre-designated routes. • Restriction of maintenance activities to daytime hours. • Use modern airport lighting systems by integrating newer technologies, such as dimmers, sensors, and time switches, allowing operators to control the emitted light. • Incorporate daylighting in airport design strategy. • Use low-intensity artificial lighting equipped with downward facing shades to minimize dispersion of the light into adjacent habitats. • Ensure that vehicles and machinery used in the project site for operation and maintenance activities comply with the prescribed emission standards. • Restore the soil and natural vegetation of any construction-phase roads which are not necessary for carrying out operation and maintenance. • Adopt operational procedures that reduce aircraft noise such as Continuous Climb and Continuous Decent Approach (CDA) methodology.	**Moderate**	• Maintain records of Bird Aircraft Strike Hazard (BASH)	EHS team (GVIAL)

Sl. No.	Aspect	Impact	Impact Intensity without mitigation	Action	Impact Intensity with mitigation	Monitoring/training Requirement	Responsibility
				• Control night flights during the breeding season of Olive Ridley Turtles to the extent possible. • Any incidents or bird hits should be reported, and location-specific mitigation measures should be employed.			
9.	Labour Rights and Welfare	• Violation of labour and human rights, especially of contractual workers	**Moderate**	• GVIAL through the contractor agreement shall ensure that the construction contractors commit and adhere to social obligations including community relations, handling complaints and grievances, adherence to labour laws and international commitments etc. • GVIAL shall ensure that no child or forced labour is engaged by contractors and all wage payments are done without any discriminations or delays by the contractors. • Similarly, adequate sanitation and waste disposal facility shall be ensured at the project site.	**Minor**	Periodic labour and social audits	EHS team (GVIAL)

8.2.1 Occupational Health and Safety Plan (OHSP)

OHSP provides a guidance document for identifying the potential risks involved in a project operation. This section provides the OHSP applicable to the project, during operation phase of the project. This section also covers the training requirements and safe work practices to be followed onsite to manage various risks involved during the operation phase of the project.

The occupational health and safety plan (OHSP) will address the following:

- Evaluation and Identification of hazards;
- Defining responsibilities to prevent risks;
- Elimination and removal of hazards;
- Control of Hazards which cannot be eliminated; and
- Recovery from accidents.

Risk Assessment

Risk assessment is an important step in protecting workers. GVIAL/ EPC Contractor shall ensure a risk assessment to be performed by a competent person before commencement of operations on site. Such an assessment shall as a minimum:

- identify the risks and hazards to which persons may be exposed to;
- analyse and evaluate the identified risks and hazards;
- document a plan of safe work procedures, including the use of any personal protective equipment or clothing and the undertaking of periodic “toolbox talks” or inductions before undertaking hazardous work, to mitigate, reduce or control the risks and hazards that have been identified;
- provide a monitoring plan; and
- provide a review plan.

Risk assessment includes:

- Identification of hazards, discuss with workers and employees actually working at site, check manufacturer’s instructions or data sheets for chemicals and equipment, review accident and ill-health records, long-term hazards to health (e.g., high levels of noise or exposure to harmful substances) as well as safety hazards etc.;
- Identify who may be harmed and what type of injury or ill health might occur;
- Evaluate the risks and decide on precautions to protect people from harm. Consider if the hazard can be eliminated and controlled so that harm is unlikely.

Control Measures

Following control measures can be implemented to prevent risks identified on project site:

- Organise work to reduce exposure to the hazard;
- Identification of unsafe working conditions, e.g., falls, electrical hazards, heat/cold stress.
- Provide personal protective equipment (e.g., clothing, footwear, goggles etc.);
- Provide welfare facilities (e.g., First aid and washing facilities for removal of contamination);
- Implementation of LOTO; and
- Record the findings by writing down the findings of the risk assessment.

Training Requirements

GVIAL to ensure that every employee / worker (direct or contractual) is aware of the EHS risks associated with the work being carried out at the site and is trained and competent in the relevant work practices and maintenance procedures. GVIAL shall also establish procedures to identify training needs and provide adequate safety training for all levels of employees including contractors. The safety training should provide staff with the knowledge and skills necessary for organising and managing occupational safety and health programmes; team leaders with

leadership skills and knowledge to lead, implement and apply occupational safety and health activities; and workers with the knowledge, skills and right attitudes to enable them to work safely. Training proposed for the project includes but not limited to:

- Induction Training on Health and Safety
- HSE policy;
- Hazards and risks associated with operation and workplace;
- Control measure to eliminate or minimise HSE risks, including safe working systems and procedures; use of personal protective equipment; action to be carried out during emergency;
- Emergency response procedures, such as firefighting and evacuation procedure;
- Toolbox Training or pre-task briefings, highlighting hazards and the method of dealing with them;
- Special Job Hazard Training including entry into confined space and another hazardous environment; and
- Training on first aid

Documentation and Record Keeping

GVIAL and its contractors to maintain data and records concerning the identification of hazards, assessment and control of risks of the ongoing activities. The document should establish and maintain procedures for controlling all relevant EHS documents and data. Such documents can include but not limited to:

- EHS Policy;
- Hazard Identification Records;
- Risk Register;
- Licenses, Certificates, Permits;
- Control Methods including process control and machine design, safe work procedures, in-house work rules;
- Design Drawings;
- Organisation Structure;
- HSE group meeting records;
- Training Records;
- Drill Reports;
- Inspection and Audit Records;
- Incident/ Accident Records; and
- Medical and Health Surveillance Records

GVIAL should communicate and inform any person affected by risks about:

- The nature of risks involved; and
- The control measures or safe work procedures to be taken to address the risks involved.

The risk assessment should be reviewed and revised upon the occurrence of any injuries to any person as a result of exposure to a hazard in the workplace; or where there is a significant change in work practices or procedures.

8.2.2 Traffic Management Plan

A Traffic Management Plan is required for the management of traffic due to movement of vehicles for transport of equipment and material. Additional traffic on the village road can be managed by measures mentioned below.

Management Measures

- Only trained drivers with valid license shall be recruited by GVIAL/ Contractor for transfer of material;
- Training program for all the drivers, regarding awareness about road safety and adopting best transport and traffic safety procedures shall be provided;

- Mitigation measures such as emphasizing on safety amongst drivers, adopting limits for trip duration and arranging driver roster to avoid overtiredness and avoiding dangerous routes and times of day to reduce risk of accident shall also be implemented;
- Regular maintenance of vehicles and use of manufacturer approved parts should be adopted to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- The villagers shall be made aware about the schedule prior to the movement of trucks and transportation in the project area.

8.2.3 Environment and Social Monitoring Plan

Environmental Monitoring Plan

Regular monitoring of environmental aspects during the project operations phase is important to assess the status of environment with respect to baseline conditions. The monitored data can serve as an indicator for any change in environmental quality due to the project activities, and further to take adequate mitigation measures to safeguard the environment.

Monitoring indicators have been developed for each of the activity considering the mitigation measures proposed. Monitoring needs to be carried out within the Area of Influence. Monitoring results would be documented, analysed and reported internally. Monitoring requirements (including monitoring frequency) have been presented in ***Table 8-2.***

Table 8-2 Environmental Monitoring Plan

Sl. No.	Environmental Attribute	Monitoring Parameters	Monitoring Location	Frequency of Monitoring	Responsibility
Construction Phase					
1.	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, O_3, Pb	Project site, Upwind site, Downwind site	Quarterly	EPC Contractor
2.	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A) Leqday and Leqnight	Project site, Dibbalapalem School, M. P. P. School, Gudepuvalasa, Kanchery Village, Patnavanipalem, Near Sunray Beach Resorts	Monthly	EPC Contractor
3.	Drinking Water	IS10500:2012	Labour Camps		EPC Contractor
4.	Soil Quality	Soil parameters viz. pH, SAR, Water holding capacity, Conductivity, Organic Carbon, NPK, Heavy Metals	At the Project Site	Quarterly	EPC Contractor
5.	Surface water quality	IS 2296	Bay of Bengal	Quarterly	EPC Contractor
6.	Groundwater	IS10500:2012	Kavulavada Kancheru	Quarterly	EPC Contractor
7.	Biodiversity Monitoring and Evaluation Programme	BMP parameters	Study area	Quarterly	EPC Contractor
Operation Phase					

Sl. No.	Environmental Attribute	Monitoring Parameters	Monitoring Location	Frequency of Monitoring	Responsibility
8.	Ambient Air quality	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, O_3, Pb	Project site, Upwind site, Downwind site	Quarterly	EHS Team
9.	Ambient Noise quality	Measurement of Noise Pressure Level in dB(A) Leqday and Leqnight	Project site, Dibbalapalem School, M. P. P. School, Gudepuvalasa, Kanchery Village, Patnavanipalem, Near Sunray Beach Resorts	Quarterly	EHS Team
10.	Surface water quality	IS 2296	Bay of Bengal	Quarterly	EPC Contractor
11.	Groundwater	IS10500:2012	Kavulavada Kancheru	Quarterly	EPC Contractor
12.	Treated wastewater from STP	pH, TSS, COD, BOD, NH_3-N, PO_4-P, T. Coli, F. Coli	STP inlet and outlet	Quarterly	EHS Team
13.	Strom water discharge	CPCB Discharge Standard (Schedule VI)	Outlet	During rainy season	EHS Team
14.	Health and Safety Risks	• Sanitation status of onsite office building • Potable nature of drinking water with respect to BIS drinking water standards 10500:2012; • Usage of adequate PPEs; • Electromagnetic field • Adequate Health and Safety Training to workers • Fire Safety measures on site • Incident/ Accident Records • Permit to Work Records • LOTO records • OHSMP of the project		As per EHS monitoring	EHS Team
15.	Biodiversity Monitoring and Evaluation Programme	• BMP parameters	Study area	Quarterly	EHS Team

8.2.4 Emergency Preparedness and Response Plan

The primary objective of formulating Emergency Preparedness and Response Plan (EPRP) is to undertake immediate rescue and relief operations and stabilize the mitigation process as quickly as possible. GVIAL to prepare a Disaster and Emergency plan to be followed at the site:

- Identification and declaration of potential emergencies;
- Signal/warning mechanism;
- Activities and their Levels;
- Command and control structure;
- Individual roles and responsibilities of each specified authority to achieve the activation as per response time;
- Emergency procedures;
- Alternate plans & contingency measures; and
- Co-ordination with external parties

Responsibilities

The Site EHS Coordinator will be responsible for implementing this procedure, which includes:

- Ensuring that the emergency preparedness measures are in place;
- Providing training to the personnel at site regarding reporting of the emergencies, and to site office personnel regarding response to emergency calls from the site personnel,
- Direct action-and co-ordination at the time of an emergency

Identification of Emergencies

Probable emergencies that might arise due to these hazards for the duration of the project have been listed below.

Hazardous Areas

Following potentially hazardous areas and activities have been identified at the construction site:

- Fuel storage areas
- Electrical installations – improper laying of cables
- Switch Yard
- Transformer Area
- Hazardous waste storage area

Emergency Situations

The possible emergency situations identified for the operation phases of the Project are as listed below:

Fire and Explosion

- Leakage of fuel from storage areas; and
- Short-circuit at project site.

Mechanical and Electrical Hazards

- Accidentally dropped object;
- Electrocution.

Occupational Hazards

- Handling of chemicals;
- Electrocution;
- Working at height.

Declaration of Emergencies

Level 1 (Minor Emergency)

All events with no escalation potential and which can be controlled and contained by the action of Safety Officer at the site will be considered as Level 1. In such cases of local alert, Site EHS Manager will be notified. Some typical incidents are:

- Vehicle collision (involving no loss of life);
- Equipment damage;
- Medical Evacuation (not very serious cases);
- Minor fires.

Level 2 (Serious Emergency)

All events with escalation potential, depending on the effectiveness of the local response will be considered as Level 2. These incidents may impact the entire project operations or have cascading effect. For such type of incidents Site Manager will take the lead. Some typical incidents are:

- Substantial security incident / Vandalism;
- Structural collapse;
- Cyclone;
- Serious damage to structures;
- Substantial fire; and
- Cultural conflict.

Level 3 (Major Emergency)

The crisis that requires assistance from external resources in order to save lives, minimize damage and to bring the abnormal situation back under control are Level 3 emergencies. These incidents have the potential to impact beyond the project footprints and affect the community. In such cases appropriate government / regulatory authorities will be informed and involved. Some typical Level 3 incidents are:

- Major fire/explosion;
- Fatality;
- Cyclone.

Personnel on site will know that a Major Emergency has been declared if the site fire alarm siren and /or the local fire alarm systems are activated. The Emergency Siren Modes will be demonstrated and shared with all workers to identify with them.

Level 2 and level 3 will be declared using emergency siren and evacuation shall be done.

Emergency Equipment

The following points should be implemented to tackle emergency situations:

- Onsite emergency equipment such as first aid boxes, firefighting equipment, PPEs etc. shall be maintained at project site;
- The adequacy and availability of emergency equipment shall be assessed at periodic intervals by the EHS Manager;
- Inventory and locations of respective emergency equipment shall be displayed at project office building and other work areas;
- It is to be ensured that the site staff is trained on usage of each type of emergency equipment.

First Aid Boxes

First aid boxes shall be provided at identified locations within the plant premises. A first aid box shall contain, but not limited to the following articles:

- Cotton wool
- Sterile gauze
- Antiseptic lotion
- Box of adhesive dressing (Plasters) for small wounds
- Blunt-ended scissors
- Tweezers for removing splinters.
- Triangular bandages (for making a sling or emergency bandage)
- Safety pins
- Sterile eye dressings
- Crepe bandages
- Aspirin/ Paracetamol tablets
- Skin creams for treating burns
- Antihistamine cream for insect bites and stings

Fire Fighting Equipment

During operation phase, fire extinguishers and sand buckets shall be provided at critical areas such as fuel storage area, waste storage area, areas with electrical installations and project office. Other firefighting systems to be installed should include:

- Heavy-duty ABC powder type fire extinguishers kept at important electrical equipment areas;
- Portable CO2 extinguishers provided throughout the plant

Provision of Personal Protective Equipment (PPE)

Onsite workers and site staff should be provided with adequate number of personal protective equipment (PPEs) to deal with emergency situations. The PPEs shall be stored at the designated Emergency Control Centre (ECC) in the plant premises and will be easily accessible during times of emergency. Training of proper use of PPEs shall be provided to all working personnel on periodic basis.

Assembly Area

Safe assembly area shall be identified and marked and employees to be instructed to gather at the assembly area during emergencies.

Codification of Sirens

The following codes of siren will be following during emergencies:

Table 8-3 Codification of Siren

Sl. No.	Siren	Indicate	Authority
1.	120 seconds Continuous Whelming Sound	On site emergency (alert) for evacuation	Plant Head/ EHS Manager
2.	30 + 30 + 30 seconds Sound with an interval of 5 seconds each	Emergency controlled	Site Manager/ Site EHS Manager

Below points shall be noted during prevalence of emergency situation:

- Emergency siren to be sounded only if required.
- All staff shall be prior informed of use of emergency sirens during mock drills.
- No worker will leave the emergency spot unless ‘all clear’ siren blown.

Coordination with External Agencies

During emergency situations, Site Manager and Site EHS Manager shall form the Emergency Control Centre (ECC). Site EHS Manager shall coordinate with the following departments:

- Fire brigade;
- Police department;
- Hospitals/ Ambulance Services;
- Utility departments (electricity and water);
- Technical departments such as SPCB, Factory Inspectorate etc.
- Local Authorities and District Administration
- District Disaster Control Room, Vizianagaram

Emergency Response Team

- The Emergency Response Team (ERT) shall be set up immediately for the project;
- Each personnel identified as part of the ERT shall be designated specific roles and responsibilities for handling emergency situations.
- The ERT at the operating site under its control will have following role:
- Control the emergency and render the facility premises safe by the application of local resources; and
- Support the local response effort by co-ordinating additional equipment, personnel, and other external resources for the direct response effort.
- The ERT will comprise of the following personnel:
  - Site Manager;
  - Site EHS Manager;
  - Safety Officer(s);
  - Evacuation Officer;
  - Employee/Workers

Emergency Response Procedure

Effective command and control start with a clear definition of the overall command and control structure, and description of the duties of key personnel with specific responsibilities for emergency response. The control of emergencies will consider the minimum number of persons required to provide an adequate response to emergencies.

All emergencies occurring as a result of project activities shall be managed according to the following order of priorities:

- Preservation of Life (self, team, community);
- Protection of the Environment;
- Protection or Property/assets; and,
- Preservation of Evidence.

Reporting and Documentation

The following aspects need to be communicated for the emergency reporting:

- While witnessing or receiving notification of an emergency, as much information as possible should be taken and/or conveyed to the relevant emergency activation authority;
- Where possible, all information should be logged in written form with time and date included and provided to EHS Manager;
- Personnel working on the site may, at any time, be exposed to an emergency which could take many forms, for example (but not limited to):
  - Injuries and/or fatalities
  - Fires and/or explosions

- Extreme weather

- When an emergency occurs, an appropriate and prompt response is required, providing precise action to control, correct and return the site to a safe condition. Timely action will also be required to protect people, the environment and property from damage; and
- All near misses and unsafe acts will be written in logbooks / reported in the 'near miss, unsafe acts, hazards and sub-standard conditions report' and verbally communicated to the concerned Site Supervisor within a reasonable time. All accidents and incidents will be immediately reported to the EHS Manager, and requisite forms completed.

8.2.5 Community Health and Safety Plan

Access control and barricading should be done to prevent the entry of unauthorized persons on construction sites which protect people from exposure to construction site activities and any possible accidents. Following additional mitigation measures should be incorporated to avoid/reduce the potential impacts:

- To the extent possible, locate the labour camp inside the site boundary.
- GVIAL, to ensure to restrict the interaction of migrated labour with local community as to avoid any conflict.
- Development of labour camp as per the IFC Workers accommodation guidelines such as:
  - Adequate supply of safe potable water;
  - Sanitation facilities for contract labourers: Proper functional toilets have been provided in the labour camp. The disposal of wastewater will be routed to the septic tanks and soak pits constructed in the camp.
  - Proper and adequate drainage system to drain out the wastewater to avoid any kind of contamination or spread of disease thereby;
- Efforts should be made to avoid heavy vehicle movement during peak traffic hours.
- Use of open ground, community properties, etc. for project activities or parking should not be done without proper permissions of concern authorities.
- The labour camps should be at sufficient distance from nearby habitations and labours should be instructed about not trespassing any other area.
- Efforts should be made to avoid dismantling / misfunctioning of any community infrastructure like road, gas, telecommunication, etc. without prior permission of concern authorities and due intimation to community which will be affected.
- If there is necessary, then contractor should provide other alternative options for locals.
- All community utilities likely to be impacted, such as sources of water, community centre etc. shall be relocated to nearby suitable places.
- The work scheduled should be arranged to avoid any nuisance to nearby communities.
- Use of agricultural land for storage of construction materials and equipment's should be avoided.
- Work area should be barricaded to ensure public safety and access to such area should be prohibited for locals and passers-by.
- Contractors should display appropriate signage in local language at the construction sites to make the travellers aware of the ongoing work.
- The segregation, storage and disposal of various solid and liquid wastes generated at site should be as per relevant applicable national regulations. Disposal of solid and liquid waste should be done at designated areas with proper permission from concern authorities.
- All construction machinery and equipment's should be operated and maintained regularly in such a way so that air emission, noise or vibration related impacts are minimal on nearby community.
- Implement onsite vector control measures.
- Security Staff will have instructions to ensure women's safety.

- All contractors will be bound through contractual provisions to observe environmental, health and safety regulations of the Company, including compliance with local security requirements. Violations of these regulations should result in fines and/or cancellation of contracts.
- Undertake health awareness amongst the local community.

Construction Area Management Plan

During the construction period, there is a possibility nearby communities are affected by project work. Maintaining construction area is important. Following measures shall be adopted to reduce the inconvenience to the commuters.

- The signage, barricading and other safety and environmental monitoring requirements shall be as per EMP.
- The contractor is required to prepare detailed construction methodology plan covering these areas and get the same approved from GVIAL before commencement of construction work.
- The contractor shall implement the approved Traffic Management Plan and Material Movement Plan.
- Rehabilitate temporary access roads prior to the contractor leaving the site.
- Clearly identify and notify primary routes to the site and issue to all suppliers and Sub- contractors.
- The Contractor shall plan routes to the site for construction purposes in conjunction with GVIAL and affected stakeholders. If the route is passing through the private property, agreements shall be made before starting the construction work. The Contractor shall clearly mark all access roads.
- Where new access roads are constructed, this must be done according to design and specifications agreed by project. GVIAL shall ensure the aspect related to natural drainage and erosion while finalizing the access roads.
- All damaged roads shall be rehabilitated using suitable measures. In the event of rehabilitation work being required on private roads, such work shall be done as per the agreed condition with the private landowner.
- Access roads should be maintained in good condition by attending to potholes, and storm water damage as soon as these develop due to construction activities.
- At no given time, access of any area should be closed.
- All the hazardous material shall be stored properly on the construction site.

8.2.6 Community Development Plan under CSR

As per Companies Act, 2013 it is mandatory to undertake developmental activity for the community of the project affected area. Companies Act, 2013 has introduced mandatory Corporate Social Responsibility Regulations which are effective from 1st April 2014. Section 135 of the Companies Act, 2013 (‘the Act’), read with Companies (Corporate Social Responsibility Policy) Rules, 2014 (‘CSR Rules’) requires every company having:

- Net worth of Rs.500 crore or more; or
- Turnover of Rs. 1,000 crore or more; or
- Net profit of Rs.5 crore or more

GVIAL has developed a Corporate Social Responsibility (CSR) Policy In line with the CSR Regulations. GVIAL may take initiatives for Community Development Plan as per their budget in the project area village(s):

- Employment opportunities to the people who are losing their lands in a manner that is affecting their livelihood resource in project area village(s);
- Creating provisions for generating employment opportunities to the people who are skilled and semi-skilled in project area village, or organise vocational training/skill based training programme in enhancing the skill set of the local youths;
- Extend support towards primary health care facility in the project village;
- GVIAL to support to improve the female literacy in the project village;

- Promotion of education, including special education and employment enhancing vocation skills especially among children, women, elderly, and the differently abled and livelihood enhancement projects;.

8.2.7 Needs Gap Assessment for CSR Initiatives

Analysis of socio economics description and community consultation in Project area village reveals that concern of villagers are linked with the fulfilment of basic needs and improvement of some infrastructural facilities at education/ health, water etc. levels. On the basis of discussion with villagers, schoolteacher and panchayat member, following recommendations have been identified which can be addressed as part of CSR programme.

Table 8-4: Recommendation for CSR

Key Areas	Gap Identified	Recommendation for CSR
Livelihood/Employment	• Total 405 families are displaced due to the acquisition of land. • Among total PDFs, 65 PDFs are from SC community. • The primary occupation of the PDFs are agriculture, animal husbandry and daily wage labourers. • Some of the impacted landowners lost their entire land. • Vulnerable persons such as WHH and elderly (above 65 years) were also observed to be impacted due to the acquisition of land. • Low female literacy rate compared to male. Women are generally engaged in household work, agricultural activities and rearing livestock's. • Lack of skill development facilities among youth in the study area, • Lack of industries in the study area and nearby places.	• Provision of employable skill development centre near the impacted villages. • Priority should be given to PDFs in the employment opportunities in the proposed project. • Preference should be given in procurement of equipment and machinery for the project to generate self-employment opportunities in the area. • Supporting local self-Help Groups (SHGs) to provide self-employment opportunities to women in the study villages.
Health	• As per census 2011, no CHC and PHC in the study villages. T • As reported, nearest CHC available in Bhogapuram Village which is about 10 km from the study villages. • District Government hospital, Vizianagaram is about 30 km from study villages. • The ground water is saline in nature. • Outbreak reported from Polipalli Village/PHC, Bhogapuram Mandal due to consumption of contaminated water in 2010. • Lack of drainage system in the study villages.	• Organizing awareness camp on general health awareness and about water borne diseases and its prevention. • Provision of RO water facilities in the villages for safe drinking water. • Health camps or mobile health clinics can be provided. • Provision and maintenance of drainage system in the impacted villages.
Education	• Low female literacy rate compared to male. • As per census 2011, no study village have the presence of Senior secondary schools.	• Awareness program for female education at village level. This can be linked with vocational training programme of study area village; • Provision for smart classes for students;

Key Areas	Gap Identified	Recommendation for CSR
	• Lack of vocational training for women in study area villages • During consultation, local people raise concern over the quality of education in government school.	• Coordination with education department to improve the infrastructure and learning for quality education in primary schools in the impacted villages.
Livestock	• About 2000 Shepherds families are live in Kongavanipalem and other nearby villages. They open land for grazing. • Currently, project land is used for grazing by few shepherds due to the presence of grass and shrubs in the monsoon season.	• Collaborate with the gram panchayat of the project impacted villages for livestock development program for the provision of fodder to livestock during lean season.

8.2.8 Stakeholder Engagement Plan

Stakeholders are persons or groups who are directly or indirectly affected by a Project as well as those who may have interests in a Project and/or ability to influence its outcome either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interest, the academic community and other businesses . Stakeholder engagement process can be described as a process which engages stakeholders with an aim to achieve certain outcomes. The process enables communication between the community members and the Project proponent. Increased communication between them would lead to a favourable condition and would thereby increase the viability of a project.

