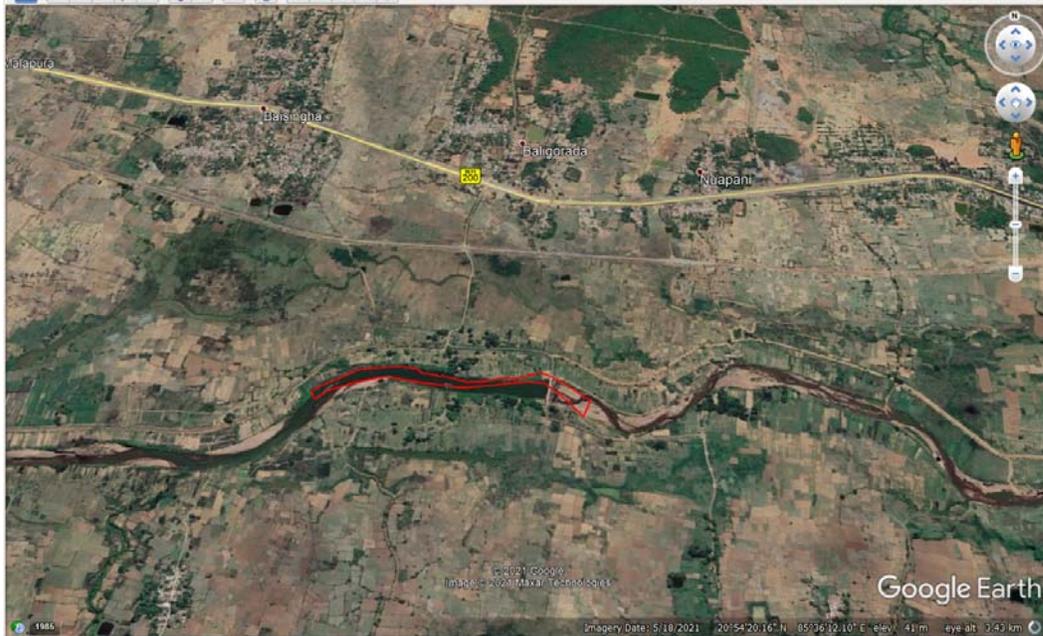


DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BALIGORAD SAND MINE, RAMIAL RIVER,

**AT BALIGORAD VILLAGE, KAMAKHYANAGAR TAHASIL, DHENKANAL
DISTRICT, ODISHA STATE**

PROJECT ACTIVITY - MINING OF MINERALS 1(A) (I) PROJECT CATEGORY - B



PROJECT PROPONENT

**TAHASILDAR, KAMAKHYANAGAR
ODISHA STATE**

MONITORING PERIOD: - OCTOBER - DECEMBER 2020

PREPARED BY



**Rightsource Industrial
Solutions Pvt. Ltd.**



AN ISO 9001-2008 & CAT A ACCREDITATED
BY NABET AS EIA CONSULTANCY ORGANISATION

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JUNE 2021

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ANNEXURES

ANNEXURE I	LEASE DEED LETTER
ANNEXURE II	MINING PLAN APPROVAL LETTER
ANNEXURE III	TOR LETTER

ABBREVIATIONS	
AAQM	Ambient Air Quality Monitoring
AMSL	Above Mean Sea Level
bgl	Below Ground Level
CPCB	Central Pollution Control Board
dB	Decibel
DG	Diesel Generator
E	East
EIA	Environmental Impact Assessment
EMC	Environmental Management Cell
EMP	Environmental Management Plan
ENE	East of North- East
EPA	Environmental Protection Agencies
ESE	East of South East
FCC	False Colour Composite
GIS	Geographical Information System
GPS	Global Positioning System
HP	Horse Power
Hr.	Hour
IMD	Indian Meteorological Department
IRS	Indian Remote Sensing Satellite
ISCST	Industrial Source Complex, Short Terms
ISO	International Organization of Standardization
ISS	Indian Standard Specification
KLD	Kilo Litre Per Day
Km	Kilometer
KW	Kilo Watt
LOS	Level of Service
m	Meter
MCDR	Mining Conservation & Development Rules
mg	Milligram
MoEF&CC	Ministry Of Environment Forest and Climate Change
N	North
NE	North-East
NNE	North of North-East
NNW	North of North-West
NO ₂	Nitrogen Dioxides
NTU	Naphelo Turbidity Unit

ABBREVIATIONS	
NW	North-West
OB	Over Burden
OH&S	Occupational Health and Safety
PCU	Passenger Car Unit
PM	Particulate Matter
PPE	Personal Protective Equipment
PPM	Part Per Million
Pvt.	Private
R&R	Rehabilitation and Resettlement
RDS	Respirable Dust Sampler
SE	South- East
SEIAA	State Level Environmental Assessment Authority
SO ₂	Sulphur-di-Oxide
SOI	Survey of India
SOPs	Standard Operating Procedures
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SSE	South of South-East
SSW	South of South-West
TDS	Total Dissolve Solid
TOR	Terms of Reference
TPA	Tons Per Annum
TPA	Tone Per Hour
TPH	Tons Per Hour
TS	Total Solid
US EPA	United State Environmental Protection Agencies
w.e.f.	With Effective From
w.r.t.	With Reference To
W/W	Weight By Weight
WNW	West of North-West
WSW	West of South-West