The purpose of the Stakeholder Engagement Plan (SEP) is to ensure that the direct and indirect impacted stakeholders of the Project are regularly apprised of the Project activities. The plan has been developed in order to draw out an outline wherein the communication process associated with the activities of the project cycle is to be undertaken.

Stakeholder Engagement and public consultation is embedded in IFC Performance Standards, 2012 on Environmental and Social Sustainability, and Land Acquisition and Involuntary Resettlement. It is pertinent to note that the host country's regulations also cover public participation, consultation disclosure and grievance resolution process in its EIA notification and Land acquisition laws.

Stakeholder Engagement

To ensure the systematic implementation and execution of the stakeholder engagement process certain resources and framework is required to be in place. Certain defined roles and responsibilities of designated personnel can assist in smooth implementation of the stakeholder engagement process. The following personnel can be involved:

Site In-charge: The Site-in-Charge shall assist the Community Liaison Officer/CSR Officer/Grievance Officer to develop stakeholder engagement activity plan for the financial year. The responsibility for assistance with the execution and implementation of the activity would also be the incumbent's responsibility.

Community Liaison Officer/ CSR Officer/ Grievance Officer at the Site level: The Community Liaison Officer shall be responsible for the implementation of the stakeholder engagement and consultation activities. The Community Liaison Officer in consultation with the Site In-charge at the site level shall develop resources and plan for the consultation activities to be conducted. Documentation of all processes such as identification and engagement activities with stakeholders is imperative and shall be done by the Community Liaison Officer/CSR Officer.

ESMS Officer (Corporate) Head at the corporate level: The ESMS Officer shall be responsible for the overall budgeting and monitoring of the stakeholder engagement activities undertaken at the site level. Impact Assessment reports should be reviewed by the ESMS Officer and shall determine the feasibility of the implementation of the activity. To engage the stakeholders, certain process can be followed. The process includes the following procedures:

- Stakeholder Identification and Analysis
- Stakeholder Engagement
- Information Disclosure
- Monitoring and Reporting

Stakeholder Identification and Analysis

The first step involves the identification of all affected communities. They should be identified and classified according to the degree of their vulnerability to the impacts of the project. They can be classified into Direct and Indirect Stakeholders according to their degree of influence of the project and vice versa. The Community Liaison Officer/CSR Officer/Grievance Officer shall be responsible in developing a list of stakeholders according to the degree of impact to identify and classify the stakeholders.

Table 8-5: Stakeholder Analysis

Categorisation	Key Stakeholders Identified	Influence level	Interest Level
Inform	GMR Visakhapatnam International Airport Limited (GVIAL)	High	High
	Andhra Pradesh Airports Development Corporation Ltd (APADCL)	High	High
	Revenue Divisional Office, Vizianagaram	High	High
	Labour Department, Government of Andhra Pradesh	High	High
	Village Panchayats	High	High
	Regional Police Stations	High	High
Monitor	Contractors and its workers	High	High
	Subcontractors and its workers	High	High
	Vendors	High	High
Consult	Direct employees	High	High
	Contractors and its workers	High	High
	Subcontractors and its workers	High	High
	Vendors	High	High
Engage	Project Affected persons (PAPs) and Project Displaced Families (PDFs)	High	High
	Community members of villages	Low	Medium
	Women Community Members	High	Medium
	Employees	Medium	High

Stakeholder Engagement

On identification and classification of Stakeholders, Community Liaison Officer/CSR/Grievance Officer will develop stakeholder engagement activities. These activities would be developed ensuring an effective engagement process with detailed objectives and platforms wherein the views, interests, concerns of different stakeholders are allowed to be communicated. Communicated views and concerns should be considered while making project decisions and formulation of development benefits for affected communities. In order to increase and improve communication with the stakeholder's certain communicative methods have been outlined below:

- **Communicative Methods:** Communicative Methods are to be developed and adopted to ensure proper information dissemination and communication to the affected communities. These methods may vary according to the target audience, and it can comprise of the following:
  - **General Information of the Project:** Information related to the entire project cycle should be made available to the community members. The company website should be updated with the details of the project which should include the purpose, nature and scale of the project. It can also include the list of

risks and impacts that is anticipated. The information related to the project can be displayed at information boards of the local authority's office as well as the company website.

- **Detailed Information of the Project:** Documents like the ESIA report, Environment Management Plan, Stakeholder Engagement Plan and Social Management Plan shall be made available for the stakeholders if asked for. The hard copies of the same should be placed at the project site office.

- **Table 8-6** presents the stakeholder engagement schedule, frequency of engagement, the areas of interest and influence. It also presents the appropriate methods of communication that can be utilised to engage with different stakeholders and the proposed plan of activities.

Table 8-6: Stakeholder Engagement Plan

Targeted Stakeholder	Areas of Influence/Interest	Project Phase	Objective	Communication Methods	Proposed Plan of Activities	Engagement Tools	Frequency
GMR Visakhapatnam International Airport Limited (GVIAL)	Concessionaire Agreement	All	Compliance to Concessionaire Agreement	Submission of compliance reports	Compliance to Concessionaire Agreement	Face to Face Meetings	As per requirements
Andhra Pradesh Airports Development Corporation Ltd (APADCL)	Regulatory Compliance	All	Compliance to regulatory requirements. Regional Socio-economic planning	Information Meetings Permitting and licensing Compliance review	Compliance with regulatory requirements	Face to Face Meetings	As per regulatory requirements and when required
Revenue Divisional Office, Vizianagaram	Regulatory Compliance Resolution of Grievances	Pre-construction and construction phase	Compensation for land, assets, and land litigations Land related grievances	Information Meetings	Compliance with regulatory requirements	Face to Face Meetings	As per requirements
Labour Department, Government of Andhra Pradesh	Regulatory Compliance	All	Compliance to regulatory requirements.	Information Meetings Application/permit Renewal visits	Compliance with regulatory requirements	Face to face Meetings	As per regulatory requirements and when required
Village Panchayats	Local Impacts and opportunities Regional Planning	All	Knowledge sharing and Conduits for consulting with sensitive groups	Information Meetings Local knowledge sharing Participatory planning	Meetings for the local conflicts, project information dissemination, CSR implementation, community health and safety.	Face to face Meetings	Frequent engagement
Contractors and Vendors		All	To appraise about labour working condition and compliance of EHS related aspects	Meetings	Monthly Meetings for the purpose of information dissemination, including information regarding labour laws, local employment	Interactive Sessions	Continual Engagement

Targeted Stakeholder	Areas of Influence/Interest	Project Phase	Objective	Communication Methods	Proposed Plan of Activities	Engagement Tools	Frequency
					opportunities, safety measures and discussions of grievances.		
Community Members (Impacted villages)	Local Impacts and Opportunities	All	Livelihood enhancement Managing and ensuring participation in CSR activities As part of GRM	Focus group Discussions. Public Consultations Participatory Workshops	To enhance skills and diversify livelihood options of the community. Training sessions on skill development To contribute and provide assistance for improvement of the project area. To share/ exchange and develop ideas on better environmental management of the area.	Skill Development Programmes Livelihood Enhancement and Diversification programmes	Frequent Engagement
Women Community Members (Impacted villages along the alignment)	Local Impacts and Opportunities	All	Ensuring participation in CSR activities	Focus Group discussion Participatory Workshops	To enhance skills and diversify livelihood options of the community. Training sessions on skill development Orientation on health, education, sanitation etc.	Livelihood Enhancement and Diversification programmes Orientation program	Frequent Engagement

Information Disclosure

Information disclosure involves delivery of project related information to the community members and ensuring access to such information by other stakeholders. It is a means to communicate with the direct, indirect and external stakeholders of the project. The disclosure information should be communicated in the appropriate language (native), accessible and understandable. Disclosure of information can be done through various means such as display/information boards at local authorities' office, through audio-visual methods such as radio, pamphlets and relevant videos.

Monitoring and Reporting

Internal audits of the stakeholder engagement program should be done. The frequency of the internal audits should be decided upon at the corporate level. Review of the applicability, execution and feedback/response to the programme should be done. At the site level, the Community Liaison Officer and the Site-in-Charge shall be responsible for the monitoring of the stakeholder engagement activities that have been done and ESG/Sustainability/Environment head at the corporate level shall be updated on the stakeholder engagement activities at the site and shall review the stakeholder engagement activities and provide feedback on its implementation.

Record-Keeping

Following Documentation should be done:

- Stakeholders Identified
- Communicative Methods used for Stakeholders, participation during these engagement activities and feedback/responses received.

Minutes of Meetings

8.2.9 Grievance Redress Mechanism

Grievance Redressal Mechanism is an important component of a development project. As when developmental projects are initiated it involves the participation of numerous stakeholders and impacts to existing environment and social scenario are anticipated. Certain changes are expected on the initiation and establishment of development projects. These changes on the one hand may be opportunistic for some individual/groups while on the other it may put certain individual/groups at risk despite attempts to maintain environmental and social accountability.

Introduction and formulation of a Grievance Redressal Mechanism (GRM) will assist in reducing and mitigating the anticipated risks that may arise with the project development. It is understood that the effective grievance mechanisms are a part of broader perspective of addressing human and social rights in the projects. An effective mechanism would be one which is transparent and approachable and would address the concerns promptly in a culturally appropriate manner. The grievance mechanism should be able to inform and complement the existing stakeholder engagement process.

This Grievance Redressal Mechanism to be prepared in accordance with the International Finance Corporation's (IFC) Good Practice Book on 'Addressing Grievances from Project Affected Communities'. The aim of development of the Grievance Redressal Mechanism is to enable the project proponent to effectively address the community and labour concerns in order to ensure the viability of the project in its entire project cycle.

Importance of Grievance Redressal Mechanism

For successful construction and operation of developmental projects, Grievance Redressal Mechanism is an important tool. The primary objective of a Grievance Redressal Mechanism is to develop and promote practices which would ensure creation and sustenance of healthy stakeholder relationships and redressal and expeditious settlement of genuine grievances of the workers and communities. Grievance Redressal Mechanism is a tool which enables risk mitigation as well as a barometer for stakeholder engagement process. Its aim is to be gender inclusive, social class inclusive and a continuous and transparent stakeholder engagement process. It would enable building of trust between the project proponent and the stakeholders thereby bringing about positivity in the entire project cycle. The Grievance Redressal Mechanism is developed with the prime intention of being a primary apparatus for identification of complaints, its subsequent assessment and thereafter the resolution of the complaints.

Steps for developing a Grievance Mechanism

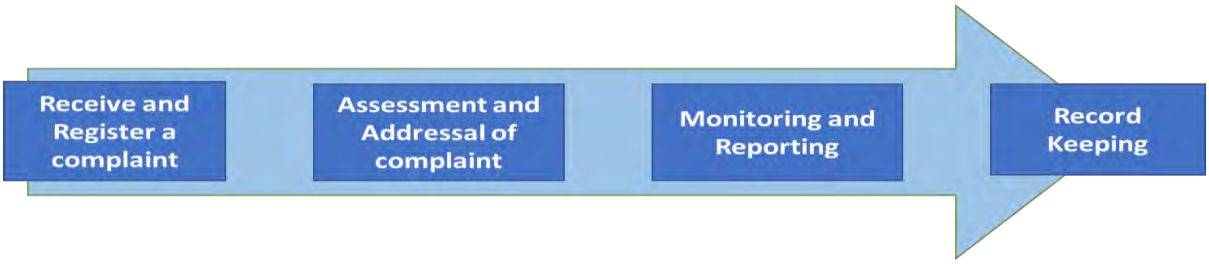
Following section will provide certain recommendations which should be considered while developing a Grievance Redressal Mechanism for the project:

Development of Procedure: VRPL to ensure that there is a procedure in place at the site level to lodge and register complaints. Identification and appointment of a point of contact such as a Grievance Officer is the foremost step to develop a Grievance Redressal Mechanism. It should be followed by the procedure of receiving complaints, assessment of complaints, procedure to identify the appropriate resolution path and decision making on the final resolution process. These procedures are to be given appropriate time frames to ensure effective and suitable redressal.

Development of Responses and Suitable Options: The second step would be to develop appropriate responses for the received/anticipated grievances. Procedures to reach an appropriate resolution should be in place. It could include formal or informal procedures to reach a resolution such as discussions and negotiations. Resolutions can be reached through mediation with the intervention of a third-party generally a community leader or prominent member of the community.

Publicise the Grievance Redressal Mechanism: The information dissemination of the grievance redressal mechanism will be undertaken. Awareness creation of the mechanism will ensure increased involvement of the

stakeholders. Information dissemination to the local community comprises of the next step. The publicising of the GRM can be done through stakeholder engagement activities such as focus group discussions, local community meetings, and development of communicative methods such as printing of pamphlets with the telephone number



of the Grievance officer, installation of grievance boxes at suitable locations, updating of websites etc. The GRM should be documented both in the native language (Marathi) and Hindi for wider outreach.

Training on Grievance Redressal Mechanism: Community members and the workers to be informed on the procedures involved in the mechanism. For the workers, at the time of recruitment and formal induction programme they can also be trained on the workings of the GRM. During these trainings the whole process of the GRM should be discussed. It includes the identification and appointment of a local point of contact, process of registering a grievance, timelines for redressal of the complaints and information on the personnel involved in the redressal process.

Recording of Grievances: After the dissemination of the provision of the Grievance Redressal Mechanism, VRPL would start receiving and addressing the grievances. Required grievances boxes, record books and tracking form should be in order to address and record the grievances.

Resolution and Follow up Action: On receiving the complaints and grievances, the corrective action to be taken should be discussed and implemented within stipulated time frames in each level. Record of follow up action in the form of photographs, agreements between the project proponent and the complainant should be documented for reference purposes.

Appeals: On account of the complainant not being satisfied with the follow up action, the individual should be offered an appeal process. Involvement of the VRPL in the appeal process is encouraged to maintain transparency and accountability.

Proposed Grievance Redressal Mechanism for Project

Grievance Redressal is a complicated process since it involves different temperaments, personalities and individuals. For easy and smooth addressal of the grievances it is mandatory to have a system in place which would look into the functioning.

Formation of a Grievance Redressal Committee:

For the purpose of the successful implementation of the GRM, it is a prerequisite that GVIAL/ EPC contractor identifies a point of contact at the site level and at the corporate level for instances of escalation of grievances.

The formal recruitment of a Community Liaison Officer (CLO)/Grievance Redressal Officer by GVIAL is advised. The CLO/Grievance Redressal Officer shall act as the point of contact at the site level. The functions of the Grievance Redressal Committee are:

- To record grievances brought up by the community members and the workers/management staff. To assess and prioritize the grievances and redressal of the grievances within a stipulated timeframe.
- To inform the aggrieved community members and workers/management staff on the progress of the grievance redressal and the outcome or decisions taken by the committee.
- The Grievance Redressal Committee at the site level should inform the concerned i.e., at the corporate level at the event of escalation. The Grievance Redressal Committee should proactively analyse the received grievance and accordingly act towards redressing it.
- To continually review the existent Grievance Redressal Mechanism and its applicability on the basis of local customary tradition and culture. Thereafter should initiate systemic reforms/modifications if required for better connectivity and implementation of the GRM.

Stages of Grievance Redressal

As grievance redressal would involve a multitude of individuals, information and action responses. It is imperative to develop a structure which would assist in effective information gathering, recording and addressal of the grievances received. The figure below represents the stages of Grievance Redressal:

Receive and Register a Complaint

- Installation of secured Grievance boxes at relevant sites (such as site office, substation) within the project area.
- Dissemination of the mobile-phone number of the Grievance Officer and the local community member as a point of contact for grievances to community members/workers through display at strategic locations in the site.
- A stakeholder with a concern/grievance regarding the onsite safety, community health and safety, compensation related grievance may register a written complaint to the appointed grievance officer and drop the written complaint at the grievance boxes installed at different locations.
- The complainant may have the option of lodging complaints verbally as many may not have the ability to write.
- The complainant should have the option to remain anonymous while registering the complaint.
- Once received, a database in the form of a Grievance Register or computerised database should be maintained.

Assessment and Addressal of the Complaint

- The Grievance Officer is advised to check and open the grievance boxes once every fifteen (15) days.
- The grievances will be assessed by the Grievance Officer in a stipulated time frame of two (02) working days to determine if the issues raised by the compliant fall within the mandate of the grievance mechanism or not.
- During the assessment of complaints, the Grievance Redressal Committee (level I) team will assess the complaints and discuss the key issues and methods to address the issue. The complainant should be made aware of the results within fifteen (15) working days.
- If the grievance cannot be resolved at the Site Level I then the case is forwarded to Level II for redressal.
- The solution for the grievance shall be devised in five (05) working days by the Site In-Charge. On the event of no resolution at Level II, the complainant will have the option to approach the appropriate court of law for redress.
- The complainant will have the opportunity to be present and discuss the grievance at all levels of the GRC.

Monitoring and Reporting

Monitoring and reporting are requisite tools of measuring the effectiveness of the grievance mechanism, the efficient use of resources, determining broad trends and acknowledging recurring problems so that they can be resolved before they reach a higher level of contention. They also create a base level of information that can be used by the project proponent to report back to the stakeholders.

Monitoring

Depending on the extent of project impacts and the volume of grievances, monitoring measures like internal (by identified corporate level staff) and external audits (third party consultants) every once in a year based on the complexity of the nature of grievances can be adopted by VRPL. Grievance records maintained should provide the background information for these regular monitoring exercises. Through the review of each grievance and analysis of its effectiveness and efficiency, VRPL can draw on the complaints to evaluate systematic deficiencies. In addition, monitoring of the grievance mechanism helps to ensure that the design and implementation of the mechanism is adequately responding to stakeholder's comments in a cost-effective manner.

Reporting

All grievances registered have to be recorded and regularly updated. The site management or Grievance Officer is responsible to discharging this responsibility and he should be able to produce this document whenever any audits take place. All minutes of meetings with stakeholders, complainants and Grievance Committee are to be recorded and documented regularly for reference purposes. In addition, through the process of monitoring and the reports produced thereafter, assurance of continual improvement of the company's operations is guaranteed. The company can also use these monitoring reports to report back to the community on its implementation of the mechanism and the modification/ changes proposed to make it more user-friendly.

Record Keeping

The following records are to be maintained:

- Grievance Tracking Form: A Grievance Tracking Form should be prepared. It will enable the GRC to trace the grievances and present similar responses.
- Grievances Record Register: GRC will maintain a Grievance Record Register containing all the received complaints and the actions taken. The Grievance Record Register should include the following details:

Particulars of the complainant:

- Date of Receipt of complaint
- The Name of Complainant (optional in case anonymity is asked to be maintained)
- Address of the Complainant
- Contact Number of the Complainant
- Whether acknowledgement was given at the time or receipt

Particulars of the Grievance

- Subject of the Grievance
- Description of Grievance
- Date of Acknowledgement
- Date of Redress
- Date of the complaint

Maintenance of Minutes of Meetings: The Grievance officer shall be responsible to maintain the Minutes of Meetings with Stakeholders, Complainants and Grievance Redressal Committee

9 Conclusions and Recommendations

9.1 Project Categorisation

The ESIA study aimed to identify and evaluate potential environmental and social impacts associated with all aspects of the construction and operation of the Project. The Bhogapuram International Airport is an entirely greenfield project proposed to be developed on 2203.26 acres of land spreads over seven villages namely Savaravilli, Amatam Ravivalasa, Gudepuvalasa, Kancheru, Kavuluvada, Ravada and Munjeru in Bhogapuram Mandal of Vizianagaram District, Andhra Pradesh. The Bhogapuram International Airport is being developed under a Public-Private Partnership (PPP) model in accordance with the Greenfield Airports Policy of the Ministry of Civil Aviation (MoCA). The Project has received required clearances including the Environmental Clearance from the Ministry of Environment, Forest, and Climate Change (MoEF&CC), GoI under EIA notification, 2006. The Project has also obtained consent to establish (CTE) from Andhra Pradesh Pollution Control Board (APPCB).

Applying the criteria stipulated by the IFC PS, NIIF's E&S Policy and US DFC Environment and Social Policy and Procedures, the Project is categorized as ***Category A***, which implies that the Project is having potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented. The risks and impacts can be mitigated by adopting suitable mitigating measures proposed for the Project. Additional rationale for the above categorization is as below:

- **Key Resource Requirement**:

- **Land:** Total land acquired for the development of Bhogapuram International Airport is 2203.26 acres, which includes 1453.71 acres private land, 505.42 acres of assigned land and 244.13 acres of government land. Land for the proposed project is acquired by the Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014.
- **Power Requirement:** During operation phase the project will require 25 MVA power.
- **Water Requirement:** During Operation Phase the project will require 1727 kld of water including 821 kld of potable water and 905 kld of non-potable water.

- **Sources of Environmental Pollution:**

The potential significant impact includes the following:

- Air Quality: The major sources of air pollution during construction phase are use of machinery and equipment, vehicular emissions, emissions from crushers, dust emission from Aggregate Processing Plant/ Batching Plant. The main sources of airport air emissions include combustion exhaust from aircraft during landing and take-off and ground operation, from ground service vehicles, vapours from fuel storage and handling, and emissions from local ground transportation activities servicing the airport.
- Noise: The construction activities such as operation of construction machinery, vehicular movement, operation of DG sets is expected to have adverse impacts on the ambient noise levels in the area. During operation phase main noise sources will be aircraft noise and ground noise.
- Wastewater Generation: It is estimated that approximately 320 KLD of domestic water will be required for the labour camp. The quantity of sewage generated from labour camps will be 280 KLD (considering 80% of sewage generation from the domestic demand). Sewage will be treated in the septic tank and soak pit/portable STP. The treated water will comply with discharge standards.
- During operation phase, it is estimated that approximately 1254 KLD of sanitary wastewater will be generated. Sewage will be treated in the proposed sewage treatment plant (STP) of 1400KLD capacity. The treated water from the STP will be recycled for flushing, horticulture and HVAC make up water.
- Solid waste Management: Airports produce a large quantity of wastes from a wide variety of sources including waste food from food establishments, packaging materials from retail facilities, and paper, newspaper, and a variety of disposable food containers from offices and common passenger areas.

9.2 Recommendation

An Environmental and Social Management Plan (ESMP) has been developed to ensure that social and environmental impacts, risks are identified during the ESIA process are effectively managed during the construction and operation phase. The ESMP delineates the monitoring and management measures to avoid and/ or minimize the identified impacts by allocating management responsibility for implementation of these measures. To cover all the E&S attributes, ESMP has been divided into following components.

- Pollution prevention plan with respect to air, water, noise and soil (detailed out in ESMP)
- Waste Management Plan
- Occupational Health and safety Plan
- Environmental and Social Monitoring Plan
- Emergency Preparedness and Response Plan
- Community Health and Safety Management plan
- Community Development Plan under CSR
- Stakeholder Engagement Plan
- Grievance Redressal Mechanism

Based on the environmental and social assessment conducted for the Project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures have been stipulated in the ESMP.

9.3 Major Findings and Conclusion of ESIA

This ESIA presents the findings and outcomes of the overall assessment carried out by the AECOM with respect to the applicable reference framework and all identified gaps and issues. Based on the ESIA, an implementable Environmental and Social Management Plan (ESMP) has been developed for the Project to address the identified risks and impacts. The Project is required to implement the following recommendations to mitigate adverse E&S risks and impacts.

Environment Findings

1. As construction phase of the Project involved major construction activities, the EPC contractor is required to prepare pollution prevention plan with respect to air, water, noise and soil quality by adhering to regulatory requirements and industry best practices. These include the following:
    a. Providing with air pollution control devices, acoustic enclosures as per pollution control board guidelines, maintaining appropriate stack heights, regular monitoring etc.
    b. Construction of settling tank to settle the suspended impurities from various plants (HMP/ BMP/WMM) at construction site before discharging,
    c. Provision of dust suppression, raw material to be covered with tarpaulin sheet during transportation and storage,
    d. Provision of oil interceptors for refuelling areas, vehicle parking, washing areas,
    e. Management of waste mater and any discharge from the Project site should comply with CPCB/APPCB and IFC discharge standards.
    f. The EPC contractor to prepare a traffic and transportation management plan to ensure provision of safe and convenient passage for workers, vehicles, pedestrians and general public while using the common access roads and within the construction site.
2. GVIAL is required to prepare Noise Management Plan for compliance of the Airport Noise Standards as per CPCB's requirement[78] under GSR 568 (E) dated 18 June 2018. GVIAL to take necessary noise prevention and control strategies in noise abatement zones (e.g. sound insulation of buildings that are exposed to aircraft noise above levels stipulated by local authorities.
3. GVIAL is required to undertake Airport Noise Mapping as per the requirements specified in the DGCA's requirements considering future aircraft movement and traffic projections of the airport as per the Master Plan

[78] https://cpcb.nic.in/uploads/Standerds/Noise-Standards/Airport_Noise_Standards_06.07.2018.pdf

of the Airport. Noise mapping shall be displayed at a prominent place of the Airport as well as in the company's website.

4. There is no natural major drains flowing inside or close to the project site so that the development of airport could majorly alter the drainage pattern of the project site. During the development of roads and site preparation the drainage courses/ natural gradient to be properly maintained to drain the runoff water from the airport. Adequate drains will be provided within the airport area to drain out standing water in case of waterlogging. The drainage plan to consider highest rainfall of the area, engineering design with respect to natural gradient of the site, ground water aquifer recharge data, stormwater network and impact on the upstream and downstream areas so that runoff water from the airport does not impact the village/ community.
5. The Project is required to develop a waste management plan including for hazardous wastes as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The hazardous waste should be kept in an access controlled and weather proof area with provision of secondary containment and disposed off through authorized vendors.
6. The Project is expected to have a large footprint with respect to consumption of water in both construction as well as operation phase. Though GVIAL has received the water supply approval for the Project, the EPC contractor and GVIAL to ensure water availability through sustainable sources. If the Project decides to use borewell prior permission to be obtained from Central Ground Water Authority (CGWA).
7. As the project is located in an open landscape the possibility of movement of wild animals (such as snakes, monitor lizards etc) cannot be ignored. The EPC contractor to install snake deterrent mechanism at locations of high movement area to reduce man animal conflict with within the project premises and labour camps.
8. The EPC contractor will obtain required E&S approvals (CTE/CTO/ HWM approvals, PESO license, permission for mining, CLRA license, ISMW license, PLI etc.), maintain compliance of these approvals (along with reporting to authorities), conduct construction phase environment monitoring (as suggested in environment monitoring plan), implement good construction practices, dumping/ disposal of wastes in designated area/ through authorised vendors and take appropriate mitigation measures with respect to EHS risks at all times during the construction phase.

Social Findings

1. The EPC contractor is required to develop appropriate labour accommodation standards by adhering to EBRD/ IFC guidelines and BOCW guidelines. The labour accommodation should have basic facilities such as provision of bedding, sanitation facility (toilets, bathroom, washing area separate for male/ female workforce), clean kitchen area, potable drinking water, waste/ sewage management facility, fuel for cooking etc.
2. Washing and bathing areas in the workers camp to be provided with proper drainage system so that wastewater is not accumulated. The disposal of wastewater from workers camp needs to be routed to the septic tanks and soak pits (or temporary STP) constructed in the labour camp. The drainage system at the vehicle repairing workshop to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff. Oil interceptors shall be provided for refuelling areas, vehicle parking, washing areas etc.
3. The EPC contractor is required to develop a labour influx management plan to ensure no conflict with local community due to different cultural behaviour and sharing of local resources occur between the migrant labour and community.
4. Both, GVIAL and the EPC contract are required to prepare and implement a site specific grievance management plan and made aware to all construction workforce and nearby community. The grievances should be resolved on priority basis.
5. GVIAL is required to prepare and implement a site specific stakeholder management plan for both construction and operation phase of the project and engage with the stakeholders (EPC contractors, regulators, lenders/ investors, impacted persons, community and media perrons etc).

Health and Safety Findings

1. The EPC contractor is required to develop and implement a Health and Safety (H&S) plan throughout the construction phase. The EPC contractor is required to prepare a job safety assessment and provide adequate PPEs to workforce as per the nature of job and impart periodic OHS training to ensure safety of workforce.

2. The EPC contractor will maintain records of various permit to work system, working at height, lifting operations, periodic inspection of heavy equipment, keeping health inspection record of workers working in hazardous operations and provide training on OHS aspects.
3. The EPC contractor is required to a develop project specific emergency response plan including provision of fire extinguishers, first aid personnel, ambulance, emergency contact no. etc. along with mechanism of incident and accident investigation and reporting procedure.
4. The EPC contractor during construction phase and GVIAL in operation phase ensure that appropriate earthing and bonding connections are attached to tank farm areas, spark plugs and other exposed terminal connections are properly insulated. GVIAL to ensure the following in operation phase:
    a. Presence of at least 2 x 9kg ABC dry powder fire extinguishers at both sides of the refuelling browser/ dispenser,
    b. All vehicles other than those performing fuel servicing, are not driven or parked under aircraft wings,
    c. Electric tools, drills or similar tools likely to produce sparks or arcs are not used,
    d. The ground service activities do not impede the egress should there be an emergency,
    e. A clear area for emergency evacuation of the aircraft is maintained at the rear (or front) aircraft exit door.
5. GVIAL is required to ensure that the EPC contractor (and other contractors as well) are complying to regulatory compliance, keep overall monitoring with respect Project construction activities, and conduct construction phase quarterly E&S monitoring audit to ensure adequate implementation of the mitigation measures are adhered as suggested in the ESMP.

Land Acquisition and Livelihood Findings

1. The land for the Project was acquired by Government of Andhra Pradesh as per the provision of RFCTLARR Act, 2013 and Andhra Pradesh RFCTLARR Rules, 2014 in a span of 7-8 years between 2015 and 2022. The land acquisition involved compulsory government driven acquisition process through expropriation and compensation was paid to land owners as per provisions of the said Act. As no Social Impact Assessment (SIA) study was conducted for the Project, hence a comprehensive data is not available (or shared to AECOM) for review to estimate the exact impact on the project affected persons. As the land acquisition resulted into physical and/or economic displacement, and the land was acquired through expropriation in accordance with the legal system of the country, hence the provision of PS 5 is applicable to this Project. In absence of SIA and a comprehensive land database, AECOM recommends to prepare/ generate a baseline data of project impacted persons to arrive at the magnitude of actual impact.
2. As landlessness is envisaged (due to complete physical and economic displacement), but the quantum of livelihood lost couldn't not be assessed due to unavailability of data, the Client may require preparing a supplementary Resettlement Action Plan or Livelihood Restoration Plan (LRP) and take corrective action as per the findings of RAP/ LRP. The Client is required to implement the findings of RAP/ LRP to assess the loss of livelihood among the impacted families.
3. The Project had acquired land from total 1465 landowners in 7 villages. A total of 405 families were displaced due to the land acquisition from 4 villages (or hamlets) namely Rellipeta, Bollinkalapalem in Gudepuvalasa Gram Panchayat and Mudasarlapeta and Maradapalem is under Kavulavada Gram Panchayat. Two resettlement colonies have been developed to rehabilitate 405 PDFs in Gudepuvalasa and Polipalli villages in an area of approximately 17 acres and 23 acres, respectively. Each PDFs were provided 5 cents (240 square yards) of land and INR 9.70 lakh as per Schedule 2 of RFCTLARR Act 2013 for construction of houses and for other provisions. During site visit, AECOM noted that the few facilities (such as community hall, temple, road and drainage construction) were under construction at the R&R colony. NIIF to take an update with respect to completion of all facilities in these two R&R colonies.
4. The Project may create employment generation during construction and operation phase. To offset the loss of livelihood the GVIAL/ the EPC contactor may priorities offering unskilled, semi-skilled employment opportunities to local people especially the impacted land owners.
5. Compensation for lost land and assets were paid to landowners between 2016 and 2022. At the time of site visit, the compensations were paid to all the affected persons (landowners), except 111 landowners of 39.86 acres land. As reported by GVIAL, there are 7 court cases are pending on 39.86 acres of land on the title

disputes in the Vizag Tribunal for which compensation was deposited by the State Government in the designated account. As the matter is under litigations due to title disputes in the Vizag Tribunal, the compensation was deposited by the state government in the designated account. Hence, NIIF is required to obtain the present status and resolution of litigation to safeguard its reputational risk.

6. Except the 7 court cases, there are another 54 cases pending with LARR Authority[79] involving demand for additional compensation on 156 acres of land. The entitled compensation amount has been deposited by the State Government with the LARR Authority in the year 2022 and 2023. The petitioners are being advised by APADCL to approach LARR Authority to look into their claims and accordingly the State Government will take final decision on the enhanced compensation amount. As entire land has been already acquired and in possession of APADCL (also handed over to GVIL) the construction of Project can start. On closure of cases, APADCL will deposit additional compensation amount with LARR Authority for payment to the entitled persons who have filed the cases. NIIF is required to obtain the present status, deposit of additional compensation and closure of cases to safeguard its reputational risk.

[79] Under section 51 of the LARR Act, the government for the purpose of providing speedy disposal of disputes relating to land acquisition, compensation, rehabilitation and resettlement, establish, an Authorities to be known as — the Land Acquisition, Rehabilitation and Resettlement Authority (LARR Authority).

Appendix A : Physical Risk Assessment

Assessment ratings reflect both an SSP2-4.5 and SSP5-8.5 climatic scenario, unless otherwise specified in the notes.

Physical Risk Assessment-Construction

Climate Hazard	Likelihood of climate hazard occurring	Climate-related impact	Likelihood of climate-related impact occurring	Consequence (description)	Consequence (rating)	Overall risk rating	Notes
Higher annual average and daily maximum temperatures and more hot days >35°C	High	Increased heat stress/ heat exhaustion of worker's	Moderate	Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism); disruption to construction programme; frequent breaks of workers due to extreme heat	Moderate	Moderate	Though temperature is increasing, and the area falls under very high zone of heatwave as per ThinkHazard and IMD Hazard record, personal protective equipment and safety gadgets shall be provided to workers during construction phase. Working shift will be there and safety plan will be put in place in case of accidents. Construction activities will take place in shorter period against operational phase. Hence, moderate risk.
Higher annual average and daily maximum temperatures and more hot days >35°C	High	Overheating of equipment/machinery and safety risks associated with flammable equipment; Damage to airfield pavement surface during construction; increase needs of cooling capabilities	Moderate	Reduced revenue and disruption to construction programme due to increase costs in airport infrastructure; airports' inability to accommodate infrastructure, additional firefighting services	Low	Low	No heat sensitive and flammable equipment is used. Heat resistant pavements will be designed. Cooling tower is proposed in case of additional cooling requirements. All cable wires will be well laid underground to avoid heat stress. For protection against any electrical fault, proper earthing will be equipped. Hence, low risk though there is rise in temperature.
Higher annual average and daily maximum temperatures and more hot days >35°C	High	Potential damage to road surfacing due to prolonged exposure to high intensity temperatures, leading to road subsidence and possible temporary road closure until repairs are conducted	Low	Delays to the delivery of construction materials and construction workers to the site	Low	Low	As mentioned above, safety measures will be taken up and temperature will not be that high that might lead to road surfacing. Hence, low risk.

Climate Hazard	Likelihood of climate hazard occurring	Climate-related impact	Likelihood of climate-related impact occurring	Consequence (description)	Consequence (rating)	Overall risk rating	Notes
More frequent and longer drought	High	Increased risk of soil erosion from exposed soils during construction	Moderate	Stability risks of ground conditions and potential interruptions to construction.	Low	Low	Though drought or water stress is highly expected as per ThinkHazard and falls under moderate zone as per IMD Hazard record, construction activities such as drilling, soiling etc. would take place within the project site only. Soil erosion or any mounting activities with respect to soil will be taken into consideration by investigating soil quality, soil bearing capacity and soil resistivity for safe bearing capacity and its stratification by an experienced and reputed agency. Based on this investigation, the foundation structure will be designed. Therefore, low risk.
More frequent and more intense heavy precipitation	High	Potential flooding and waterlogged construction site hampering movement of machinery such as disruption in ground transport; damage of airfield infrastructure and construction equipment	Low	Financial costs; insurance implications; disruption and delay to construction programme due to insufficient capacity of storm drainage; contamination of groundwater due to inundation; disruption to ground transport links during construction; damage to construction infrastructure from standing water; failure of electrical systems including lighting and signage due to inundation; debris deposition restricting access; new equipment acquisition and new training requirements	Low	Low	As per ThinkHazard and IMD Hazard record, flood in this area is classified as moderate zone. Adequate drainage will be provided, and flood management plan will be prepared. Therefore, disruption and damage to construction equipment and other activities due to inundation is not anticipated. Hence, low risk.
More frequent and more intense heavy precipitation	High	Risk of communicable diseases & epidemics due to waterlogging; inundation of airfield	Low	Risks of safety incidents during construction	Low	Low	As stated above, such risks are not anticipated. Hence, low risk.

Climate Hazard	Likelihood of climate hazard occurring	Climate-related impact	Likelihood of climate-related impact occurring	Consequence (description)	Consequence (rating)	Overall risk rating	Notes
More frequent and severe wildfires and heatwaves	High	Damage to structures and construction equipment; risk to human health & life	Low	Disrupted construction programme and construction supplies, loss of assets, reconstruction costs & loss of life	Low	Low	Though heatwave is projected to increase over the region, no dense forest near or within the site is located. Hence, such types of issues may not be anticipated. However, heatwaves may pose likely risk to human health while exposing during daytime. To address this, personal protective equipment and safety gadgets will be provided to the workers during construction activities. Hence, low risk.
Increased frequency of cyclones / tropical storms	High	Unable to access construction site due to surface water flooding of roads; damage to structures and construction equipment; delay of service; temporary compounded by storm surge; construction site closure; movement and deposition of debris onto construction site; roadway damage	Moderate	Disrupted construction programme; loss of assets; reconstruction costs; workers unable to get to site; reduce business impacts due to safety of equipment & workers; increase maintenance requirements & costs; electrical system failure/shortage/spike; communication system failure; destruction or damage to construction transport assets	Moderate	Moderate	As per IMD cyclone report and ThinkHazard, the region falls under high cyclone vulnerability zone with extremely high surface wind speed. As per Indian Ministry of Housing's Building Materials & Technology Promotion Council (BMPTC), the region falls under very high damage risk zone of cyclone. Heavy precipitation and high wind associated with cyclone could be expected. However, adequate drainage system will be provided, buildings will be designed to address risks from water ingress and flooding, storm water barriers will be designed and installed. Airport Emergency Centre will be developed to address the necessity and importance of emergency response planning including safety and efficiency. Hence, moderate risk.
Increased frequency of heavy winds (not related to cyclones)	Unknown	Damage to structures and construction equipment; dust settlement due to prevalent wind movements or erosion; destruction of construction transport assets,	Unknown	Disrupted construction programme; loss of assets; reconstruction costs; workers unable to get to site; dust accumulation picked up by high winds; increase in maintenance and repair;	Unknown	Unknown	Climate projections regarding wind are highly variable, and as such a robust assessment of risk is not possible. However, AECOM notes that the Indian Ministry of Housing's Building Materials & Technology Promotion Council (BMPTC) has the project area rated as very high damage risk zone with basic wind speeds of 50 m/s. As per IMD

Climate Hazard	Likelihood of climate hazard occurring	Climate-related impact	Likelihood of climate-related impact occurring	Consequence (description)	Consequence (rating)	Overall risk rating	Notes
				debris deposition onto construction site			Hazard record also, the region falls under high zone of extreme wind speed with very high zone in post-monsoon season. However, extreme wind load is calculated & taken into consideration. Hence, prevention measures would be taken up.
Potential loss or damage due to sea level rise	Low	Disruptions and damage on construction site due to waterlogging; temporary closure of construction site during recovery from hide tide or storm surge; limit to access.	Low	Disruptions to workers; hampering movement; deposition of debris; water level elevation nearby construction area; increase in maintenance and repair costs; emergency procedures & operations.	Low	Low	Though sea level rise is increasing, the boundary of the proposed airport area is quite far from high tide line (minimum distance of 671 m). Hence, low risk.

Physical Risk Assessment-Operation Phase

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
Higher annual average and daily maximum temperatures and more hot days >35°C	High	High	Increased heat stress / heat exhaustion of workers and outdoor staff and passengers; hazardous working conditions for airport staff affecting workforce	Moderate	Moderate	Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism); frequent breaks of outdoor staff due to extreme heat; reduced operating efficiency due to health impacts on airline staff, flight crew due to heat stroke; personal and passenger discomfort due to strains on AC; negative customer experience, reduced visibility such as visual and signal line of sight issues to pilots and staffs	Moderate	Moderate	Moderate	Though temperature is increasing, and the area falls under very high zone of heatwave as per ThinkHazard and IMD Hazard record, personal protective equipment and safety gadgets shall be provided to workers and employees. Working shift will be there and safety plan will be put in place in case of accidents. Parts of employees shall stay and work inside the airport building and flight cabin with proper cooling provision. As for outdoor employees, schedule cooling breaks with drinking water will be provided. Hence, moderate risk.
Higher annual average temperatures, daily maximum temperatures, more hot days >35°C and more intense and frequent heavy precipitation	High	High	Increased risk of disease transmission (e.g., malaria and dengue fever, improved growing conditions for algae and potentially harmful micro-organisms in water courses).	Low	Low	Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism).	Low	Low	Low	As stated above, any impacts that is likely to be faced by workers and employees will be taken care of. Hence, low risk.
Higher annual average and	High	High	Overheating of transformer cooling	Low	Low	Maximum take-off restrictions; reduced rate	Low	Low	Low	No heat sensitive and flammable equipment is

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
daily maximum temperatures and more hot days >35°C			fluids, equipment /machinery and safety risks associated with flammable equipment; deterioration of heat sensitive surface; limit to operations performance; risk of ignition by higher fuel requirement			of climb & increased fuel consumption; maintenance costs & fuel consumption due to higher take-off thrust; reduced capacity stress due to optimizing fleet; demand for additional cooling; increase cooling costs in terminals & other infrastructure such as Air Traffic Control Towers; overhaul; failure of electrical systems; concrete pavement buckling damaging runways; increase in maintenance/repair of runways, taxi-ways and other heat vulnerable surfaces and infrastructure; changes to safety criteria & procedures due to reduced aircraft take-off performance				used. Heat resistant pavements will be designed. Cooling tower is proposed in case of additional cooling requirements. All cable wires will be well laid underground to avoid heat stress. For protection against any electrical fault, proper earthing will be equipped. Airport will be designed as per ICAO and DGCA standard. Hence, low risk though there is rise in temperature.
Higher annual average and daily maximum temperatures and more hot days >35°C	High	High	Reduced carrying capacity of lines, increased losses in lines /transformers/equipment sensitive to heat stress; temperature-driven changes in demand for air travel in business & economics	Low	Low	Reduced revenue, airports' inability to meet demand and accommodate certain aircraft, destination changes, noise insulation; additional firefighting services; potential recruitment or redeployment of staff, reduced payload capacity resulting in reduced revenue in business	Low	Low	Low	Same as above.

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
Higher annual average and daily maximum temperatures and more hot days >35°C	High	High	Potential damage to access road surfacing due to prolonged exposure to high intensity temperatures, leading to road subsidence and possible temporary road closure until repairs are conducted.	Low	Low	Financial costs; insurance implications; disruption to operation due to airports' inability to accommodate certain demand	Negligible	Negligible	Negligible	No such damage is anticipated. As mentioned above, safety measures will be taken up and temperature will not be that high that might lead to road surfacing. Hence, negligible.
Higher annual average and daily maximum temperatures and more hot days >35°C	High	High	Transmission line cladding heat expansion causing sagging.	Low	Low	Risk of fire and electrocution; increase in bird strikes and wildlife interactions due to species migration patterns caused by temperature-driven changes	Low	Low	Low	Though there is increase in temperature, no heat sensitive equipment is there. Air traffic will be control and managed by ATC. Cables shall be laid underground to avoid any heat stress. Fire extinguisher is also available in case of any heat related damages. Hence, low risk.
More frequent and longer drought	High	High	Accelerated land degradation, and soil erosion	Low	Low	Stability of ground conditions and potential interruptions to operations.	Low	Low	Low	Though drought or water stress is highly expected as per ThinkHazard and falls under moderate zone as per IMD Hazard record, soil erosion or any activities with respect to soil will be taken into consideration by investigating soil quality, soil bearing capacity and soil resistivity for safe bearing capacity and its stratification by an experienced and reputed agency. Based on this investigation, the foundation structure will be

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
										designed. Therefore, low risk.
More frequent and more intense heavy precipitation	High	High	Flooding of airfield, airport building, utility cables/tunnels, infrastructure, and ground transportation; drainage system failure; damage to airport infrastructure from standing water including substations, runways; deterioration of pavement structure and runway friction due to contamination of pavement surfaces; potential damage to access road surfacing, leading to loss of access for maintenance; low visibility; debris deposition.	Low	Low	Disruption to operation; unplanned shut-down or temporary closure; flight delays & cancellation; disruption in ground transport; prevention of employees, passengers & freight to ground transport access; restrict access to airport and air traffic facilities; take-off & landing issues due to irregular or degraded surface friction; re-routing of aircraft; overhaul; preventing travel.	Low	Low	Low	As per ThinkHazard and IMD Hazard record, flood in this area is classified as moderate zone. Adequate drainage will be provided, and flood management plan will be prepared. Pavements of the runway and taxiways will be designed in such a way to support the loads imposed by aircraft without excessive distortion or failure. Design is based on ICAO guidelines and regulations and IATA guidelines. Therefore, disruption and damage to airport infrastructure, equipment, and other operational activities due to inundation is not anticipated. Hence, low risk.
More frequent and more intense heavy precipitation	High	High	Disruption and damage to airport assets, infrastructure, airfield, transport, facilities due to waterlogging.	Low	Low	Financial implications and costs; insurance implications; lost revenues due to flight delays, schedule changes & cancellations; increased operating costs due to operations	Low	Low	Low	Same as above.

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
						interruptions, repairs & maintenance of infrastructure, equipment acquisition, additional new training requirements for water and waste management, safety incidents due to new equipment & procedures; passenger inconvenience; uncertainty in new markets due to changes in intensity & frequency of rainfall.				
More frequent and more intense heavy precipitation	High	High	Risk of contamination from substations and transformers entering surrounding environment; risk of communicable diseases & epidemics	Low	Low	Impacts on wildlife and environment; loss of life	Low	Low	Low	The project sites are located at a place located far away from human settlements, sensitive environment zone (if any). Therefore, no wildlife, environment and human life will be affected. Hence, low risk.
More frequent and more intense heavy precipitation	High	High	Potential for landslides	Negligible	Negligible	Destruction of assets and sections of transmission line, utility cables.	Negligible	Negligible	Negligible	Such destruction is not anticipated. Because the cables shall be properly laid. Soil quality investigation shall be done by experienced and reputed agency before the installation. As per ThinkHazard, the area where the project sites are

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
										located is classified as low risk damage zone from landslide. Hence, negligible.
More frequent and severe wildfires	High	High	Loss or damage to the transmission line; impact on human health & risk to life due to increased prevalence of wildfires.	Low	Low	Disruption to operations; loss of assets, reconstruction costs; disruption to fuel supply chain due to wildfires impacting availability of fuel & other supplies at airport.	Low	Low	Low	Though heatwave is projected to increase over the region, no dense forest near or within the site is located. Hence, such types of issues may not be anticipated. However, heatwaves may pose likely risk to human health while exposing during daytime. To address this, personal protective equipment and safety gadgets will be provided to the workers and staffs. Hence, low risk.
Increased frequency of heavy winds (not related to cyclones)	Unknown	Unknown	Loss or damage to assets, infrastructure such as pavement structure, fuel storage; damage to navigation equipment due to sight issues; disrupted access; dust settlement due to prevalent wind movements or erosion.	Unknown	Unknown	Disruption to operations; reconstruction costs; disrupted supply; flight delays and cancellations; discomfort on passenger inconvenience, en-route traffic, long-haul flights; electrical power supply failure; inability of aircraft to land and take-off, reduced visibility, and restriction due to high winds contributing blizzard; change of flight approach routes/path, damage to aircraft from debris, debris deposition onto runways, increased fuel consumption due to longer routings,	Unknown	Unknown	Unknown	Climate projections regarding wind are highly variable, and as such a robust assessment of risk is not possible. However, AECOM notes that the Indian Ministry of Housing's Building Materials & Technology Promotion Council (BMPTC) has the project area rated as very high damage risk zone with basic wind speeds of 50 m/s. As per IMD Hazard record also, the region falls

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
										under high zone of extreme wind speed with very high zone in post-monsoon season. However, extreme wind load is calculated & taken into consideration. Hence, prevention measures would be taken up.
Increased frequency of cyclones / tropical storms	High	High	Disruption and damage to aircraft structural, air traffic, planes, ground service equipment and other assets; disruption to airport operations; communication system failure; disruption to fuel supply chain may impact availability of fuel at airports; deposition of debris onto runways; roof damage or thrown debris; roadway damage.	Moderate	Moderate	Passenger inconvenience due to flight delays, cancellations, change in flight path including approach routes, take-off & landing issues; reduced service capacity; inability of employees to get to work or facilities; danger to front line workers that maintain facilities; closed facilities; financial implications and increased operating costs, lost revenues; increased maintenance requirements & costs; additional adaptation to accommodate lightning strikes to aircraft & other aviation infrastructure; overhaul/repair/maintenance; electrical system failure/shortage/spike; greater turbulence; use of airport as shelter/hub for relief operations; network-wide effects; reduce business impacts	Moderate	Moderate	Moderate	As per IMD cyclone report and ThinkHazard, the region falls under high cyclone vulnerability zone with extremely high surface wind speed. As per Indian Ministry of Housing's Building Materials & Technology Promotion Council (BMPTC), the region falls under very high damage risk zone of cyclone. Heavy precipitation and high wind associated with cyclone could be expected. However, adequate drainage system will be provided, buildings will be designed to address risks from water ingress and flooding, storm water barriers will be designed and installed. Airport Emergency Centre will be developed to address the necessity and importance of emergency response planning including safety and

Climate Hazard	Likelihood of climate hazard occurring		Climate-related impact	Likelihood of climate-related impact occurring		Consequence (description)	Consequence (rating)	Overall risk rating		Notes
	2021-2040	2041-2060		2021-2040	2041-2060			2021-2040	2041-2060	
						and economic losses due to safety of operations by airlines relocating equipment.				efficiency. Hence, moderate risk.
Potential loss or damage due to sea level rise	Low	Low	Temporary closure of airport during recovery from high tide or storm surge event; permanent closure of airport due to permanent inundation; limit or prohibit access to an airport	Low	Low	Inundation of airport assets, airfield & ground transportation; drainage systems impacted due to higher ground water table leading to increase of risk of flooding; passenger inconvenience due to temporary inundation; revenue losses/increased costs due to flight cancellations/schedule changes; re-routing of flights; interruptions of operations; negative public opinion; emergency procedures & operations.	Low	Low	Low	Though sea level rise is increasing, the boundary of the proposed airport area is quite far from high tide line (minimum distance of 671 m). Hence, low risk.

Appendix B : Transition Risk and Opportunities

Transition Risk Assessment under RCP2.6 scenario

Risk Type	Transition Risk	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall risk rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
Policy and legal	Increased pricing of GHG emissions.	Low	Low	Low	Increased operating costs (e.g., higher compliance costs).	Low	Low	Low	Low	Energy will be provided by Govt of Andhra Pradesh. Clean energy in the form of installation of solar panels will be explored after construction for operational purpose. Electricity from grid and backup from DG shall be used. Low carbon cooling strategy shall be adhered and incorporated. GHG emission and any emission associated activities is not anticipated. However, emissions from other stages of solar life cycle during manufacturing, transportation, maintenance, decommissioning and dismantlement, etc. could slightly contribute to emission but insignificantly. Water will be received from Vizianagaram Municipal Corporation, other options of the source of water will be considered after a feasibility study. Hence, low risk.
	Enhanced emissions-reporting obligations.	Negligible	Negligible	Negligible	Increased operating costs higher compliance costs, and early retirement of existing assets due to policy changes	Negligible	Negligible	Negligible	Negligible	As stated above no GHG emission is anticipated. Moreover, operating cost has been calculated beforehand for all the project requirements and activities. Hence, every operation activity shall be assigned within the appropriate timelines to avoid any likely

Risk Type	Transition Risk	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall risk rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
										cost effect. Hence, negligible.
	Mandates on and regulation of existing products and services	Low	Low	Low	Increased costs associated with regulation on electricity production and transmission and procurement; reduced demand for products and services resulting from fines and judgements	Low	Low	Low	Low	Electricity from grid and backup from DG shall be used. Solar panel installation will be explored for operational purpose. Therefore, no such mandates and regulation are anticipated. Hence, low risk.
Technology	Substitution of existing products and services with lower emissions options	Low	Low	Low	Stranded assets	Low	Low	Low	Low	During operational phase, such large substitution is not anticipated as clean energy installation shall be explored. Hence, low risk.
	Unsuccessful investment in new technologies	Negligible	Negligible	Negligible	Economic losses from unsuccessful investment	Negligible	Negligible	Negligible	Negligible	Same as above. Hence, negligible.
	Transition to lower emissions technologies changes transport/logistics options and/or cost	Low	Low	Low	Costs for option exploration towards more efficient substations and new technology investment with lower technical losses	Negligible	Negligible	Negligible	Negligible	Same as above. Hence, negligible.
Market	Changing customer behaviour	Negligible	Negligible	Negligible	Reduced demand for goods and services due to shift in consumer preferences	Negligible	Negligible	Negligible	Negligible	Same as above. Hence, negligible.
	Uncertainty in market signals	Low	Low	Low	Abrupt changes in demand for services.	Low	Low	Low	Low	Same as above. Hence, low risk.
	Increased cost of raw materials	Low	Low	Low	Increased operating and production costs due to changing input prices	Low	Low	Low	Low	Same as above. Hence, low risk.

Risk Type	Transition Risk	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall risk rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
Reputation	Stigmatization of sector	Negligible	Negligible	Negligible	Negative reputation of project	Negligible	Negligible	Negligible	Negligible	Same as above. Hence, no such negative reputation is anticipated. Therefore, negligible.
	Increased stakeholder concern or negative stakeholder feedback	Negligible	Negligible	Negligible	Stakeholder scrutiny due to higher GHG emission	Negligible	Negligible	Negligible	Negligible	Same as above.

Table B-2. Transition Opportunities Assessment under RCP2.6 scenario

Opportunity Type	Transition Opportunities	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall opportunities rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
Resource Efficiency	Use of recycling	Negligible	Negligible	Negligible	Use of recycled materials in construction and maintenance of transmission line	Negligible	Negligible	Negligible	Negligible	The scope for use of recycled material is limited since it is an airport development project. Clean energy such as installation of solar panel and low cooling strategy will be explored. And any associated activities to GHG emission is not anticipated. Therefore, any likely opportunities due to increase GHG emission during the project operational is not at all required. Hence, negligible.
Energy source	Exploration of new applications to ensure gas power will remain relevant as power	Negligible	Negligible	Negligible	Improved reliability through investments in state of art and resilient technologies; return on	Negligible	Negligible	Negligible	Negligible	Most of the project activities shall be functioned based on the power procurement and generation through

Opportunity Type	Transition Opportunities	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall opportunities rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
	markets embrace decarbonization				investment in lower emission technology					solar power plant. Hence, negligible.
Products and services	Development and/or expansion of low emission service; development of new products or services through R&D and innovation	Negligible	Negligible	Negligible	Development of additional infrastructure to support the increasing demand for low carbon electricity; increased revenue through new solutions to adaptation needs	Negligible	Negligible	Negligible	Negligible	Same as above. Hence, negligible.
	Shift in consumer preferences	Negligible	Negligible	Negligible	Increase in demand for low carbon electricity leading to the development of additional transmission infrastructure	Negligible	Negligible	Negligible	Negligible	Same as above.
Markets	Access to new markets	Negligible	Negligible	Negligible	Demand to connect renewable resources with demand centres. New demand associated with electrification of end users.	Negligible	Negligible	Negligible	Negligible	Same as above.
Resilience	Resource substitutes /diversification	Negligible	Negligible	Negligible	Cost abatement through use of lower carbon raw materials; ability to operate under various conditions to ensure resiliency.	Negligible	Negligible	Negligible	Negligible	Same as above.

Table B-3. Transition Risk Assessment under RCP4.5 scenario

Risk Type	Transition Risk	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall risk rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
Policy and legal	Increased pricing of GHG emissions	Negligible	Negligible	Negligible	Increased operating costs (e.g., higher compliance costs)	Negligible	Negligible	Negligible	Negligible	RCP4.5 is the scenario where the projected temperature is more than 2° C ranging between ~2.5° C to ~3° C. Regulations and policies will be comparatively less stringent and less imposing under this case. Moreover, clean energy such as installation of solar plant will be explored for operational purpose. Energy will be procured. GHG emission and any emission associated activities is not anticipated. Hence, negligible.
	Enhanced emissions-reporting obligations	Negligible	Negligible	Negligible	Increased operating costs higher compliance costs, and early retirement of existing assets due to policy changes	Negligible	Negligible	Negligible	Negligible	Same as above. No such risk envisaged under this scenario as GHG emission is less likely to be taken care of. Hence, negligible.
	Mandates on and regulation of existing products and services	Negligible	Negligible	Negligible	Increased costs associated with regulation on electricity production and transmission; reduced demand for products and services resulting from fines and judgements	Negligible	Negligible	Negligible	Negligible	The operational activities will be met through the procurement of power energy and generation from solar plant. Moreover, costs associated with regulation on electricity will not be high under this scenario. Hence, negligible.
Technology	Substitution of existing products and services with lower emissions options	Negligible	Negligible	Negligible	Stranded assets	Negligible	Negligible	Negligible	Negligible	Not anticipated under this scenario. Hence, negligible.

Risk Type	Transition Risk	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall risk rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
	Transition to lower emissions technologies changes transport/logistics options and/or cost	Negligible	Negligible	Negligible	Costs for option exploration towards more efficient substations and new technology investment with lower technical losses	Negligible	Negligible	Negligible	Negligible	Not anticipated under this scenario. Hence, negligible.
Market	Changing customer behaviour	Negligible	Negligible	Negligible	Reduced demand for goods and services due to shift in consumer preferences	Negligible	Negligible	Negligible	Negligible	Same as above. Customer behaviour will not change though there will be less stringent under this scenario. Hence, negligible.
	Uncertainty in market signals	Negligible	Negligible	Negligible	Uncertainty in market signals due to lesser demand for power from non-renewable resources	Negligible	Negligible	Negligible	Negligible	Same as above.
	Increased cost of raw materials	Negligible	Negligible	Negligible	Increased operating and production costs due to changing input prices (e.g., energy /water).	Negligible	Negligible	Negligible	Negligible	Same as above.
Reputation	Stigmatization of sector	Negligible	Negligible	Negligible	Negative reputation of project due to reduced revenue from decreased production capacity such as delayed in planning or interruptions in supply chain.	Negligible	Negligible	Negligible	Negligible	Same as above.
	Increased stakeholder concern or negative stakeholder feedback	Negligible	Negligible	Negligible	Stakeholder scrutiny as it based on non-renewable energy source and higher GHG emission	Negligible	Negligible	Negligible	Negligible	Same as above.

Transition Opportunities Assessment under RCP4.5 scenario

Opportunity Type	Transition Opportunities	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall opportunities rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
Resource Efficiency	Use of recycling	Negligible	Negligible	Negligible	Use of recycled materials in construction and maintenance of transmission line	Negligible	Negligible	Negligible	Negligible	The scope for use of recycled material is limited since it is an airport development project. Clean energy such as installation of solar panel and low cooling strategy will be explored. And any associated activities to GHG emission is not anticipated. Therefore, any likely opportunities due to increase GHG emission during the project operational is not at all required. Hence, negligible.
Energy source	Exploration of new applications to ensure gas power will remain relevant as power markets embrace decarbonization.	Negligible	Negligible	Negligible	Improved reliability through investments in state of art and resilient technologies; return on investment in lower emission technology	Negligible	Negligible	Negligible	Negligible	Most of the project activities shall be functioned based on the power procurement and generation through solar power plant. Hence, negligible.
Products and services	Development and/or expansion of low emission goods; development of new products or services through R&D and innovation	Negligible	Negligible	Negligible	Development of infrastructure to support the increasing demand for low carbon electricity; increased revenue through new solutions to adaptation needs	Negligible	Negligible	Negligible	Negligible	Same as above.
	Shift in consumer preferences	Negligible	Negligible	Negligible	Increase in demand for low carbon electricity leading to the development of additional transmission infrastructure; better	Negligible	Negligible	Negligible	Negligible	Same as above.

Opportunity Type	Transition Opportunities	Likelihood of occurring			Consequence (description)	Consequence (rating)	Overall opportunities rating			Notes
		2023-2027	2028-2037	Beyond 2037			2023-2027	2028-2037	Beyond 2037	
					competitive position to reflect shifting consumer preferences					
Markets	Access to new markets;	Negligible	Negligible	Negligible	Demand to connect renewable resources with demand centres. New demand associated with electrification of end users.	Negligible	Negligible	Negligible	Negligible	Same as above.
Resilience	Resource substitutes /diversification	Negligible	Negligible	Negligible	Cost abatement through use of lower carbon emitting raw materials; increased reliability of supply chain and ability to operate under various conditions to ensure resiliency.	Negligible	Negligible	Negligible	Negligible	Same as above.

Source: <Source>

Appendix C :

C.1 Flora of the Study Area

Sr. No.	Scientific Name	Common Name	IUCN Status*
1	*Acacia nilotica*	Nalla tumma	Mimosaceae
2	*Acacia ferruginea*	Gappatumma, Sandra	Mimosaceae
3	*Acacia leucophloea*	Tella tumma	Mimosaceae
4	*Acacia planifrons*	Godugu tumma	Mimosaceae
5	*Acacia chundra*	Sandra	Mimosaceae
6	*Acer oblongum*	-	Aceraceae
7	*Adenanthera pavonia*	Bandi Gurivinda	Mimosaceae
8	*Adina cordifolia*	Ramba, Bandaru	Rublaceae
9	*Aegle marmelos*	Maredu	Rublaceae
10	*Aegle roxburghiana*	Konda andaga	Rublaceae
11	*Ailanthus excelsa*	Peddamanu	Rublaceae
12	*Ailanthus lamarckii*	Vooduga, Woodika	Rublaceae
13	*Albizzia amara*	Narlenga, Cheekireni	Mimosaceae
14	*Albizzia lebbeck*	Siris, Dirisinam.	Mimosaceae
15	*Albizzia odoratissima*	Gannara, Chindaga.	Mimosaceae
16	*Albizzia procera*	Tella chindaga	Mimosaceae
17	*Albizzia stipulata*	bandi chindaga	Mimosaceae
18	*Alstonia scholaris*	bdakalapala	Apocynaceae
19	*Alsophila spp. (Tree fern)*	-	Cyatheaceae
20	*Amoora ronituka*	-	Meliaceae
21	*Anacardium occidentale*	Jeedimamidi	Anacardlaceae
22	*Anogeissus acuminata*	Pasi	Combretaceae
23	*Anogeissus latifolia*	Enirumana	Combretaceae
24	*Antidesma diandrum*	Pullagummadi	Euphorbiaceae
25	*Anona reticulata*	Ramaphalam	Anonaceae
26	*Anona squamosa*	Sithaphalam	Anonaceae
27	*Artocarpus integrifolia*	Panasa	Moraceae
28	*Atlantia monophylla*	Karunimma	Rutaceae
29	*Azadirachta indica*	Vepa	Meliaceae
30	*Barringtonia acutangula*	Kadem	Becytnidaceae
31	*Bauhinia racemosa*	Ari	Caesalpiniaceae
32	*Bauhinia retusa*	Godderi	Caesalpiniaceae
33	*Bauninia purpurea*	Konenam.	Caesalpiniaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
34	*Bauhinia variegata*	Bodaddam	Caesalpiniaceae
35	*Bischofia javanica*	-	Suphorbiaceae
36	*Bombax ceiba*	Burugu	Malvaceae
38	*Borassus flabellifer*	Tati, Tadi	Palmaceae
39	*Boswellia serrata*	Anduga (Guggilam)	Burseraceae
40	*Bridelia retusa*	Anem, Koramanu.	Eaphorolaceae
41	*Bridelia hamiltoniana*	Pantangi, Devakanchanam	Eaphorolaceae
42	*Bridelia tomentosa*	Balli	Eaphorolaceae
43	*Buchanania lanzan (B.latifolia)*	Sara, Jarumamidi	Anacardiaceae
44	*Buchanania frondosa.*	Duga	Caesalpiniaceae
45	*Caesalpinea coriaria*	Dividivi	Caesalpiniaceae
46	*Calophyllam inophyllam*	Poona	Gutti feraceae
47	*Canthiam didymum*	Nekkri, Nalla balusu.	Rubiaceae
48	*Careya arborea*	Kumbi	Decythidaceae
49	*Caryota urens*	Jeelugu	Palmaceae
50	*Cassia fistula*	Rela	Caesalpiniaceae
51	*Cassia slames*	Sima tangedu	Caesalpiniaceae
52	*Cearala toona*	Galimanu	Meliaceae
53	*Chloroxylon swietenia*	Billa, Billudu	Meliaceae
54	*Chakrasla tanpularis*	Konda vepa	Meliaceae
55	*Clpadessa fratilosa*	Rana bilia (ranabheri)	Meliaceae
56	*Clelstanthus collinus*	Vadesa, Woodiga, Kodisa.	Euphorbiaceae
57	*Cocnlospermum religio sum*	Konda gogu, Konda burugu	Bixaceae
58	*Cocos nuclfera*	Tonkaya, Kobbari	Palmaceae
59	*Cordiamyxa*	Iriki, Nakeri, Bhootan kusuma	Koraginaceae
60	*Crataeva religiosa*	Urimidi, Tellavalimiri	Capparidaceae
61	*Dalbergia lanceolaria*	Tella iridi	Papilionaceae
62	*Dalbergia latifolia*	Truguducheva	Papilionaceae
63	*Dalbergia Paniculata*	Patchari, Sayiboddi	Papilionaceae
64	*D.Sissoo*	Sissu	Papilionaceae
65	*Dalbergia Spinosa*	Chillanki	Paplionaceae
66	*Dalbergia Chrostachya cinerea*	Velthuru	Mimosaceae
67	*Dillenia pentagyna*	Revadi	Lilleniaceae
68	*Diospyros enloroxylon*	Vullinda (Tokarika)	Ebenaceae
69	*Diospyros melanoxylon*	Tuniki, Abnas	Ebenaceae
70	*Diospyros tomentosam*	Tummiki, Tuki	Ebenaceae
71	*Diospyros microphylla*	-	Ebenaceae
72	*Diospyros montana*	Yerragatna	Ebenaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
73	*Diospyros sylvatica*	Gatna	Ebenaceae
74	*Doli chandrone falcata*	Wooddi, Chitti Woodi	Bighoniaceae
75	*Doli crispa*	Niroaddi	Bighoniaceae
76	*Elaeocarpus serratus*	-	Eocarpaceae
77	*Emblica orricinalis*	Racha usurika	Euphorbiaceae
78	*Elaeo denaron glaacum*	Neridi (Neeri jia)	Celastraceae
79	*Samania saman*	Nidra ganneru	Mimosaceae
80	*Srythrina indica*	Baditha	Papilionaceae
81	*Syzygium cumini*	Neredu	Myrtaceae
82	*Emblica Jambos*	Jambu neredu, Alle neredu	Myrtaceae
83	*euphorbia tirucualli*	Jemudu	Eaphorolaceae
84	*Feronia elephantum*	Velaga	Rutaceae
85	*Fluggea microcarpa*	-	Euphorbiaceae
86	*Ficas bengalensis*	Marri	Moraceae
87	*Ficas nispida*	Boddamarri	Moraceae
88	*Ficas retusa*	Yerra juvvi	Moraceae
89	*Ficas religiosa*	Ravi	Moraceae
90	*Ficas tomentosa*	Juvvi	Moraceae
91	*Ficas tsiela*	Pitta juvvi	Moraceae
92	*Gardenia gummi fera*	Manchi bikki	Rubiaceae
93	*Gardenia latifolia*	Pedda bikki	Rubiaceae
94	*Gardenia lucida*	Yerri bikki	Rubiaceae
95	*Garuga pinnata*	Garugudu	Burseraceae
96	*Givotia rotteleri formis*	Tellapoliki	Euphorbiaceae
97	*Gmelina arborea*	Gummidi	Verbenaceae
98	*Gmelina asiatica*	Karugummadi	Verbenaceae
99	*Grewia laevigata*	Potrika	Tiliaceae
100	*Grewia pilosa*	Nalli	Tiliaceae
101	*Grewia asiatica*	Bankarara	Tiliaceae
102	*Grewia tiliaefolia*	Thadi	Tiliaceae
103	*Grewia hirsuta*	Chrijana	Tiliaceae
104	*Gymnosporia montana*	Chinni, Danti	Celastraceae
105	*Gyrocarpus jaquini*	Tanuku, Yenapolini	Hernandiaceae
106	*Hardwickia binata*	Yepi	Caesalpiniaceae
107	*Hemi cyclia sepiaria*	Bira	Euphorbiaceae
108	*Holarrhena antidysenterica*	Pala, Isteripola	Apocynaceae
109	*Holoptelea integrifolia*	Nemali nara	Ulmaceae
110	*Hymenodictyon excelsum*	Dudippa	Rubiaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
111	*Ixora parviflora*	Korivi, Korimpala	Rubiaceae
112	*Jatropha curcas*	Pedda napalam	Euphorbiaceae
113	*Rydia calycina*	Konda patni	Malvaceae
114	*Lagerstroemia parviflora*	Chennangi	bythraceae
115	*Lantana camara*	Sitammavari poda	Verbenaceae
116	*Lanea coramandalica*	Gumpena	Anacardiaceae
117	*Limonia acidissima*	Thoriri velaga	Kutaceae
118	*Mangifera Indica*	Mamidi	Anscardiaceae
119	*Mallotas philippinensis*	Vasantha Gada (Kumkum tree)	Euphorbiaceae
120	*Macaranga roxburghi*	Alamanda	Euphorbiaceae
121	*Memecylon edule*	Alli	Melastomaceae
122	*Michelia champaca*	Sampanga	Magnollaceae
123	*Millettia auriculata*	Konda tangedu teega	Papilionaceae
124	*Manilkera hexandra*	Pala	Sapotaceae
125	*Mitragyna Parvifolia*	Botraga	Radiaceae
126	*Morinda tinctoria*	Togaru	Radiaceae
127	*Mandalea suberosa*	Varribilla	Papilionaceae
128	*Murraya exotica*	Naga goluga	Rubiaceae
129	*M.konidi*	Kari vepa	Rubiaceae
130	*Nyctantnes arbortristis.*	Parijatham pogada	Verbenaceae
131	*Ochna squarrosa*	Sunari	Ochaceae
132	*Olax scandens*	Theega nakiri	Olaceaceae
133	*Oroxylum indicus*	Pampini	Bignoniaceae
134	*Oageinia dalbergioides*	Chikkudu	Papilionaceae
135	*Phoenix sylvestris*	Ita	Palmaceae
136	*Paldium guava*	Jami	Myrtaceae
137	*Pleurostylia wignti*	Kunti chinta	Celastraceae
138	*Pongamia pinnata*	Kanuga	Papilionaceae
139	*Polyalthia cerasoides*	chilaka duaduga	Papilionaceae
140	*Premna tomentosa*	Navuru	Verbenaceae
141	*Prosopis spicigera*	Jammi	Caesalpiniaceae
142	*Pterospermum suberlforium*	Lolugu	Caesalpiniaceae
143	*Pterocarpus marsupium*	Yegisa	Papilionaceae
144	*Pterocarmum santalinus*	Rakta chandanam, yerra chandanam	Papilionaceae
145	*Pterolopiam Indicus*	Rorintha, Ro dimudusu	Caesalphinaceae
146	*Saccopetalum tomentosum*	Budda duaduga	Anonaceae
147	*Santalum album*	Chandanam, Sreegandham	Santalaceae
148	*Sapindas emerginatus*	Kunkudu, Ritta	Sapindaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
149	*Schlercheraoleosa*	Bsi	Sapindaceae
150	*Semecarpus anacardium*	Jeedi	Anacardiaceae
151	*Shorea robusta*	Sal guggilam	Diptero
152	*Soymida febrifuja*	somitha	Meliaceae
153	*Spondias mangifera*	Adavi mamidi	Anacardiaceae
154	*Sterculia urens*	Thapasi	Sterculiaceae
155	*Streblus asper*	Barinika	Moraceae
156	*Strychnos nuxvomica*	Musti, Musini	Doganiaceae
157	*sypotatorum*	Ghilla, Indupa.	Doganiaceae
158	*Syzygium cuminii*	Neredu	Myrtaceae
159	*Swietenia mahagoni*	Mahagoni	Meliaceae
160	*Tamarindus indica*	Chinta	Gaesalpiniaceae
161	*Tectona grandis*	Teku	Verbenaceae
162	*Terminalia arjuna*	Tellamaddi, Yerumaddi	Combretaceae
163	*Terminalia belerica*	Thadi, Thani	Combretaceae
164	*Terminalia Chebula*	Karaka	Combretaceae
165	*Terminalia tomentosa*	Nallamaddi	Combretaceae
166	*Trewia nudiflora*	-	Suphorbiaceae
167	*Tnespesia populneae.*	Gangaravi	Malvaceae
168	*Vitex altissima.*	Nemali adugu	Verbenaceae
169	*Wrightia tinctoria*	Ankudu	Apocynaceae
170	*W.tomentosa*	Tadlapala	Apocynaceae
171	*Walsura piscidia*	volivodisa (Walursi)	Meliaceae
172	*Wrightia tomentosa*	Chittenkudu	Apocynaceae
173	*Xylia xylocarpa*	Konda thangedu	Mimosaceae
174	*Zizyphyus xylopyrus*	Gotti	Rhamnaceae
175	*Zanthxylum rhetsa*	Radha, Rhetae	Rhamnaceae
Shrub			
1	*Acacia pinnata*	Mulla korinta	mimosaceae
2	*Acanthus ilicifolium*	Aloni	Acantnaceae
3	*Adhatoda vasica*	Addasaram	Acantnaceae
4	*Aloe vera*	Kithanara	Liliaceae
5	*Calotropis gigantea*	Jilledu	Ascelepiadaceae
6	*Cantnium parviflora*	Balusu	Rubiaceae
7	*Capparis sepiaria*	Nalluppi	Capparidaceae
8	*Carissa carandas*	Kalivi	Apocynaceae
9	*Gasearia spinarum*	Peddavaka	Apocynaceae
10	*Gasearia tomentosa*	Garigudi, Chilakadudduga	Samydaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
11	*Gassia auriculata*	Thangedu	Caesalpiniaceae
12	*Gassia montana*	Pagadi, Tangedu	Caesalpiniaceae
13	*Gassia tora (occidentalis)*	Kasivinda, Kasinda	Caesalpiniaceae
14	*Gealastrus paniculata*	Danti	Celestraceae
15	*Glerodendron infortunatum*	Pisinika, Bockeda	Verbenaceae
16	*coffee arabica*	Coffee	Rubiaceae
17	*Glerodendron robusta*	-	-
18	*Combretum decadrum*	Bontha teega	Combretaceae
19	*Desmodium pulchellam*	Kondantinta	Papilionaceae
20	*Indonaea viscosa*	Dhandaru	Sapindaceae
21	*Erythroxylon monogynum*	Adivi gerenta	Linaceae
22	*Euphorinia nivulia*	Brahma jemudu	Euphorbiaceae
23	*E.trigona*	Kattimandu	Euphorbiaceae
24	*Flacourtia ramontchi*	Kanregu, Peddakanregu	Bixaceae
25	*Flacourtia separia*	Kanregu, Peddakanregu	Bixaceae
26	*Flemingia chappar*	-	Papilionaceae
27	*Fluggea leucopyrus*	-	Euphorbiaceae
28	*Glycosmis pentaphyllaym*	Golugu	Rutaceae
29	*Guasuma tomentosa*	Rudraksha	Sterculiaceae
30	*Helicteres isora*	Adivienamanti gubataga	Sterculiaceae
31	*Hugonia mystax*	Pentapeega kakibeera	Linaceae
32	*Indigofera pulchella*	Pulichinta	Papilionaceae
33	*I.Parviflora*	Konda vempali	Papilionaceae
34	*Jatropha glandalifera*	chinna nepalam	Euphorbiaceae
35	*Lantana indica*	Lantana	Varbenaceae
36	*Lantana camara*	Sitammavaripodu	Varbenaceae
37	*Leae sambucina*	-	Vitaceae
38	*Lawsonia alba*	Gorinta	Bythraceae
39	*Loranthus Longiflorus*	Bajinika	Loranthaceae
40	*Mababuxifolia*	Pisinika	Ebenaceae
41	*Ocimum gratissimum*	Ramatulasi	Labiatae
42	*Opuntia monacantha*	Nagajannudu	Castaceae
43	*Pendanus odoratissimus*	Mogali	Palmaceae
44	*Pavetta indica*	Papidi	Rubiaceae
45	*Plectronia parviflora*	Balusu	Rubiaceae
46	*randia dumetorum*	Mango	Rubiaceae
47	*Rubus sp.*	-	Rosaceae
48	*Ricinus communis*	Amadam	Euphorbiaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
49	*Sterospermum chelonoides*	sukarasi pisa, kalagora	Sterculiaceae
50	*Stronilanthes sp*	-	Acanthaceae
51	*Tabernaemontana spp. (heyneana)*	Boddamalli	Apocynaceae
52	*Toddalia aculeaca*	Kondamirapa	Rutaceae
53	*Toddalia asiatica*	Kondakasintha	Rutaceae
54	*Woodrordia, floribunds*	Jaji (Tellapala)	Lythraceae
55	*Webera corymbosa*	Kommi	Rubiaceae
56	*Zizyphus mauritiana*	Regu	Rhamnaceae
57	*Zizyphus oenoplia*	Pariki	Rhamnaceae
58	*Zinziber casumnar*	Karupasapa	Zingibereceae
Herb			
1	*Acalypha fraticosa*	-	Euphorbiaceae
2	*Achyranthus aspera*	Uttaram	Amarantaceae
3	*Tephrosia purpurea*	Vempali	Papilionaceae
4	*Tribulus terrestris*	Palleru	Zycophyllaceae
Climbers			
1	*Abrus precatorius*	Gurivinda	Papilionaceae
2	*Acacia concinna*	Shikayi	Mimosaceae
3	*Acacia intsia (A.caesia)*	Korinta	Mimosaceae
4	*Aristoloenia indica*	Iswara theega	Aristolochisceae
5	*Asparagus racemosus*	Pilli theegalu	Lilisceae
6	*Bauminia vahlii*	Addasaram	Caesalpiniaceae
7	*Butea superba*	Tiga moduga	Caesalpiniaceae
8	*Caesalpinia bonducella*	Gaena	Caesalpiniaceae
9	*Calamus latifolius*	Pemu	Palmaceae
10	*Capparis norrida*	Adonda, Thivva	Capparidaceae
11	*Cuscuta reflexa*	Seethammavari savaram	Convolvulaceae
12	*Derris scandens*	Nallateega	Papilionaceae
13	*Dioscorea esculanta*	Tippa theega	Dioscoreaceae
14	*Dioscorea pentaphylla*	Adavi gummadi theega	Dioscoreaceae
15	*Hemidesmus indicus*	Sugandhapala	Ascelepiadaceae
16	*Ichnocarpus frutescens*	Pala theega	Apocynaceae
17	*Ipomea nilopa*	Chevulelapalli theega	Convolvulaceae
18	*Jasminium angustifolium*	Adavimalle	Cleaceae
19	*Leptadenia reticulata*	Mukkutummudu theega	Ascelepiadaceae
20	*Mucuna pruriens*	Yenugu delagonda	Papilionaceae
21	*Mimosa rubicaulis*	Undra kampa	Mimosaceae
22	*Piper longum*	Adavi miriyam	piperaceae

Sr. No.	Scientific Name	Common Name	IUCN Status*
23	*Spatnolobus roxburghii*	Moduga theega	piperaceae
24	*Smilax zeylanica*	Kummari theega	Liliaceae
25	*Tinospora cordifolia*	Tippa theega	Menispermaceae
26	*Ventilago calyculata*	Errachratali	Rhamnaceae
27	*Vitis guadrangularis*	Nalleru	Vitaceae
Grasses			
1	*Aristida setacea*	Chippera gaddi	Graminae
2	*Cymbopogan contortas*	-	-
3	*Chrysopogan montanas*	Gorraethokalugaddi	-
4	*Cymbopogan martini*	rosegrass	-
5	*Cynogon dactylon*	-	-
6	*Digiteria sp.*	-	-
7	*elatliopsis binata*	sabal, kuprigaddi	-
8	*Fschaemum pilosum*	koporigaddi	-
9	*Imperata arundinaces*	Darba gaddi	-
10	*Saicarum spontaneus*	-	-
11	*Spinifex sauarrosus*	Ravanasurudu misalu	-
12	*Schima nervosum*	Nendra gadal	-
13	*themeda sp.*	-	-
14	*Thysoloena maxima*	Hillborrm kondachipuru	-
15	*Vetiveri Zonoides*	Vattiveru	-

Source: Forest Working Plan, Vizianagaram District

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where –LC – Least Concern, EN – Endangered, NT – Near Threatened, VU-Vulnerable*

C.2 Mammals of the Study Area

SN	Scientific Name	Common Name	IUCN Status*
1	*Anathana ellioti*	Cheetah	Least Concern
2	*Aonyx cinereus*	Lesser Bandicoot Rat	Vulnerable
3	*Axis axis*	Golden Jackal	Least Concern
4	*Balaenoptera acutorostrata*	Grey Wolf	Least Concern
5	*Balaenoptera edeni*	Caracal	Least Concern
6	*Balaenoptera musculus*	Cutch Rock-rat	Endangered
7	*Bandicota bengalensis*	Oriental serotine	Least Concern
8	*Bandicota indica*	Jungle Cat	Least Concern
9	*Bos gaurus*	Five-striped Palm Squirrel	Vulnerable
10	*Boselaphus tragocamelus*	Chinkara	Least Concern
11	*Canis aureus*	Little Hairy-footed Gerbil	Least Concern
12	*Canis lupus*	Dwarf Gerbil	Least Concern
13	*Cuon alpinus*	Indian Bush-rat	Endangered
14	*Cynopterus sphinx*	Indian long-eared hedgehog	Least Concern
15	*Felis chaus*	Small Indian Mongoose	Least Concern
16	*Feresa attenuata*	Indian Grey Mongoose	Least Concern
17	*Funambulus palmarum*	Fulvus Leaf-nosed Bat	Least Concern
18	*Funambulus pennantii*	"Indian roundleaf bat	Least Concern
19	*Globicephala macrorhynchus*	Striped Hyaena	Least Concern
20	*Grampus griseus*	Indian Crested Porcupine	Least Concern
21	*Herpestes edwardsii*	Indian Hare	Least Concern
22	*Herpestes smithii*	Greater False Vampire	Least Concern
23	*Hipposideros speoris*	Rhesus Monkey	Least Concern
24	*Hystrix indica*	Honey Badger	Least Concern
25	*Indopacetus pacificus*	Madras Treeshrew	Least Concern
26	*Kogia breviceps*	Asian Small-clawed Otter	Least Concern
27	*Kogia sima*	Chital	Least Concern
28	*Lagenodelphis hosei*	Common Minke Whale	Least Concern
29	*Lepus nigricollis*	Bryde's Whale	Least Concern
30	*Loris lydekkerianus*	Blue Whale	Near Threatened
31	*Lutrogale perspicillata*	Lesser Bandicoot Rat	Vulnerable
32	*Lyroderma lyra*	Greater Bandicoot Rat	Least Concern
33	*Macaca mulatta*	Gaur	Least Concern
34	*Manis crassicaudata*	Nilgai	Endangered
35	*Megaptera novaeangliae*	Golden Jackal	Least Concern
36	*Mellivora capensis*	Grey Wolf	Least Concern
37	*Melursus ursinus*	Dhole	Vulnerable

SN	Scientific Name	Common Name	IUCN Status*
38	*Mesoplodon densirostris*	Greater Shortnosed Fruit Bat	Least Concern
39	*Moschiola indica*	Jungle Cat	Least Concern
40	*Muntiacus vaginalis*	Pygmy Killer Whale	Least Concern
41	***Murina cyclotis***	**Common Palm Squirrel**	**Least Concern**
42	*Mus booduga*	Five-striped Palm Squirrel	Least Concern
43	*Mus musculus*	Short-finned Pilot Whale	Least Concern
44	*Mus platythrix*	Risso's Dolphin	Least Concern
45	*Mus terricolor*	Indian Grey Mongoose	Least Concern
46	*Myotis peytoni*	Ruddy Mongoose	Data Deficient
47	*Neophocaena phocaenoides*		Vulnerable
48	*Orcaella brevirostris*	Indian Crested Porcupine	Endangered
49	*Orcinus orca*	Indo-Pacific Beaked Whale	Data Deficient
50	*Panthera pardus*	Pygmy Sperm Whale	Vulnerable
51	*Panthera tigris*	Dwarf Sperm Whale	Endangered
52	*Paradoxurus hermaphroditus*	Fraser's Dolphin	Least Concern
53	*Peponocephala electra*	Indian Hare	Least Concern
54	*Physeter macrocephalus*	Grey Slender Loris	Vulnerable
55	*Pipistrellus ceylonicus*	Smooth-coated Otter	Least Concern
56	*Prionailurus bengalensis*	Greater False Vampire	Least Concern
57	*Prionailurus rubiginosus*	Rhesus Monkey	Near Threatened
58	*Prionailurus viverrinus*	Indian Pangolin	Vulnerable
59	*Pseudorca crassidens*	Humpback Whale	Near Threatened
60	*Pteropus giganteus*	Honey Badger	Least Concern
61	*Rattus rattus*	Sloth Bear	Least Concern
62	*Rhinolophus lepidus*	Blainville's Beaked Whale	Least Concern
63	*Rhinolophus pusillus*	Indian Chevrotain	Least Concern
64	*Rhinolophus rouxii*	Northern Red Muntjac	Least Concern
65	*Rhinopoma hardwickii*	Round-eared Tube-nosed Bat	Least Concern
66	*Rousettus leschenaultii*		Near Threatened
67	*Rusa unicolor*	House Mouse	Vulnerable
68	*Scotophilus heathii*	Brown Spiny Mouse	Least Concern
69	*Scotozous dormeri*		Least Concern
70	*Semnopithecus entellus*	Peytonâ€™s Whiskered Myotis	Least Concern
71	*Sousa chinensis*	Indo-Pacific Finless Porpoise	Vulnerable
72	*Stenella attenuata*	Irrawaddy Dolphin	Least Concern
73	*Stenella coeruleoalba*	Killer Whale	Least Concern
74	*Stenella longirostris*	Leopard	Least Concern
75	*Steno bredanensis*	Tiger	Least Concern
76	*Suncus murinus*	Common Palm Civet	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
77	*Sus scrofa*	Melon-headed Whale	Least Concern
78	*Taphozous longimanus*	Sperm Whale	Least Concern
79	*Tatera indica*	Kelaart's Pipistrelle	Least Concern
80	*Tetracerus quadricornis*	Mainland Leopard Cat	Vulnerable
81	*Tursiops aduncus*	Rusty-spotted Cat	Near Threatened
82	*Tursiops truncatus*	Fishing Cat	Least Concern
83	*Viverricula indica*	False Killer Whale	Least Concern
84	*Vulpes bengalensis*	Indian Flying Fox	Least Concern
85	*Ziphius cavirostris*	House Rat	Least Concern

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where –CR – Critically Endangered, EN – Endangered, LC – Least Concern, NT – Near Threatened, VU – Vulnerable*

C.3 Birds of the Study Area

SN	Scientific Name	Common Name	IUCN Status*
1	*Accipiter badius*	Shikra	Least Concern
2	*Acridotheres fuscus*	Jungle Myna	Least Concern
3	***Acridotheres tristis***	**Common Myna**	**Least Concern**
4	*Acrocephalus stentoreus*	Clamorous Reed-warbler	Least Concern
5	*Actitis hypoleucos*	Common Sandpiper	Least Concern
6	*Aegithina tiphia*	Common Iora	Least Concern
7	*Aethopyga siparaja*	Crimson Sunbird	Least Concern
8	*Alauda gulgula*	Oriental Skylark	Least Concern
9	*Alcedo atthis*	Common Kingfisher	Least Concern
10	*Alcedo meninting*	Blue-eared Kingfisher	Least Concern
11	***Alexandrinus krameri***	**Rose-ringed Parakeet**	**Least Concern**
12	*Amandava amandava*	Red Avadavat	Least Concern
13	*Amaurornis phoenicurus*	White-breasted Waterhen	Least Concern
14	*Anas crecca*	Common Teal	Least Concern
15	*Anas poecilorhyncha*	Indian Spot-billed Duck	Least Concern
16	*Anastomus oscitans*	Asian Openbill	Least Concern
17	*Anhinga melanogaster*	Oriental Darter	Near Threatened
18	*Anthracoceros albirostris*	Oriental Pied Hornbill	Least Concern
19	*Anthus godlewskii*	Blyth's Pipit	Least Concern
20	*Anthus richardi*	Richard's Pipit	Least Concern
21	***Anthus rufulus***	**Paddyfield Pipit**	**Least Concern**
22	*Anthus trivialis*	Tree Pipit	Least Concern
23	*Aquila nipalensis*	Steppe Eagle	Endangered
24	*Aquila rapax*	Tawny Eagle	Vulnerable
25	*Ardea alba*	Great White Egret	Least Concern
26	*Ardea cinerea*	Grey Heron	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
27	*Ardea intermedia*	Intermediate Egret	Least Concern
28	***Ardea purpurea***	**Purple Heron**	**Least Concern**
29	***Ardeola grayii***	**Indian Pond-Heron**	**Least Concern**
30	***Argya caudata***	**Common Babbler**	**Least Concern**
31	*Argya striata*	Jungle Babbler	Least Concern
32	*Artamus fuscus*	Ashy Woodswallow	Least Concern
33	*Arundinax aedon*	Thick-billed Warbler	Least Concern
34	*Asio flammeus*	Short-eared Owl	Least Concern
35	*Athene brama*	Spotted Owlet	Least Concern
36	*Aythya ferina*	Common Pochard	Vulnerable
37	*Aythya fuligula*	Tufted Duck	Least Concern
38	*Aythya nyroca*	Ferruginous Duck	Near Threatened
39	*Bubo bengalensis*	Rock Eagle-Owl	Least Concern
40	*Bubo coromandus*	Dusky Eagle-Owl	Least Concern
41	***Bubulcus ibis***	**Cattle Egret**	**Least Concern**
42	*Burhinus indicus*	Indian Thick-knee	Least Concern
43	*Butastur teesa*	White-eyed Buzzard	Least Concern
44	*Butorides striata*	Green-backed Heron	Least Concern
45	*Cacomantis merulinus*	Plaintive Cuckoo	Least Concern
46	*Cacomantis passerinus*	Grey-bellied Cuckoo	Least Concern
47	*Cacomantis sonneratii*	Banded Bay Cuckoo	Least Concern
48	*Calandrella dukhunensis*	Mongolian Short-toed Lark	Least Concern
49	*Calidris alba*	Sanderling	Least Concern
50	*Calidris ferruginea*	Curlew Sandpiper	Near Threatened
51	*Calidris minuta*	Little Stint	Least Concern
52	*Calidris pugnax*	Ruff	Least Concern
53	*Calidris ruficollis*	Red-necked Stint	Near Threatened
54	*Calidris subminuta*	Long-toed Stint	Least Concern
55	*Calidris temminckii*	Temminck's Stint	Least Concern
56	*Calliope calliope*	Siberian Rubythroat	Least Concern
57	*Caprimulgus affinis*	Savanna Nightjar	Least Concern
58	*Caprimulgus asiaticus*	Indian Nightjar	Least Concern
59	*Caprimulgus indicus*	Jungle Nightjar	Least Concern
60	*Carpodacus erythrinus*	Common Rosefinch	Least Concern
61	*Cecropis daurica*	Red-rumped Swallow	Least Concern
62	***Centropus sinensis***	**Greater Coucal**	**Least Concern**
63	*Ceryle rudis*	Pied Kingfisher	Least Concern
64	*Charadrius alexandrinus*	Kentish Plover	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
65	*Charadrius dubius*	Little Ringed Plover	Least Concern
66	*Charadrius mongolus*	Lesser Sandplover	Least Concern
67	***Chlidonias hybrida***	**Whiskered Tern**	**Least Concern**
68	*Chloropsis jerdoni*	Jerdon's Leafbird	Least Concern
69	*Chrysocolaptes festivus*	White-naped Woodpecker	Least Concern
70	*Ciconia ciconia*	White Stork	Least Concern
71	***Cinnyris asiaticus***	**Purple Sunbird**	**Least Concern**
72	*Circaetus gallicus*	Short-toed Snake-eagle	Least Concern
73	*Circus aeruginosus*	Western Marsh-Harrier	Least Concern
74	*Circus macrourus*	Pallid Harrier	Near Threatened
75	*Circus melanoleucos*	Pied Harrier	Least Concern
76	*Cisticola juncidis*	Zitting Cisticola	Least Concern
77	*Clamator coromandus*	Chestnut-winged Cuckoo	Least Concern
78	*Clamator jacobinus*	Jacobin Cuckoo	Least Concern
79	***Columba livia***	**Rock Dove**	**Least Concern**
80	*Copsychus fulicatus*	Indian Robin	Least Concern
81	*Copsychus malabaricus*	White-rumped Shama	Least Concern
82	*Copsychus saularis*	Oriental Magpie-robin	Least Concern
83	*Coracias affinis*	Indochinese Roller	Least Concern
84	***Coracias benghalensis***	**Indian Roller**	**Least Concern**
85	*Coracina macei*	Indian Cuckooshrike	Least Concern
86	***Corvus macrorhynchos***	**Large-billed Crow**	**Least Concern**
87	***Corvus splendens***	**House Crow**	**Least Concern**
88	*Coturnix coromandelica*	Rain Quail	Least Concern
89	*Coturnix coturnix*	Common Quail	Least Concern
90	*Cuculus micropterus*	Indian Cuckoo	Least Concern
91	*Cuculus poliocephalus*	Lesser Cuckoo	Least Concern
92	*Cyornis poliogenys*	Pale-chinned Flycatcher	Least Concern
93	*Cyornis rubeculoides*	Blue-throated Blue-flycatcher	Least Concern
94	*Cyornis tickelliae*	Tickell's Blue-flycatcher	Least Concern
95	***Cypsiurus balasiensis***	**Asian Palm-Swift**	**Least Concern**
96	*Dendrocitta vagabunda*	Rufous Treepie	Least Concern
97	*Dendrocopos macei*	Fulvous-breasted Woodpecker	Least Concern
98	*Dendrocygna bicolor*	Fulvous Whistling-Duck	Least Concern
99	*Dendrocygna javanica*	Lesser Whistling-Duck	Least Concern
100	*Dicaeum agile*	Thick-billed Flowerpecker	Least Concern
101	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	Least Concern
102	*Dicrurus caerulescens*	White-bellied Drongo	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
103	*Dicrurus hottentottus*	Hair-crested Drongo	Least Concern
104	*Dicrurus leucophaeus*	Ashy Drongo	Least Concern
105	***Dicrurus macrocercus***	**Black Drongo**	**Least Concern**
106	*Dicrurus paradiseus*	Greater Racquet-tailed Drongo	Least Concern
107	*Dumetia hyperythra*	Tawny-bellied Babbler	Least Concern
108	***Egretta garzetta***	**Little Egret**	**Least Concern**
109	*Elanus caeruleus*	Black-winged Kite	Least Concern
110	*Ephippiorhynchus asiaticus*	Black-necked Stork	Near Threatened
111	***Eremopterix griseus***	**Ashy-crowned Sparrow-Lark**	**Least Concern**
112	*Eudynamys scolopaceus*	Western Koel	Least Concern
113	*Eumyias thalassinus*	Verditer Flycatcher	Least Concern
114	*Falco amurensis*	Amur Falcon	Least Concern
115	*Falco peregrinus*	Peregrine Falcon	Least Concern
116	*Falco tinnunculus*	Common Kestrel	Least Concern
117	*Francolinus pictus*	Painted Francolin	Least Concern
118	*Fregetta tropica*	Black-bellied Storm-Petrel	Least Concern
119	*Fulica atra*	Common Coot	Least Concern
120	*Gallicrex cinerea*	Watercock	Least Concern
121	*Gallinago stenura*	Pintail Snipe	Least Concern
122	*Gallinula chloropus*	Common Moorhen	Least Concern
123	*Galloperdix lunulata*	Painted Spurfowl	Least Concern
124	*Gallus gallus*	Red Junglefowl	Least Concern
125	*Geokichla citrina*	Orange-headed Thrush	Least Concern
126	*Glaucidium radiatum*	Jungle Owlet	Least Concern
127	*Gracupica contra*	Indian Pied Starling	Least Concern
128	*Gymnoris xanthocollis*	Chestnut-shouldered Bush-sparrow	Least Concern
129	*Gyps bengalensis*	White-rumped Vulture	Critically Endangered
130	*Gyps indicus*	Indian Vulture	Critically Endangered
131	*Haematopus ostralegus*	Eurasian Oystercatcher	Near Threatened
132	*Halcyon pileata*	Black-capped Kingfisher	Vulnerable
133	***Halcyon smyrnensis***	**White-breasted Kingfisher**	**Least Concern**
134	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	Least Concern
135	*Haliastur indus*	Brahminy Kite	Least Concern
136	*Hemiprocne coronata*	Crested Treeswift	Least Concern
137	*Hierococcyx varius*	Common Hawk-Cuckoo	Least Concern
138	*Himalayapsitta cyanocephala*	Plum-headed Parakeet	Least Concern
139	*Himantopus himantopus*	Black-winged Stilt	Least Concern
140	***Hirundo rustica***	**Barn Swallow**	**Least Concern**

SN	Scientific Name	Common Name	IUCN Status*
141	*Hirundo smithii*	Wire-tailed Swallow	Least Concern
142	*Hydrobates monorhis*	Swinhoe's Storm-Petrel	Near Threatened
143	***Hydrophasianus chirurgus***	**Pheasant-tailed Jacana**	**Least Concern**
144	*Hydroprogne caspia*	Caspian Tern	Least Concern
145	*Hypothymis azurea*	Black-naped Monarch	Least Concern
146	*Ictinaetus malaiensis*	Black Eagle	Least Concern
147	*Iduna caligata*	Booted Warbler	Least Concern
148	*Irena puella*	Asian Fairy-bluebird	Least Concern
149	*Ixobrychus cinnamomeus*	Cinnamon Bittern	Least Concern
150	*Ixobrychus flavicollis*	Black Bittern	Least Concern
151	*Jynx torquilla*	Eurasian Wryneck	Least Concern
152	*Ketupa zeylonensis*	Brown Fish-owl	Least Concern
153	*Lalage melanoptera*	Black-headed Cuckooshrike	Least Concern
154	*Lanius cristatus*	Brown Shrike	Least Concern
155	*Lanius schach*	Long-tailed Shrike	Least Concern
156	*Lanius vittatus*	Bay-backed Shrike	Least Concern
157	*Larus brunnicephalus*	Brown-headed Gull	Least Concern
158	*Larus ichthyaetus*	Pallas's Gull	Least Concern
159	*Larvivora brunnea*	Indian Blue Robin	Least Concern
160	*Leptocoma zeylonica*	Purple-rumped Sunbird	Least Concern
161	*Lewinia striata*	Slaty-breasted Rail	Least Concern
162	*Limosa limosa*	Black-tailed Godwit	Near Threatened
163	*Lonchura striata*	White-rumped Munia	Least Concern
164	*Loriculus vernalis*	Vernal Hanging-Parrot	Least Concern
165	*Luscinia svecica*	Bluethroat	Least Concern
166	*Malacocincla abbotti*	Abbott's Babbler	Least Concern
167	***Merops orientalis***	**Asian Green Bee-eater**	**Least Concern**
168	***Merops philippinus***	**Blue-tailed Bee-eater**	**Least Concern**
169	*Metopidius indicus*	Bronze-winged Jacana	Least Concern
170	***Microcarbo niger***	**Little Cormorant**	**Least Concern**
171	*Micropternus brachyurus*	Rufous Woodpecker	Least Concern
172	***Milvus migrans***	**Black Kite**	**Least Concern**
173	*Mirafra affinis*	Jerdon's Bushlark	Least Concern
174	*Monticola cinclorhyncha*	Blue-capped Rock-Thrush	Least Concern
175	*Monticola solitarius*	Blue Rock-Thrush	Least Concern
176	*Motacilla alba*	White Wagtail	Least Concern
177	*Motacilla cinerea*	Grey Wagtail	Least Concern
178	*Motacilla citreola*	Citrine Wagtail	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
179	*Motacilla flava*	Western Yellow Wagtail	Least Concern
180	*Motacilla maderaspatensis*	White-browed Wagtail	Least Concern
181	*Muscicapa dauurica*	Asian Brown Flycatcher	Least Concern
182	*Mycteria leucocephala*	Painted Stork	Near Threatened
183	*Neophron percnopterus*	Egyptian Vulture	Endangered
184	*Nettapus coromandelianus*	Cotton Pygmy-Goose	Least Concern
185	*Numenius arquata*	Eurasian Curlew	Near Threatened
186	*Numenius phaeopus*	Whimbrel	Least Concern
187	*Nycticorax nycticorax*	Black-crowned Night-heron	Least Concern
188	*Oceanites oceanicus*	Wilson's Storm-Petrel	Least Concern
189	*Oriolus xanthornus*	Black-hooded Oriole	Least Concern
190	*Orthotomus sutorius*	Common Tailorbird	Least Concern
191	*Ortygornis pondicerianus*	Grey Francolin	Least Concern
192	*Otus bakkamoena*	Indian Scops-owl	Least Concern
193	*Otus scops*	Eurasian Scops-owl	Least Concern
194	*Palaeornis eupatria*	Alexandrine Parakeet	Near Threatened
195	*Pandion haliaetus*	Osprey	Least Concern
196	*Parus major*	Great Tit	Least Concern
197	***Passer domesticus***	**House Sparrow**	**Least Concern**
198	*Pastor roseus*	Rosy Starling	Least Concern
199	*Pavo cristatus*	Indian Peafowl	Least Concern
200	*Pelargopsis capensis*	Stork-billed Kingfisher	Least Concern
201	*Pelecanus philippensis*	Spot-billed Pelican	Near Threatened
202	*Perdicula asiatica*	Jungle Bush-Quail	Least Concern
203	*Pericrocotus cinnamomeus*	Small Minivet	Least Concern
204	*Pericrocotus ethologus*	Long-tailed Minivet	Least Concern
205	*Pericrocotus flammeus*	Scarlet Minivet	Least Concern
206	*Pernis ptilorhynchus*	Oriental Honey-buzzard	Least Concern
207	*Phaenicophaeus tristis*	Green-billed Malkoha	Least Concern
208	*Phaenicophaeus viridirostris*	Blue-faced Malkoha	Least Concern
209	*Phalacrocorax carbo*	Great Cormorant	Least Concern
210	*Phoenicopterus roseus*	Greater Flamingo	Least Concern
211	*Phoenicurus ochruros*	Black Redstart	Least Concern
212	*Phylloscopus affinis*	Tickell's Leaf-Warbler	Least Concern
213	*Phylloscopus burkii*	Green-crowned Warbler	Least Concern
214	*Phylloscopus griseolus*	Sulphur-bellied Warbler	Least Concern
215	*Phylloscopus humei*	Hume's Leaf-warbler	Least Concern
216	*Phylloscopus occipitalis*	Western Crowned Leaf-warbler	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
217	*Phylloscopus trochiloides*	Greenish Warbler	Least Concern
218	*Picoides nanus*	Indian Pygmy Woodpecker	Least Concern
219	*Picus chlorolophus*	Lesser Yellownape	Least Concern
220	*Pitta brachyura*	Indian Pitta	Least Concern
221	*Ploceus philippinus*	Baya Weaver	Least Concern
222	*Pluvialis squatarola*	Grey Plover	Least Concern
223	*Podiceps cristatus*	Great Crested Grebe	Least Concern
224	*Pomatorhinus horsfieldii*	Indian Scimitar-Babbler	Least Concern
225	*Porphyrio porphyrio*	Purple Swamphen	Least Concern
226	*Prinia hodgsonii*	Grey-breasted Prinia	Least Concern
227	***Prinia inornata***	**Plain Prinia**	**Least Concern**
228	*Prinia socialis*	Ashy Prinia	Least Concern
229	*Prinia sylvatica*	Jungle Prinia	Least Concern
230	*Psilopogon haemacephalus*	Coppersmith Barbet	Least Concern
231	*Psilopogon zeylanicus*	Brown-headed Barbet	Least Concern
232	*Ptyonoprogne concolor*	Dusky Crag Martin	Least Concern
233	***Pycnonotus cafer***	**Red-vented Bulbul**	**Least Concern**
234	*Pycnonotus jocosus*	Red-whiskered Bulbul	Least Concern
235	*Pycnonotus luteolus*	White-browed Bulbul	Least Concern
236	*Rallina eurizonoides*	Slaty-legged Crake	Least Concern
237	*Recurvirostra avosetta*	Pied Avocet	Least Concern
238	*Rhipidura aureola*	White-browed Fantail	Least Concern
239	*Rubigula flaviventris*	Black-crested Bulbul	Least Concern
240	*Sarkidiornis melanotos*	African Comb Duck	Least Concern
241	*Saxicola caprata*	Pied Bushchat	Least Concern
242	*Schoenicola striatus*	Bristled Grassbird	Vulnerable
243	*Sitta frontalis*	Velvet-fronted Nuthatch	Least Concern
244	*Spatula clypeata*	Northern Shoveler	Least Concern
245	*Spatula querquedula*	Garganey	Least Concern
246	***Spilopelia senegalensis***	**Laughing Dove**	**Least Concern**
247	***Spilopelia suratensis***	**Western Spotted Dove**	**Least Concern**
248	*Spilornis cheela*	Crested Serpent-eagle	Least Concern
249	*Sterna acuticauda*	Black-bellied Tern	Endangered
250	*Sterna aurantia*	River Tern	Vulnerable
251	***Streptopelia decaocto***	**Eurasian Collared-dove**	**Least Concern**
252	*Strix leptogrammica*	Brown Wood-Owl	Least Concern
253	*Strix ocellata*	Mottled Wood-Owl	Least Concern
254	*Sturnia malabarica*	Chestnut-tailed Starling	Least Concern

SN	Scientific Name	Common Name	IUCN Status*
255	*Sturnia pagodarum*	Brahminy Starling	Least Concern
256	*Sypheotides indicus*	Lesser Florican	Critically Endangered
257	*Taccocua leschenaultii*	Sirkeer Malkoha	Least Concern
258	*Tachybaptus ruficollis*	Little Grebe	Least Concern
259	*Tadorna ferruginea*	Ruddy Shelduck	Least Concern
260	*Tephrodornis pondicerianus*	Common Woodshrike	Least Concern
261	*Tephrodornis virgatus*	Large Woodshrike	Least Concern
262	*Terpsiphone paradisi*	Indian Paradise-flycatcher	Least Concern
263	*Thalasseus bengalensis*	Lesser Crested Tern	Least Concern
264	*Threskiornis melanocephalus*	Black-headed Ibis	Near Threatened
265	*Treron bicinctus*	Orange-breasted Green-Pigeon	Least Concern
266	*Treron phoenicopterus*	Yellow-footed Green-Pigeon	Least Concern
267	*Tringa erythropus*	Spotted Redshank	Least Concern
268	*Tringa glareola*	Wood Sandpiper	Least Concern
269	*Tringa nebularia*	Common Greenshank	Least Concern
270	*Tringa ochropus*	Green Sandpiper	Least Concern
271	*Tringa totanus*	Common Redshank	Least Concern
272	*Turdus unicolor*	Tickell's Thrush	Least Concern
273	*Turnix suscitator*	Barred Buttonquail	Least Concern
274	*Turnix sylvaticus*	Common Buttonquail	Least Concern
275	*Turnix tanki*	Yellow-legged Buttonquail	Least Concern
276	*Tyto alba*	Common Barn-owl	Least Concern
277	*Upupa epops*	Common Hoopoe	Least Concern
278	***Vanellus indicus***	**Red-wattled Lapwing**	**Least Concern**
279	***Vanellus malabaricus***	**Yellow-wattled Lapwing**	**Least Concern**
280	*Zapornia akool*	Brown Crake	Least Concern
281	*Zosterops palpebrosus*	Indian White-eye	Least Concern

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where –DD – Data Deficient, LC – Least Concern, NT-Near Threatened, VU – Vulnerable*

C.4 Reptiles of the Study Area

SN	Scientific Name	Common Name	IUCN Status*
1	*Acrochordus granulatus*	Wart Snake	Least Concern
2	*Ahaetulla nasuta*	Long-nosed Tree Snake	Least Concern
3	*Amphiesma stolatum*	Buff Striped Keelback	Least Concern
4	*Argyrogena fasciolata*	Banded Racer	Least Concern
5	*Atretium schistosum*	Olive Keelback Water Snake	Least Concern
6	*Barkudia melanosticta*	Russell's Legless Skink	Data Deficient
7	*Boiga trigonata*	Indian Gamma Snake	Least Concern
8	*Bungarus caeruleus*	Common Krait	Least Concern
9	*Calliophis melanurus*	Slender Coral Snake	Least Concern
10	*Calotes versicolor*	Changeable Lizard	Least Concern
11	*Caretta caretta*	Loggerhead Turtle	Vulnerable
12	*Chamaeleo zeylanicus*	Asian Chameleon	Least Concern
13	*Coelognathus helenae*	Trinket Snake	Least Concern
14	*Coelognathus radiatus*	Copper-head Trinket Snake	Least Concern
15	*Crocodylus palustris*	Mugger	Vulnerable
16	*Cyrtodactylus nebulosus*	Clouded Indian Gecko	Least Concern
17	*Daboia russelii*	Western Russelâ€™s Viper	Least Concern
18	*Dendrelaphis tristis*	Daudin's Bronzeback	Least Concern
19	*Dermochelys coriacea*	Leatherback Turtle	Vulnerable
20	*Echis carinatus*		Least Concern
21	*Eretmochelys imbricata*	Hawksbill Turtle	Critically Endangered
22	*Eublepharis hardwickii*	Eastern Indian Leopard Gecko	Least Concern
23	*Eutropis allapallensis*	Schmidt's Mabuya	Least Concern
24	*Eutropis beddomei*	Beddome's Mabuya	Least Concern
25	*Eutropis carinata*	Keeled Indian Mabuya	Least Concern
26	*Eutropis macularia*	Bronze Mabuya	Least Concern
27	*Eutropis trivittata*	Three-banded Mabuya	Least Concern
28	*Fowlea piscator*	Chequered Keelback	Least Concern
29	*Geochelone elegans*	Indian Star Tortoise	Vulnerable
30	*Grypotyphlops acutus*	Beaked Worm Snake	Least Concern
31	*Hemidactylus brookii*	Brooke's House Gecko	Least Concern
32	*Hemidactylus frenatus*	Common House Gecko	Least Concern
33	*Hemidactylus leschenaultii*		Least Concern
34	*Hemidactylus maculatus*	Spotted Leaf-toed Gecko	Least Concern
35	*Hemidactylus sushilduttai*	Duttaâ€™s Mahendragiri Gecko	Least Concern
36	*Hemidactylus treutleri*		Least Concern
37	*Hemidactylus triedrus*	Dakota's Leaf-toed Gecko	Least Concern

38	*Hydrophis caerulescens*	Dwarf Sea Snake	Least Concern
39	*Hydrophis cantoris*	Cantorâ€™s Narrowâ€“headed Sea Snake	Data Deficient
40	*Hydrophis curtus*	Spine-bellied Sea Snake	Least Concern
41	*Hydrophis cyanocinctus*	Annulated Sea Snake	Least Concern
42	*Hydrophis fasciatus*	Striped Sea Snake	Least Concern
43	*Hydrophis gracilis*	Graceful Small-headed Sea Snake	Least Concern
44	*Hydrophis lapemoides*	Arabian Gulf Sea Snake	Least Concern
45	*Hydrophis mamillaris*	Bombay Sea Snake	Data Deficient
46	*Hydrophis ornatus*	Ornate Reef Sea Snake	Least Concern
47	*Hydrophis platurus*	Yellow-bellied Sea Snake	Least Concern
48	*Hydrophis schistosus*	Beaked Sea Snake	Least Concern
49	*Hydrophis spiralis*	Yellow Sea Snake	Least Concern
50	*Hydrophis stokesii*	Stokes' Sea Snake	Least Concern
51	*Hydrophis stricticollis*	Collared Sea Snake	Data Deficient
52	*Hydrophis viperinus*	Viperine Sea Snake	Least Concern
53	*Indotyphlops braminus*	Brahminy Blind Snake	Least Concern
54	*Indotyphlops porrectus*	Stoliczkaâ€™s Slender Blind Snake	Least Concern
55	*Kerilia jerdoni*		Least Concern
56	*Laticauda colubrina*		Least Concern
57	*Laticauda laticaudata*		Least Concern
58	*Lepidochelys olivacea*	Olive Ridley Turtle	Vulnerable
59	*Lepidodactylus lugubris*	Mourning Gecko	Least Concern
60	*Liopeltis calamaria*	Calamaria Reed Snake	Least Concern
61	*Lissemys punctata*	Indian Flapshell Turtle	Vulnerable
62	*Lycodon anamallensis*	Colombo Wolf Snake	Least Concern
63	*Lycodon aulicus*	Common Wolf Snake	Least Concern
64	*Lycodon nympha*	Vellore Bridal Snake	Least Concern
65	*Lycodon striatus*	Barred Wolf Snake	Least Concern
66	*Lycodon travancoricus*	Travancore Wolf Snake	Least Concern
67	*Lygosoma albopunctata*	White-spotted Supple Skink	Least Concern
68	*Lygosoma punctata*	Common Dotted Garden Skink	Least Concern
69	*Naja naja*	Indian Cobra	Least Concern
70	*Oligodon arnensis*	Common Kukri Snake	Least Concern
71	*Oligodon taeniolatus*	Streaked Kukri Snake	Least Concern
72	*Ophiophagus hannah*	King Cobra	Vulnerable
73	*Ophisops jerdonii*	Punjab-snake-eyed Lacerta	Least Concern
74	*Ophisops leschenaultii*	Leschenault's Snake Eye	Least Concern
75	*Pangshura tentoria*	Indian Tent Turtle	Least Concern
76	*Psammophilus blanfordanus*	Blanford's Rock Agama	Least Concern

77	*Ptyas mucosa*		Least Concern
78	*Python molurus*	Indian Rock Python	Near Threatened
79	*Rhabdophis plumbicolor*	Green Keelback	Least Concern
80	*Sepsophis punctatus*	Spotted Limbless Skink	Least Concern
81	*Sibynophis subpunctatus*	Dumeril's Black-headed Snake	Least Concern
82	*Sitana ponticeriana*	Pondicherry Fan Throated Lizard	Least Concern
83	*Trimeresurus gramineus*	Common Bamboo Viper	Least Concern
84	*Uropeltis ellioti*	Elliot's Earth Snake	Least Concern
85	*Varanus bengalensis*	Bengal Monitor Lizard	Near Threatened
86	*Varanus salvator*	Common Water Monitor	Least Concern

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where LC – Least Concern*

C.5 Fishes of the Study Area

SN	Scientific Name	Common Name	IUCN Status*
1	*Abalistes stellatus*	Starry Triggerfish	Least Concern
2	*Ablennes hians*	Flat Needlefish	Least Concern
3	*Abudefduf bengalensis*	Bengal Sergeant	Least Concern
4	*Acanthopagrus berda*	Picnic Seabream	Least Concern
5	*Acanthopagrus longispinnis*	Bengal Yellowfin Seabream	Data Deficient
6	*Acanthurus lineatus*	Lined Surgeonfish	Least Concern
7	*Acanthurus mata*	Elongate Surgeonfish	Least Concern
8	*Acanthurus triostegus*	Convict Surgeonfish	Least Concern
9	*Acentrogobius viridipunctatus*	Spotted Green Goby	Least Concern
10	*Acentronura tentaculata*	Shortpouch Pygmy Pipehorse	Least Concern
11	*Aesopia cornuta*	Unicorn Sole	Least Concern
12	*Albula oligolepis*	Smallscale Bonefish	Data Deficient
13	*Alectis ciliaris*	African Pompano	Least Concern
14	*Alectis indica*	Indian Threadfish	Least Concern
15	*Alepes djedaba*	Shrimp Scad	Least Concern
16	*Alepes melanoptera*	Blackfin Scad	Least Concern
17	*Alepes vari*	Herring Scad	Least Concern
18	*Alepisaurus ferox*	Long Snouted Lancetfish	Least Concern
19	*Aluterus monoceros*	Unicorn Leatherjacket Filefish	Least Concern
20	*Aluterus scriptus*	Scribbled Leatherjacket Filefish	Least Concern
21	*Ambassis gymnocephalus*	Bald Glassy Perchlet	Least Concern
22	*Ambassis nalua*	Scalloped Perchlet	Least Concern
23	*Ambassis urotaenia*	Bleeker's Glass Perchlet	Least Concern
24	*Amblyeleotris wheeleri*	Gorgeous Prawn-goby	Least Concern
25	*Amblypharyngodon microlepis*	Indian Carplet	Least Concern
26	*Amphiprion clarkii*	Clark's Anemonefish	Least Concern
27	*Amphiprion sebae*	Sebae Clownfish	Least Concern
28	*Anabas testudineus*	Climbing Perch	Least Concern
29	*Anacanthus barbatus*	Bearded Leatherjacket	Least Concern
30	*Anguilla bengalensis*	Indian Mottled Eel	Near Threatened
31	*Anguilla bicolor*	Shortfin Eel	Near Threatened
32	*Anguilla marmorata*	Marbled Eel	Least Concern
33	*Anodontostoma chacunda*	Shortnose Gizzard Shad	Least Concern
34	*Anoplogaster cornuta*	Common Fangtooth	Least Concern
35	*Antennatus nummifer*	Big-spot Angler	Least Concern
36	*Antigonia capros*	Deepbody Boarfish	Least Concern
37	*Aphareus furca*	Small-toothed Jobfish	Least Concern

38	*Aphareus rutilans*	Rusty Jobfish	Least Concern
39	*Apistus carinatus*	Ocellated Waspfish	Least Concern
40	*Aplocheilus panchax*	Blue Panchax	Least Concern
41	*Aplocheilus parvus*	Dwarf panchax	Least Concern
42	*Apogonichthyoides nigripinnis*	Bullseye Cardinalfish	Least Concern
43	*Aprion virescens*	Green Jobfish	Least Concern
44	*Argyropelecus hemigymnus*	Half-naked Hatchetfish	Least Concern
45	*Argyropelecus olfersii*	Silver Hatchetfish	Least Concern
46	*Argyrops spinifer*	King Soldier Bream	Least Concern
47	*Arius arius*	Threadfin Sea Catfish	Least Concern
48	*Arnoglossus macrolophus*	Large-crested Lefteye Flounder	Least Concern
49	*Arothron leopardus*	Banded Leopardblowfish	Data Deficient
50	*Astronesthes bilobatus*	Twinlobe Snaggletooth	Least Concern
51	*Astronesthes cyaneus*	Blue Snaggletooth	Least Concern
52	*Astronesthes splendidus*	Splendid Snaggletooth	Least Concern
53	*Astronesthes trifibulatus*	Triplethread Snaggletooth	Least Concern
54	*Atherinomorus lacunosus*	Hardyhead Silverside	Least Concern
55	*Atrobucca nibe*	Blackmouth Croaker	Least Concern
56	*Atropus atropos*	Cleftbelly Trevally	Least Concern
57	*Atule mate*	Yellowtail Scad	Least Concern
58	*Aurigequula fasciata*	Threadfin Ponyfish	Least Concern
59	*Auxis rochei*	Bullet Tuna	Least Concern
60	*Auxis thazard*	Frigate Tuna	Least Concern
61	*Avocettina infans*	Avocet Snipe Eel	Least Concern
62	*Bassozetus glutinosus*	Glutin Assfish	Least Concern
63	*Bathypterois guentheri*	Tribute Spiderfish	Least Concern
64	*Bathyuroconger vicinus*	Large-toothed Conger	Least Concern
65	*Benthosema fibulatum*	Spinycheek Lanternfish	Least Concern
66	*Benthosema pterotum*	Skinnycheek Lanternfish	Least Concern
67	*Beryx splendens*	Splendid Alfonsino	Least Concern
68	*Boleophthalmus boddarti*	Boddart's Goggle-eyed Goby	Least Concern
69	*Boleophthalmus dussumieri*	Mud skipper	Least Concern
70	*Bolinichthys longipes*	Popeye Lanternfish	Least Concern
71	*Bolinichthys pyrsobolus*	Fiery Lanternfish	Least Concern
72	*Bostrychus sinensis*	Four-eyed Sleeper	Least Concern
73	*Bothus myriaster*	Oval Flounder	Least Concern
74	*Bothus pantherinus*	Leopard Flounder	Least Concern
75	*Brachirus orientalis*	Oriental Sole	Least Concern
76	*Brachirus pan*	Pan Sole	Least Concern

77	*Brachypleura novaezeelandiae*	Yellow-dappled Flounder	Least Concern
78	*Brachypterois serrulifer*	Sawcheek Scorpionfish	Least Concern
79	*Brosmophyciops pautzkei*	Slimy Cuskeel	Least Concern
80	*Brotula multibarbata*	Pacific Bearded Brotula	Least Concern
81	*Butis koilomatodon*	Marblecheek Sleeper	Least Concern
82	*Callionymus sagitta*	Arrow-headed Darter Dragonet	Least Concern
83	*Caragobius urolepis*	Scaleless Worm Goby	Least Concern
84	*Carangoides chrysophrys*	Longnose Trevally	Least Concern
85	*Carangoides coeruleopinnatus*	Coastal Trevally	Least Concern
86	*Carangoides ferdau*	Blue Trevally	Least Concern
87	*Carangoides fulvoguttatus*	Yellowspotted Trevally	Least Concern
88	*Carangoides gymnostethus*	Bludger	Least Concern
89	*Carangoides hedlandensis*	Bumpnose Trevally	Least Concern
90	*Carangoides malabaricus*	Malabar Trevally	Least Concern
91	*Carangoides praeustus*	Brownback Trevally	Least Concern
92	*Caranx ignobilis*	Giant Trevally	Least Concern
93	*Caranx lugubris*	Black Jack	Least Concern
94	*Caranx melampygus*	Bluefin Trevally	Least Concern
95	*Caranx sexfasciatus*	Bigeye Trevally	Least Concern
96	*Carapus mourlani*	Star Pearlfish	Least Concern
97	*Centriscus scutatus*	Grooved Razorfish	Least Concern
98	*Centrobranchus andreae*	Andre's Lanternfish	Least Concern
99	*Cephalopholis formosa*	Bluelined Hind	Least Concern
100	*Ceratias holboelli*	Deepsea Angler	Least Concern
101	*Ceratoscopelus townsendi*	Dogtooth Lampfish	Least Concern
102	*Channa gachua*	Dwarf Snakehead	Least Concern
103	*Channa punctata*	Spotted Snakehead	Least Concern
104	*Channa striata*	Snakehead Murrel	Least Concern
105	*Chanos chanos*	Milkfish	Least Concern
106	*Chascanopsetta lugubris*	Pelican flounder	Least Concern
107	*Chauliodus sloani*	Sloane's Viperfish	Least Concern
108	*Chaunax penicillatus*	Fluffylure Frogmouth	Least Concern
109	*Cheilopogon cyanopterus*	Margined Flyingfish	Least Concern
110	*Chelon melinopterus*	Otomebora Mullet	Least Concern
111	*Chelonodontops patoca*	Milkspotted Puffer	Least Concern
112	*Chirocentrus dorab*	Dorab Wolf Herring	Least Concern
113	*Chirocentrus nudus*	Whitefin wolf-herring	Least Concern
114	*Chlorophthalmus agassizi*	Agassiz's Thread-sail Fish	Least Concern
115	*Chlorophthalmus corniger*	Spinyjaw Greeneye	Least Concern

116	*Chrysochir aureus*	Yellowfin Croaker	Least Concern
117	*Cirrhinus mrigala*	Mrigal	Least Concern
118	*Coccorella atrata*	Black Sabertooth	Least Concern
119	*Cocotropus roseus*	Velvetfish	Least Concern
120	*Coilia neglecta*	Neglected Grenadier Anchovy	Least Concern
121	*Coilia reynaldi*	Reynald's Grenadier Anchovy	Least Concern
122	*Conger cinereus*	Ashen Conger Eel	Least Concern
123	*Cookeolus japonicus*	Longfinned Bullseye	Least Concern
124	*Coryphaena equiselis*	Pompano Dolphinfish	Least Concern
125	*Coryphaena hippurus*	Common Dolphinfish	Least Concern
126	*Cosmocampus investigatoris*	Investigator Pipefish	Least Concern
127	*Crenimugil seheli*	Bluespot Mullet	Least Concern
128	*Crossorhombus azureus*	Bluespotted Flounder	Least Concern
129	*Crossorhombus valderostratus*	Broadbrow Flounder	Least Concern
130	*Cryptopsaras couesii*	Triplewart Seadevil	Least Concern
131	*Cubiceps pauciradiatus*	Bigeye Cigarfish	Least Concern
132	*Cyclothone acclinidens*	Bent-tooth Bristlemouth	Least Concern
133	*Cyclothone pallida*	Bicolored Bristlemouth	Least Concern
134	*Cyclothone pseudopallida*	Slender Bristlemouth	Least Concern
135	*Cynoglossus arel*	Largescale Tonguesole	Data Deficient
136	*Cynoglossus carpenteri*	Hooked Tonguesole	Least Concern
137	*Cynoglossus cynoglossus*	Bengal Tonguesole	Least Concern
138	*Cynoglossus kopsii*	Shortheaded Tonguesole	Least Concern
139	*Cynoglossus lida*	Roughscale Tonguesole	Least Concern
140	*Cynoglossus lingua*	Long Tonguesole	Least Concern
141	*Cynoglossus macrostomus*	Malabar Tonguesole	Vulnerable
142	*Cynoglossus semifasciatus*	Bengal Tonguesole	Data Deficient
143	*Dactyloptena gilberti*	Flying Gurnard	Least Concern
144	*Dagetichthys albomaculatus*	Kaup's Sole	Least Concern
145	*Dagetichthys commersonnii*	Commerson's Sole	Least Concern
146	*Decapterus macarellus*	Mackerel Scad	Least Concern
147	*Decapterus macrosoma*	Shortfin Scad	Least Concern
148	*Decapterus russelli*	Indian Scad	Least Concern
149	*Dendrophysa russelii*	Goatee Croaker	Least Concern
150	*Diaphus aliciae*	Aliceâ€™s Lanternfish	Least Concern
151	*Diaphus antonbruuni*	Bruunâ€™s Lanternfish	Least Concern
152	*Diaphus coeruleus*	Blue Lanternfish	Least Concern
153	*Diaphus impostor*	Impostor Lanternfish	Least Concern
154	*Diaphus jenseni*	Jensen's Lanternfish	Least Concern

155	*Diaphus knappi*	Knappâ€™s Lanternfish	Least Concern
156	*Diaphus malayanus*	Malayan Lanternfish	Least Concern
157	*Diaphus parri*	Parr's Lanternfish	Least Concern
158	*Diaphus phillipsi*	Bolin's Lanternfish	Least Concern
159	*Diaphus regani*	Regan's Lanternfish	Least Concern
160	*Diaphus thiollierei*	Thiolliere's Lanternfish	Least Concern
161	*Diaphus watasei*	Watase's Lanternfish	Least Concern
162	*Dichotomyctere fluviatilis*	Green Pufferfish	Least Concern
163	*Diodon holocanthus*	Long-spine Porcupinefish	Least Concern
164	*Diodon hystrix*	Spot-fin Porcupinefish	Least Concern
165	*Diplophos taenia*	Pacific Portholefish	Least Concern
166	*Diretmus argenteus*	Silver Spinyfin	Least Concern
167	*Ditropichthys storeri*	Doublekeeled whalefish	Data Deficient
168	*Doryrhamphus excisus*	Bluestripe Pipefish	Least Concern
169	*Dussumieria acuta*	Hasselt's Sprat	Least Concern
170	*Dussumieria elopsoides*	Slender Rainbow Sardine	Least Concern
171	*Echeneis naucrates*	Live Sharksucker	Least Concern
172	*Eleotris fusca*	Brown Spinecheek Gudgeon	Least Concern
173	*Ellochelon vaigiensis*	Squaretail Mullet	Least Concern
174	*Encrasicholina heteroloba*	Shorthead anchovy	Least Concern
175	*Engyprosopon grandisquama*	Largescale Flounder	Least Concern
176	*Entomacrodus epalzeocheilos*	Fringelip Rockskipper	Least Concern
177	*Entomacrodus striatus*	Blackspotted Rockskipper	Least Concern
178	*Epinephelus bleekeri*	Duskytail Grouper	Data Deficient
179	*Epinephelus coioides*	Orange-spotted Grouper	Least Concern
180	*Epinephelus erythrurus*	Cloudy Grouper	Least Concern
181	*Epinephelus lanceolatus*	Giant Grouper	Data Deficient
182	*Epinephelus magniscuttis*	Speckled Grouper	Least Concern
183	*Escualosa thoracata*	White Sardine	Least Concern
184	*Esomus danrica*	Flying barb	Least Concern
185	*Etelis coruscans*	Deepwater Longtail Red Snapper	Least Concern
186	*Etroplus suratensis*	Green Chromide	Least Concern
187	*Eubleekeria splendens*	Splendid Ponyfish	Least Concern
188	*Eustomias bifilis*	Twinthread Dragonfish	Least Concern
189	*Eustomias bulbornatus*	Grapevine Dragonfish	Least Concern
190	*Eustomias cryptobulbus*	Hiddenbulb Dragonfish	Least Concern
191	*Eustomias macronema*	Bigbarb Dragonfish	Least Concern
192	*Eutaeniophorus festivus*	Festive Ribbonfish	Least Concern
193	*Euthynnus affinis*	Kawakawa	Least Concern

194	*Exocoetus volitans*	Tropical Two-wing Flyingfish	Least Concern
195	*Exyrias puntang*	Puntang Goby	Least Concern
196	*Favonigobius reichei*	Indo-pacific Tropical Sand Goby	Least Concern
197	*Fistularia petimba*	Red Cornetfish	Least Concern
198	*Gazza minuta*	Toothed Ponyfish	Least Concern
199	*Gephyroberyx darwinii*	Big Roughy	Least Concern
200	*Gerres erythrourus*	Deep-bodied Mojarra	Least Concern
201	*Gerres filamentosus*	Whipfin Mojarra	Least Concern
202	*Gerres longirostris*	Strongspine Silver-Biddy	Least Concern
203	*Gerres oyena*	Common Silver-biddy	Least Concern
204	*Gnathanodon speciosus*	Golden Trevally	Least Concern
205	*Grammatobothus polyophthalmus*	Threespot Flounder	Least Concern
206	*Gymnocaesio gymnoptera*	Slender Fusilier	Least Concern
207	*Gymnocranius elongatus*	Forktail Large-eye Bream	Least Concern
208	*Gymnocranius griseus*	Grey Large-eye Bream	Least Concern
209	*Gymnostomus ariza*	Ariza Labeo	Least Concern
210	*Gymnothorax reticularis*	Dusky-banded Moray	Least Concern
211	*Gymnothorax tile*	Indian Mud Moray	Least Concern
212	*Halidesmus thomaseni*	Thomasen's Snakelet	Least Concern
213	*Halieutaea coccinea*	Scarlet Seabat	Least Concern
214	*Halieutaea fumosa*	Smoky Seabat	Least Concern
215	*Halieutaea indica*	Indian Seabat	Least Concern
216	*Halieutaea nigra*	Black Seabat	Least Concern
217	*Heniochus acuminatus*	Pennant Coral Fish	Least Concern
218	*Heteromycteris oculus*	Eyed Sole	Data Deficient
219	*Heteropriacanthus cruentatus*	Glasseye Snapper	Least Concern
220	*Hilsa kelee*	Kelee Shad	Least Concern
221	*Himantolophus groenlandicus*	Atlantic Football-Fish	Least Concern
222	*Hippichthys cyanospilos*	Bluespeckled Pipefish	Least Concern
223	*Hippichthys spicifer*	Bellybarred Pipefish	Least Concern
224	*Hippocampus histrix*	Thorny Seahorse	Vulnerable
225	*Hippocampus kelloggi*	Great Seahorse	Vulnerable
226	*Hippocampus spinosissimus*	Hedgehog Seahorse	Vulnerable
227	*Hippocampus trimaculatus*	Three-spot Seahorse	Vulnerable
228	*Histrio histrio*	Sargassumfish	Least Concern
229	*Hoplostethus melanopus*	Smallscale Slimehead	Least Concern
230	*Hygophum proximum*	Firefly Lanternfish	Least Concern
231	*Hypopleuron caninum*	Whiptail Cusk	Least Concern
232	*Ichthyocampus carce*	Indian Freshwater Pipefish	Least Concern

233	*Idiacanthus fasciola*	Ribbon Sawtail Fish	Least Concern
234	*Ilisha filigera*	Coromandel Ilisha	Data Deficient
235	*Ilisha kampeni*	Kampen's Ilisha	Least Concern
236	*Ilisha megaloptera*	Bigeye Ilisha	Least Concern
237	*Ilisha melastoma*	Indian Ilisha	Least Concern
238	*Ilisha sirishai*	Lobejaw Ilisha	Data Deficient
239	*Inegocia japonica*	Japanese Flathead	Least Concern
240	*Istigobius ornatus*	Ornate Goby	Least Concern
241	*Istiompax indica*	Black Marlin	Data Deficient
242	*Istiophorus platypterus*	Sailfish	Vulnerable
243	*Johnius belangerii*	Belanger's Croaker	Least Concern
244	*Johnius borneensis*	Hammer Croaker	Least Concern
245	*Johnius carouna*	Caroun Croaker	Least Concern
246	*Kajikia audax*	Striped Marlin	Least Concern
247	*Kali colubrina*	Fragile Cagemouth	Least Concern
248	*Katsuwonus pelamis*	Skipjack Tuna	Least Concern
249	*Kumococius rodericensis*	Spiny Flathead	Least Concern
250	*Kyphosus bigibbus*	Brown Chub	Least Concern
251	*Labeo bata*	Minor Carp	Least Concern
252	*Labeo boggut*	Boggut labeo	Least Concern
253	*Laeops guentheri*	GÃ¼nther's Flounder	Least Concern
254	*Lagocephalus inermis*	Smooth Blaasop	Least Concern
255	*Lagocephalus lagocephalus*	Oceanic Puffer	Least Concern
256	*Lagocephalus lunaris*	Lunartail Puffer	Least Concern
257	*Lagocephalus sceleratus*	Silver-cheeked Toadfish	Least Concern
258	*Lagocephalus spadiceus*	Half-smooth Golden Pufferfish	Least Concern
259	*Lampanyctus steinbecki*	Longfin Lampfish	Least Concern
260	*Leiognathus equulus*	Common Ponyfish	Least Concern
261	*Lepidotrigla spiloptera*	Spotwing gurnard	Least Concern
262	*Leptochilichthys pinguis*	Vaillant's Smoothhead	Least Concern
263	*Lepturacanthus pantului*	Coromandel Hairtail	Data Deficient
264	*Lestidiops mirabilis*	Strange Pike Smelt	Least Concern
265	*Linophryne densiramus*	Bearded Angler	Least Concern
266	*Lophiodes mutilus*	Smooth Angler	Least Concern
267	*Lophiomus setigerus*	Blackmouth Goosefish	Least Concern
268	*Lutjanus erythropterus*	Crimson Snapper	Least Concern
269	*Lutjanus indicus*	Striped Snapper	Least Concern
270	*Lutjanus johnii*	John's Snapper	Least Concern
271	*Lutjanus lemniscatus*	Yellowstreaked Snapper	Least Concern

272	*Lutjanus lunulatus*	Lunartail Snapper	Least Concern
273	*Lutjanus lutjanus*	Bigeye Snapper	Least Concern
274	*Lutjanus malabaricus*	Malabar Blood Snapper	Least Concern
275	*Luvarus imperialis*	Louvar	Least Concern
276	*Marleyella bicolorata*	Bicolor Righteye Flounder	Data Deficient
277	*Mastacembelus armatus*	Spiny Eel	Least Concern
278	*Masturus lanceolatus*	Sharptail Mola	Least Concern
279	*Megalaspis cordyla*	Torpedo Scad	Least Concern
280	*Megalops cyprinoides*	Indo-Pacific Tarpon	Data Deficient
281	*Melamphaes danae*	Bigscale	Least Concern
282	*Melamphaes indicus*	Indian Bigscale	Least Concern
283	*Melanocetus johnsonii*	Humpback Anglerfish	Least Concern
284	*Micrognathus andersonii*	Anderson's Pipefish	Least Concern
285	*Microphis brachyurus*	Opossum Pipefish	Least Concern
286	*Minous inermis*	Alcock's Scorpionfish	Least Concern
287	*Minous monodactylus*	Grey Stingfish	Least Concern
288	*Mola mola*	Ocean Sunfish	Vulnerable
289	*Monodactylus argenteus*	Silver Moony	Least Concern
290	*Monomitopus nigripinnis*	Blackfin Cusk	Least Concern
291	*Monopterus albus*	Rice Swampeel	Least Concern
292	*Monopterus javanensis*	Oriental Swamp Eel	Least Concern
293	*Morone saxatilis*	Striped Bass	Least Concern
294	*Mugil cephalus*	Flathead Mullet	Least Concern
295	*Muraenesox bagio*	Common Pike Conger	Least Concern
296	*Mycteroperca morrhua*	Comet Grouper	Least Concern
297	*Myctophum aurolaternatum*	Golden Lanternfish	Least Concern
298	*Myctophum ovcharovi*	Prickly Lanternfish	Least Concern
299	*Myersina filifer*	Thread Goby	Least Concern
300	*Nannocampus pictus*	Reef Pipefish	Least Concern
301	*Naso brevirostris*	Palefin Unicornfish	Least Concern
302	*Naso unicornis*	Bluespine Unicornfish	Least Concern
303	*Naucrates ductor*	Pilotfish	Least Concern
304	*Nectamia fusca*	Ghost Cardinalfish	Least Concern
305	*Nectamia savayensis*	Samoan Cardinalfish	Least Concern
306	*Nematalosa galatheae*	Galathea Gizzard Shad	Least Concern
307	*Nematalosa nasus*	Bloch's Gizzard Shad	Least Concern
308	*Nemichthys scolopaceus*	Slender Snipe Eel	Least Concern
309	*Nemipterus bipunctatus*	Delagoa threadfin bream	Least Concern
310	*Nemipterus furcosus*	Fork-tailed Threadfin Bream	Least Concern

311	*Nemipterus japonicus*	Japanese Threadfin Bream	Least Concern
312	*Nemipterus nematophorus*	Doublewhip Threadfin Bream	Least Concern
313	*Nemipterus peronii*	Notchedfin Treadfin Bream	Least Concern
314	*Nemipterus randalli*	Randall's Threadfin Bream	Least Concern
315	*Nemipterus zysron*	Slender Threadfin Bream	Least Concern
316	*Neobythites steatiticus*	Barred Cusk Eel	Least Concern
317	*Neopomacentrus taeniurus*	Freshwater Damsel	Data Deficient
318	*Neoscopelus microchir*	Shortfin Neoscopelid	Least Concern
319	*Nomeus gronovii*	Man-of-war Fish	Least Concern
320	*Odonus niger*	Redtooth Triggerfish	Least Concern
321	*Omobranchus ferox*	Gossamer Blenny	Least Concern
322	*Omobranchus punctatus*	Japanese Blenny	Least Concern
323	*Ophichthus macrochir*	Bigfin Snake Eel	Least Concern
324	*Ophiocara porocephala*	Spangled Gudgeon	Least Concern
325	*Ophisternon bengalense*	Bengal Mud Eel	Least Concern
326	*Oryzias dancena*	Indian Ricefish	Least Concern
327	*Ostorhinchus cookii*	Cook's Cardinalfish	Least Concern
328	*Ostorhinchus fasciatus*	Broadbanded Cardinalfish	Least Concern
329	*Ostorhinchus lateralis*	Humpback Cardinal	Least Concern
330	*Otolithes ruber*	Tigertooth Croaker	Least Concern
331	*Oxyurichthys microlepis*	Maned Goby	Least Concern
332	*Oxyurichthys ophthalmonema*	Eyebrow Goby	Least Concern
333	*Oxyurichthys papuensis*	Papuan Goby	Least Concern
334	*Pachypterus atherinoides*	Indian Potasi	Least Concern
335	*Paracaesio sordida*	Dirty Ordure Snapper	Least Concern
336	*Paralepis elongata*	Barracudina	Least Concern
337	*Paramonacanthus oblongus*	Hair-finned Filefish	Least Concern
338	*Paraplagusia bilineata*	Doublelined Tonguesole	Least Concern
339	*Parascolopsis aspinosa*	Smooth Dwarf Monocle Bream	Least Concern
340	*Parascolopsis boesemani*	Redfin Dwarf Monocle Bream	Least Concern
341	*Parascolopsis eriomma*	Rosy Dwarf Monocle Bream	Least Concern
342	*Parascolopsis inermis*	Unarmed Dwarf Monocle Bream	Least Concern
343	*Parastromateus niger*	Black Pomfret	Least Concern
344	*Parazen pacificus*	Parazen	Least Concern
345	*Pegasus volitans*	Longtail Seamoth	Data Deficient
346	*Pellona ditchela*	Indian Pellona	Least Concern
347	*Pentaprion longimanus*	Longfin Mojarra	Least Concern
348	*Periophthalmus argentilineatus*	Barred Mudskipper	Least Concern
349	*Periophthalmus kalolo*	Kalolo Mudskipper	Least Concern

350	*Phtheirichthys lineatus*	Slender Suckerfish	Least Concern
351	*Pinjalo pinjalo*	Pinjalo	Least Concern
352	*Pisodonophis cancrivorus*	Longfin Snake Eel	Least Concern
353	*Planiliza macrolepis*	Largescale Mullet	Least Concern
354	*Planiliza planiceps*	Tade Gray Mullet	Least Concern
355	*Planiliza subviridis*	Greenback Mullet	Least Concern
356	*Platybelone argalus*	Keeltail Needlefish	Least Concern
357	*Platycephalus indicus*	Bartail Flathead	Data Deficient
358	*Platytroctes apus*	Legless Searsid	Least Concern
359	*Plectorhinchus gibbosus*	Brown Sweetlips	Least Concern
360	*Plicofollis dussumieri*	Blacktip Sea Catfish	Least Concern
361	*Plicofollis platystomus*	Flatmouth Catfish	Least Concern
362	*Poecilopsetta colorata*	Coloured Righteye Flounder	Least Concern
363	*Polydactylus microstomus*	Small-mouthed Threadfin	Least Concern
364	*Polymetme corythaeola*	Rendezvous Fish	Least Concern
365	*Polymixia berndti*	Pacific Beardfish	Least Concern
366	*Pomacanthus annularis*	Bluering Angelfish	Least Concern
367	*Pomacanthus imperator*	Emperor Angelfish	Least Concern
368	*Pomacanthus semicirculatus*	Semicircle Angelfish	Least Concern
369	*Pomacanthus xanthometopon*	Yellowface Angelfish	Least Concern
370	*Pomacentrus tripunctatus*	Threespot Damsel	Least Concern
371	*Pomadasys argenteus*	Silver Javelin	Least Concern
372	*Pomadasys guoraca*	Guoraca Grunter	Least Concern
373	*Pomadasys kaakan*	Javelin Grunter	Least Concern
374	*Pomadasys maculatus*	Saddle Grunt	Least Concern
375	*Pomadasys olivaceus*	Olive Grunt	Least Concern
376	*Poromitra megalops*	Ridgehead	Data Deficient
377	*Poromitra oscitans*	Tiny-eye Bigscale	Least Concern
378	*Priacanthus prolixus*	Elongate Bulleye	Least Concern
379	*Pristipomoides filamentosus*	Crimson Jobfish	Least Concern
380	*Pristipomoides multidens*	Goldbanded Jobfish	Least Concern
381	*Pristipomoides sieboldii*	Lavender Jobfish	Least Concern
382	*Pristipomoides zonatus*	Oblique-banded Snapper	Least Concern
383	*Psammogobius biocellatus*	Sleepy Goby	Least Concern
384	*Psenes arafurensis*	Banded Driftfish	Least Concern
385	*Psenes cyanophrys*	Freckled Driftfish	Least Concern
386	*Psenes pellucidus*	Bluefin Driftfish	Least Concern
387	*Psettodes erumei*	Indian Halibut	Data Deficient
388	*Pseudorhombus arsius*	Largetooth Flounder	Least Concern

389	*Pseudorhombus dupliciocellatus*	Ocellated Flounder	Least Concern
390	*Pseudorhombus elevatus*	Deep Flounder	Least Concern
391	*Pseudorhombus javanicus*	Javan Flounder	Least Concern
392	*Pseudorhombus malayanus*	Malayan Flounder	Least Concern
393	*Pseudorhombus triocellatus*	Threespotted Flounder	Least Concern
394	*Pterotolithus maculatus*	Blotched Tiger-toothed Croaker	Least Concern
395	*Pterygotrigla hemisticta*	Blackspotted Gurnard	Least Concern
396	*Pygoplites diacanthus*	Royal Angelfish	Least Concern
397	*Rachycentron canadum*	Cobia	Least Concern
398	*Raconda russeliana*	Raconda	Least Concern
399	*Ranzania laevis*	Slender Sunfish	Least Concern
400	*Rasbora daniconius*	Slender Barb	Least Concern
401	*Rastrelliger faughni*	Island Mackerel	Data Deficient
402	*Rastrelliger kanagurta*	Indian Mackerel	Data Deficient
403	*Remora australis*	Whalesucker	Least Concern
404	*Remora brachyptera*	Spearfish Remora	Least Concern
405	*Remora osteochir*	Marlin Sucker	Least Concern
406	*Remora remora*	Common Remora	Least Concern
407	*Rhabdosargus sarba*	Goldlined Seabream	Least Concern
408	*Rogadius pristiger*	Thorny Flathead	Least Concern
409	*Rondeletia loricata*	Redmouth Whalefish	Least Concern
410	*Saccogaster tuberculata*	Bagbelly Cusk	Least Concern
411	*Samaris cristatus*	Cockatoo Righteye Flounder	Least Concern
412	*Samaris macrolepis*	Large-scale Crested Righteye Flounder	Data Deficient
413	*Sarda orientalis*	Oriental Bonito	Least Concern
414	*Sardinella albella*	White Sardinella	Least Concern
415	*Sardinella brachysoma*	Deepbody Sardinella	Least Concern
416	*Sardinella fimbriata*	Fringescale sardinella	Least Concern
417	*Sardinella gibbosa*	Goldstripe Sardinella	Least Concern
418	*Saurida lessepsianus*	Lizardfish	Least Concern
419	*Saurida micropectoralis*	Shortfin Lizardfish	Least Concern
420	*Saurida tumbil*	Greater Lizardfish	Least Concern
421	*Scartella emarginata*	Maned Blenny	Least Concern
422	*Scarus quoyi*	Quoy's Parrotfish	Least Concern
423	*Scatophagus argus*	Spotted Scat	Least Concern
424	*Schizothorax plagiostomus*	Snow Trout	Vulnerable
425	*Scolopsis vosmeri*	Whitecheek Monocle Bream	Least Concern
426	*Scomberoides commersonnianus*	Talang Queenfish	Least Concern
427	*Scomberoides lysan*	Doublespotted Queenfish	Least Concern

428	*Scomberoides tala*	Barred Queenfish	Least Concern
429	*Scomberoides tol*	Needlescaled Queenfish	Least Concern
430	*Scomberomorus commerson*	Narrow-barred Spanish Mackerel	Near Threatened
431	*Scomberomorus guttatus*	Indo-Pacific King Mackerel	Data Deficient
432	*Scomberomorus koreanus*	Korean Seerfish	Least Concern
433	*Scomberomorus lineolatus*	Streaked Seerfish	Least Concern
434	*Scopelarchus analis*	Blackbelly Pearleye	Least Concern
435	*Scopeloberyx robustus*	Longjaw Bigscale	Data Deficient
436	*Scorpaenopsis venosa*	Raggy Scorpionfish	Least Concern
437	*Searsia koefoedi*	Koefoed's Searsid	Least Concern
438	*Selar crumenophthalmus*	Bigeye Scad	Least Concern
439	*Selaroides leptolepis*	Yellowstripe Scad	Least Concern
440	*Seriola dumerili*	Greater Amberjack	Least Concern
441	*Seriolina nigrofasciata*	Blackbanded Trevally	Least Concern
442	*Setipinna taty*	Scaly Hairfin Anchovy	Least Concern
443	*Setipinna tenuifilis*	Common Hairfin Anchovy	Data Deficient
444	*Sicyopterus griseus*	Clown Goby	Least Concern
445	*Sillago indica*	Indian Sillago	Data Deficient
446	*Sillago sihama*	Silver Sillago	Least Concern
447	*Skythrenchelys zabra*	Angry Worm Eel	Least Concern
448	*Solea ovata*	Ovate Sole	Least Concern
449	*Solenostomus cyanopterus*	Robust Ghost Pipefish	Least Concern
450	*Sorsogona melanoptera*	Obscure Flathead	Least Concern
451	*Sorsogona tuberculata*	Tuberculated Flathead	Least Concern
452	*Sperata aor*	Long-whiskered Catfish	Least Concern
453	*Sphyraena barracuda*	Great Barracuda	Least Concern
454	*Spratelloides delicatulus*	Delicate Round Herring	Least Concern
455	*Spratelloides gracilis*	Blue Sprat	Least Concern
456	*Stemonosudis macrura*	Bigtail Barracudina	Least Concern
457	*Sternoptyx diaphana*	Diaphanous Hatchet Fish	Least Concern
458	*Sternoptyx pseudobscura*	Highlight Hatchetfish	Least Concern
459	*Stolephorus andhraensis*	Andhra Anchovy	Least Concern
460	*Stolephorus baweanensis*	Spotty-face Anchovy	Data Deficient
461	*Stolephorus bengalensis*	Hardenberg's anchovy	Least Concern
462	*Stolephorus dubiosus*	Thai Anchovy	Least Concern
463	*Stolephorus indicus*	Indian anchovy	Least Concern
464	*Strophidon sathete*	Giant Estuarine Moray	Least Concern
465	*Sufflamen fraenatum*	Masked Triggerfish	Least Concern
466	*Symbolophorus evermanni*	Evermann's Lanternfish	Least Concern

467	*Symphurus trifasciatus*	Threeband Tonguesole	Data Deficient
468	*Synodus oculeus*	Large-eye Lizardfish	Least Concern
469	*Taaningichthys bathyphilus*	Deepwater Lanternfish	Least Concern
470	*Taeniamia fucata*	Orangelined Cardinalfish	Least Concern
471	*Taenioides cirratus*	Whiskered Eel Goby	Data Deficient
472	*Taenioides gracilis*	Slender Eel Goby	Least Concern
473	*Takifugu oblongus*	Lattice Blaasop	Least Concern
474	*Tenualosa ilisha*	Hilsa	Least Concern
475	*Terapon jarbua*	Tiger Perch	Least Concern
476	*Terapon theraps*	Largescaled Terapon	Least Concern
477	*Tetraroge nigra*	Freshwater waspfish	Least Concern
478	*Thamnaconus melanoproctes*	Blackvent Filefish	Data Deficient
479	*Thryssa cultella*	Cutlass Thryssa	Data Deficient
480	*Thryssa dussumieri*	Dussumier's Thryssa	Least Concern
481	*Thryssa gautamiensis*	Gautama Thryssa	Data Deficient
482	*Thryssa hamiltonii*	Hamilton's Thryssa	Least Concern
483	*Thryssa malabarica*	Malabar Thryssa	Data Deficient
484	*Thryssa mystax*	Moustached Thryssa	Least Concern
485	*Thryssa purava*	Oblique-jaw Thryssa	Data Deficient
486	*Thryssa setirostris*	Longjaw Thryssa	Least Concern
487	*Thunnus albacares*	Yellowfin Tuna	Least Concern
488	*Thysanophrys celebica*	Celebes Flathead	Least Concern
489	*Torquigener hypselogeneion*	Orange-spotted Toadfish	Least Concern
490	*Toxotes jaculatrix*	Banded Archerfish	Least Concern
491	*Trachinotus baillonii*	Small Spotted Dart	Least Concern
492	*Trachinotus blochii*	Snubnose Pompano	Least Concern
493	*Trachinotus botla*	Largespotted Dart	Least Concern
494	*Trichiurus lepturus*	Largehead Hairtail	Least Concern
495	*Trigonolampa miriceps*	Threelights Dragonfish	Least Concern
496	*Triphoturus nigrescens*	Highseas Lampfish	Least Concern
497	*Trypauchen vagina*	Burrowing Goby	Least Concern
498	*Tylerius spinosissimus*	Spiny Blaasop	Least Concern
499	*Upeneus guttatus*	Two-tone Goatfish	Least Concern
500	*Upeneus margarethae*	Margaretha's Goatfish	Least Concern
501	*Upeneus moluccensis*	Goldband Goatfish	Least Concern
502	*Upeneus sulphureus*	Sulphur Goatfish	Least Concern
503	*Upeneus sundaicus*	Ochrebanded Goatfish	Least Concern
504	*Upeneus supravittatus*	Long-fin Goatfish	Least Concern
505	*Uraspis helvola*	Whitetongue Jack	Least Concern

506	*Uraspis uraspis*	Whitemouth Jack	Least Concern
507	*Valenciennellus tripunctulatus*	Constellationfish	Least Concern
508	*Velifer hypselopterus*	Sailfin Velifer	Least Concern
509	*Xanthichthys lineopunctatus*	Striped Triggerfish	Least Concern
510	*Xiphasia setifer*	Hairtail Blenny	Least Concern
511	*Xiphias gladius*	Swordfish	Near Threatened
512	*Zebrasoma desjardinii*	Indian Sailfin Tang	Least Concern
513	*Zebrasoma scopas*	Brushtail Tang	Least Concern
514	*Zebrias synapturoides*	Indian Zebra Sole	Least Concern
515	*Zenarchopterus dispar*	Feathered River-garfish	Least Concern
516	*Zenarchopterus gilli*	Shortnose River Garfish	Least Concern
517	*Zenopsis conchifer*	Silvery John Dory	Least Concern

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient*

C.6 Amphibians of the Study Area

SN	Scientific Name	Common Name	IUCN Status*
1	*Duttaphrynus melanostictus*		Least Concern
2	*Duttaphrynus scaber*		Least Concern
3	*Duttaphrynus stomaticus*	Marbled toad	Least Concern
4	*Euphlyctis cyanophlyctis*		Least Concern
5	*Euphlyctis hexadactylus*		Least Concern
6	*Fejervarya limnocharis*		Least Concern
7	*Fejervarya moodiei*	Crab-Eating Frog	Least Concern
8	*Hoplobatrachus crassus*	Jerdon's Bullfrog	Least Concern
9	*Hoplobatrachus tigerinus*	Indian Bullfrog	Least Concern
10	*Hydrophylax malabaricus*	Malabar Fungoid Frog	Least Concern
11	*Melanochelys trijuga*	Indian Black Turtle	Least Concern
12	*Microhyla ornata*	Ant Frog	Least Concern
13	*Polypedates maculatus*		Least Concern
14	*Sphaerotheca breviceps*		Least Concern
15	*Sphaerotheca dobsonii*	Mangalore Bullfrog	Least Concern
16	*Sphaerotheca rolandae*	Roland's Burrowing Frog	Least Concern
17	*Uperodon globulosus*	Indian Globular Frog	Least Concern
18	*Uperodon systoma*	Marbled Globular Frog	Least Concern
19	*Uperodon taprobanicus*	Sri Lankan Bullfrog	Least Concern

**Status assigned by the International Union for Conservation of Nature and Natural Resources, where LC – Least Concern*

Appendix D : Environmental Clearance for the Project

Appendix E : NOC from APPCB

Appendix F : Site Clearance Approval from MOCA

Appendix G :MoD Approval for Closure of Vizag Airport

Appendix H : Agreement for Provision of CNS/ATM Facilities

Appendix I : BCAS Agreement

Appendix J : Government Order for Water and Power

Appendix K : MoU Between MoCA and GVIAL

Appendix L : Living Condition Checklist for Workers Accommodation and Campsite Management

Camp Name and Location			
Sl. No	**Guide Question / Element**	**Requirement**	**Remarks and Provision**
1.0	**Accommodation**		
1.1	Is separate bed/bedding area provided for each worker? Hot bedding (assigning more than one crew member to a bed or "rack" to reduce sleeping space) will be strictly prohibited.		
1.2	Is minimum gap between beds of 1 meter maintained? Is clear access way maintained within the living area?		
1.3	Are suitable storage facilities such as wall lockers for clothing and personal articles provided for each employee in every room used for the sleeping purposes?		
1.4	Does the contractor prohibit the use of triple deck bunks?		
1.5	Is overcrowding (more than 6 personnel in a room) observed in rooms?		
1.6	Is each bed provided with clean mattresses, pillow and blanket.		
2.0	**WASH (Water, Sanitation and Hygiene Facilities)**		
2.1	Is an adequate and convenient water supply provided in camp for drinking, cooking, bathing, and laundry purposes?		
2.2	Are water consumption records being maintained?		
2.3	Is drinking water tested regularly through an accredited laboratory and meeting prescribed standard as applicable i.e., IS 10500 / IS 14543		
2.4	Are water storage facilities maintained in a clean manner, covered and regularly inspected?		
2.5	Is sufficient no. of dust bins provided in the camp and cleaned regularly?		
2.6	Are the ground and open areas surrounding the shelters maintained in a clean and sanitary condition free from rubbish, debris, waste paper, garbage, stagnant water potential for vector breeding and / or animal nuisance?		
2.7	Are toilet and bathing facilities provided adequate for the capacity of the camp? (1 toilet and 1 shower cubicle for 15 persons)		
2.8	is adequate ventilation provided in the common area, kitchen, rooms, toilet and bathing areas for the fresh air circulation and prevention of bad odour.		
2.9	Are external toilets located within 30m from the sleeping rooms, dining room, kitchen (if applicable).		
2.10	Is there sufficient markings available in English, local language and pictorial as applicable such as dining area, drinking water, toilets for Men & Women, first aid kit, fire extinguisher etc.		
2.11	Is necessary facilities provided (as applicable) such as laundry, hot water, storm water drainage, playground, indoor games etc.		
2.12	Are clothes drying facilities provided in the camp?		
2.13	Is frequency of pesticide spray defined and followed adequately?		
3.0	**First aid facility**		

Camp Name and Location			
Sl. No	**Guide Question / Element**	**Requirement**	**Remarks and Provision**
3.1	Are adequate first aid facilities, approved by a health authority, maintained and made available in the camp?		
3.2	Are trained first aid personnel (in a ratio of at least one in 25 persons) available in the camp?		
4.0	**Dining Facility**		
4.1	Is a mess hall or cafeteria provided in the camp?		
4.2	Are facilities provided to store and prepare food?		
4.3	Are all the food handlers medically fit?		
4.4	Is personal hygiene or food handlers hygiene found satisfactory?		
4.5	Are gas cylinders properly stored, locked and chained or stored with proper custody? Ensure no fire wood is used for cooking?		
4.6	Is pest control methods such as fly catcher lamps available in the dining area?		
4.7	Are food products properly stored both dry and cold storage with temperature control?		
5.0	**Waste Management**		
5.1	Is approved offsite waste handling facility identified and availed for the various waste disposal?		
5.2	Are waste disposal records being maintained?		
5.3	Are covered waste bins available in the camps such as kitchen, dining area.		
5.4	Is sewage effectively collected and treated in the septic tanks followed by soak pits		
6.0	**Power and water supply**		
6.1	Is power supply available at the camp?		
6.2	During the power cut, do DG back up power available for the minimum requirements?		
6.3	Is potable drinking water meeting the drinking water standards is made available at various places of the camp?		
6.4	Are adequate lighting and fans are provided in rooms and common area.		
6.5	Is sufficient treated water available for domestic purpose.		
7.0	**Camp management, Grievance Redressal Mechanism and Emergency Management**		
7.1	Is camp boss appointed to manage the camp		
7.2	Is grievance register provided at camp to record workers grievances		
7.3	Is camp inspection frequency defined and followed regularly?		
7.4	Is emergency contact numbers displayed at appropriate locations in camp area?		
7.5	Is fire extinguisher / fire alarm / fire & smoke detectors made available in the camp area including the cooking area.		
7.6	Is emergency exit marked clearly and free from the obstacles? Are emergency mock drills conducted regularly and records maintained?		

Appendix M : Land Proceedings and Possession

Appendix N : Fixation of Land Compensation

Appendix O : Photolog

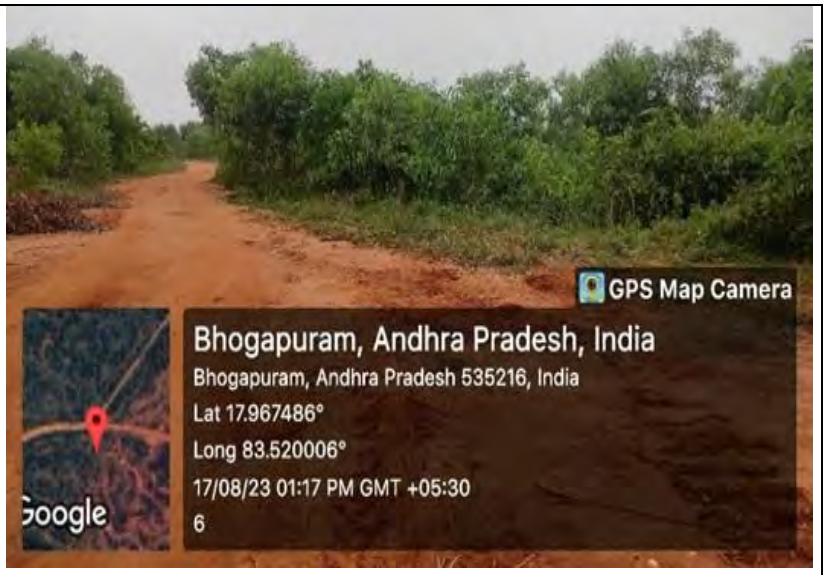
Photo no. 1	Date: 17.08.2023
Location of Photo: Project Site at Bhogaupram Mandal.	
Description: Current Site conditions at the GPs location for the proposed end point of the runway for Bhogapuram International Airport.	

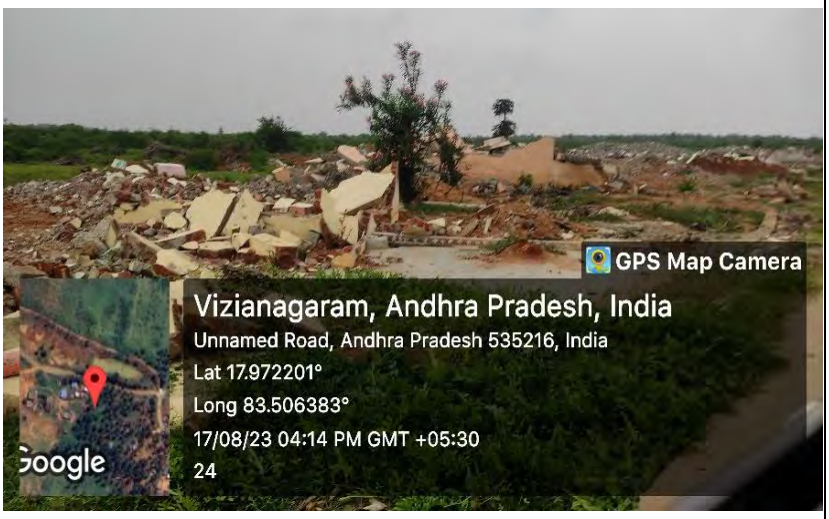
Photo no. 2	Date: 17.08.23
Location: Project Site at Bhogaupram Mandal	
Description: Debris of dismantled house/villages removed for the project.	

Photo no. 3	Date: 17.08.2023
Location of Photo: Polipalle Village, Bhogapuram Mandal.	
Description: Small pond with earthen embankments developed to store rainwater for agricultural and horticultural purposes approximately 3.5 km south west from the Project Site	

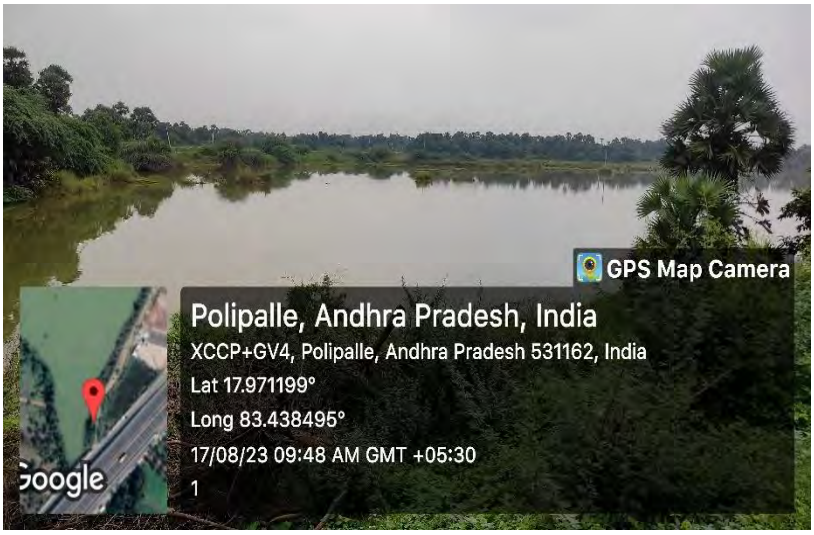


Photo no. 4	Date: 17.08.23
Location: Project Site, Bhogapuram Mandal	
Description Boundary wall under-construction on the western edge of the Project site	

Photo no. 5	Date: 18.08.23
Location of Photo: Sun Rays Beach Resort, Bhogapuram Mandal	
Description Plantation of Cocos nucifera in Sun Rays Beach Resort approximately 500 meters form the Project boundary wall.	

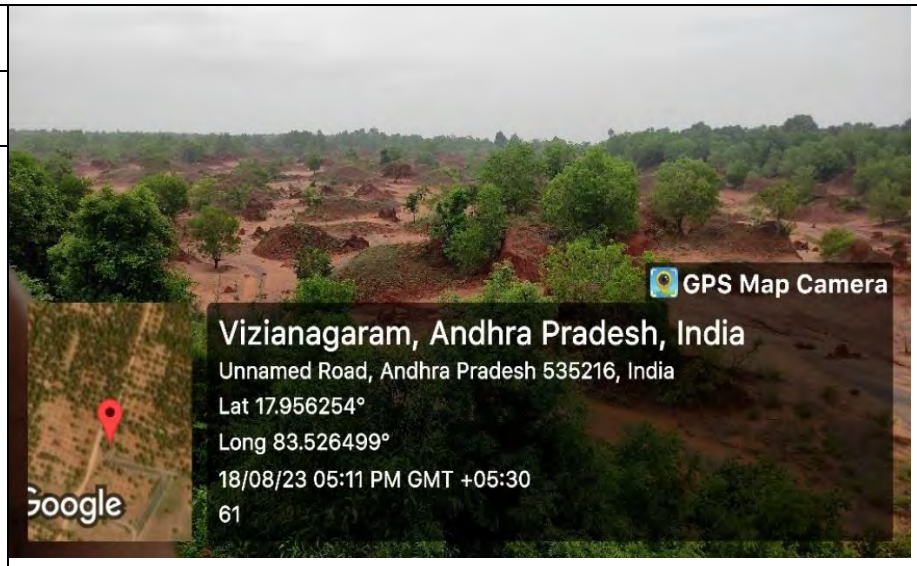
Photo no. 6	Date: 18.08.23
Location of Photo: Bhogapuram Mandal	
Description Degraded forest patches 200 meters away from the Project site.	

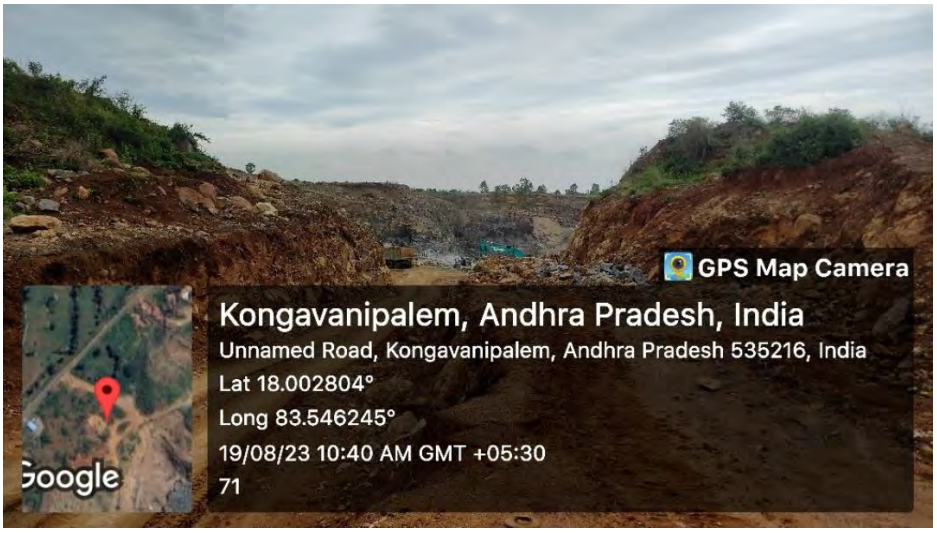
Photo no. 7	**Date:** 19.08.23
Location of Photo: Kongavanipalem, Bhogapuram Mandal	
Description A view of mining area where the mining is proposed to procure construction materials	

Photo no. 8	**Date:** 19.08.23
Location of Photo: Jaggayyapeta, Bhogapuram Mandal	
Description: Paddy fields (agriculture lands) situated in the study area.	

Photo no. 9	**Date:** 19.08.23
Location of Photo: Basavapalem, Bhogapuram Mandal	
Description Reserve Forest located in the Study Area	

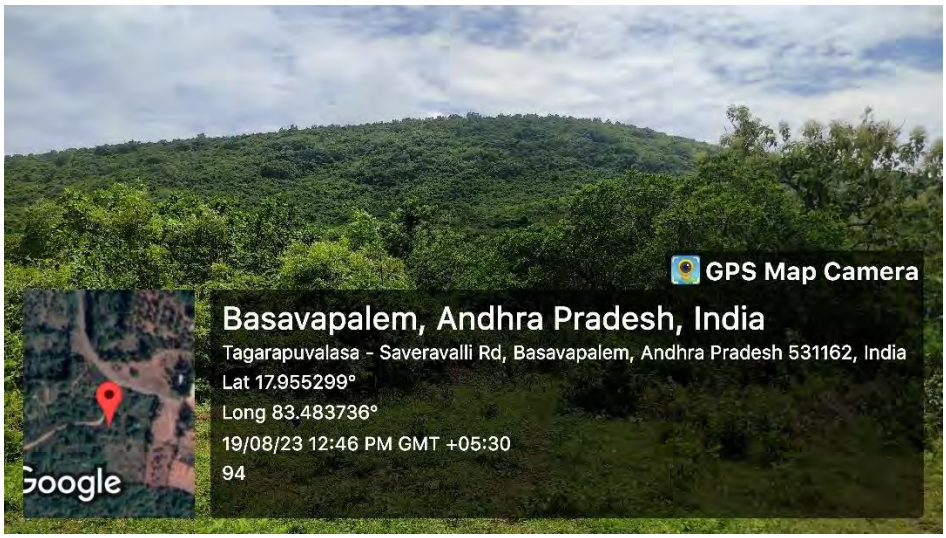


Photo no. 10	**Date:** 17.08.23
Location: Project Site, Bhogapuram Mandal	
Description Consultations with nomadic shepherd found grazing with their cattle at the project site.	

Photo no. 11	**Date:** 17.08.23
Location of Photo: Project Site, Bhogapuram Mandal	
Description Cattle grazing found in the Project Site during field survey	

Photo no. 13	**Date:** 18.08.23
Location of Photo: Project Site, Bhogapuram Mandal	
Description Environmental Monitoring being carried out in the Study Area	

Photo no. 14	**Date:** 18.08.23
Location of Photo: Project Site, Bhogapuram Mandal	
Description Water accumulation (pond) or within the Project Site	

Photo no. 15	**Date:** 17.08.23
Location of Photo: Boundary wall casting area, Project Site, Bhogapuram Mandal	
Description Consultations with workers engaged in boundary wall pre-casting works at Project Site.	

Photo no. 16	**Date:** 17.08.23
Location of Photo: Revenue Divisional Office, Vizianagaram	
Description Stakeholders Consultation with Ms. MW Suryakala-Revenue Divisional Officer (RDO), Vizianagaram	

Photo no. 17	**Date:** 18.08.23
Location of Photo: A view of Gudepuvalasa R&R colony.	 

Photo no. 18	Date: 18.08.23
Location of Photo: Polipalli R&R colony, Bhogapuram Mandal	
Description Consultations being held with Project Displaced Families (PDFs) in the R&R colony.	

Photo no. 19	Date: 18.08.23
Location of Photo: Gudepuvalasa R&R colony, Bhogapuram Mandal	
Description Religious structures constructed in the R&R colony.	

Photo no. 20	**Date:** 18.08.23
Location of Photo: Polipalli R&R colony, Bhogapuram Mandal	
Description Construction of Primary School in the R&R colony.	

Photo no. 21	**Date:** 18.08.23
Location of Photo: Gudepuvalasa R&R colony, Bhogapuram Manadal	
Description Social consultations being held with the SC PDFs in Gudepuvalasa R&R colony.	

Photo no. 22	**Date:** 18.08.23
Location of Photo: Chepala Kancheru Village, Bhogapuram Mandal	
Description Social consultations being held with the local fisherman community in the study area..	

Photo no. 23	**Date:** 18.08.23
Location of Photo: Polipalli R&R colony, Bhogapuram Mandal	
Description Small shops set up by a project displaced family in R&R colony.	

Photo no. 24	**Date:** 18.08.23
Location of Photo: Polipalli R&R colony, Bhogapuram Mandal	
Description Overhead tank for domestic water consumption being developed in the R&R colony.	

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