1 INTRODUCTION

1.1 GENERAL

Baligorad River Sand Quarry, Baligorad is a sand mining project over an area of 13.43acres/5.435 Ha. Located in village - Baligorad, Tahasil - Kamakhyanagar in District - Dhenkanal of Odisha. The mining lease granted by Tahasildar, Kamakhyanagar, Dhenkanal will be auctioned and leased out to the successful bidder after obtaining statutory clearances by Tahasildar Kamakhyanagar, District- Dhenkanal. The mining lease will be granted on for long term basis for 5 years and the lease period will start from the date of registration of executed lease deed and letter details attached as **Annexure-I**. The Mining Plan has been approved with vide No. 855 on dated 30.06.2020 by the approving authority, Office of the Joint Director, Geology, Zonal Survey, Dhenkanal and attached as an **Annexure-II**. It is relevant to mention here that approval of Mining Plan has been conferred under section 2 of Rule 28 (4) of OMMC, 2016 as per clause 5. As per EIA notification 2006 and subsequent amendments, the project is coming under B1 Category and the lease area is more than 5.0 Ha.

The Ramial River Sand quarry, Baligorad is on Khata no- 361, Plot no-3768/5973 of Kisam Nadi at village Baligorad in Kamakhyanagar Tahasil in Dhenkanal District of Odisha. The mining lease area is listed as an identified sand minor mineral in the DSR page no. 25, Serial no.21 of the Dhenkanal district. The sand quarry lies on river bed Ramial. Ramial River Sand Quarry, Baligorad, is a minor mineral project for exploitation of river sand. The average production is proposed to be 10902 cum/year and 54510 cum is the total production during the plan period. This sand would be mainly used for civil works in major projects and infrastructures development so as to meet the market potential.

As per the Environmental Impact Assessment (EIA) Notification dated 14th September 2006 and its subsequent amendments, the proposed Ramial River Baligorad Sand mine falls under 'Category B1', since the project is more than 5.0 Ha.

The ToR application submitted to SEIAA, Odisha on 25.01.2021 with proposal No. SIA/OR/MIN/60167/2021. SEIAA meeting was held on 10.02.2021. ToR was issued with F.No.663/SEIAA dated: 26.02.2021. ToR letter is enclosed as **Annexure -III** for the preparation of EIA/EMP report.

1.2 PURPOSE OF THE REPORT

The purpose of the report is to identify environmental aspects, impacts and mitigation measures arising out from the proposed project and to prepare EIA report as per the Terms of

Reference (ToR) finalized by State Environment Impact Assessment Authority (SEIAA), Odisha vide ToR F.No. 663/SEIAA dated: 26.02.2021 as a part of Environmental Clearance (EC) as mentioned in EIA notification 2006 and amendments till date. This report is prepared based on “General Structure of EIA” given in Appendix III and IIIA of mentioned EIA notification.

Tahasildar, Dhenkanal as part of the compliance from SEIAA has appointed **M/s. Rightsource Industrial Solutions Pvt. Ltd**, Plot No.203, H.No.5-36/203, Prashanthinagar, Kukatpally IDA, Hyderabad - 500072 as Environmental Consultants who are accredited by National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI), New Delhi.

1.3 IDENTIFICATION OF PROJECT & PROJECT PROPONENT

1.3.1 IDENTIFICATION OF PROJECT

The Sand mine is over an extent of 5.435 hectares located in Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District and Odisha State. The area is marked in the survey of India Topo sheet No. 73H/9. The mine area falls in the Ramial River and the details of area are given in Table 1.1. The geographical coordinates of the mine lease areas are given in Table 1.2.

TABLE 1-1 DETAILS OF AREA

District & State	Village	Tahasil	Sy.No.	Extent	Ownership	Nature of Excavation
Dhenkanal, Odisha State	Baligorad Village.	Kamakhyanagar	River Bed	5.435Ha	Govt. Land	Open Excavation

TABLE 1-2 THE GEOGRAPHICAL COORDINATES OF THE MINE LEASE AREAS

LOCATION	LONGITUDE & LATITUDE		
	BP	LONGITUDE	LATITUDE
Specified Area	1.	85°36'30.71"E	20°54'24.22"N
	2.	85°36'29.66"E	20°54'21.93"N
	3.	85°36'26.85"E	20°54'24.89"N
	4.	85°36'24.02"E	20°54'27.31"N
	5.	85°36'22.10"E	20°54'27.57"N
	6.	85°36'18.82"E	20°54'27.34"N
	7.	85°36'16.34"E	20°54'27.02"N
	8.	85°36'11.79"E	20°54'26.87"N
	9.	85°36'06.80"E	20°54'27.72"N

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10.	85°36'01.74"E	20°54'28.72"N
11.	85°36'00.10"E	20°54'28.88"N
12.	85°35'55.85"E	20°54'28.20"N
13.	85°35'52.27"E	20°54'27.14"N
14.	85°35'50.47"E	20°54'25.79"N
15.	85°35'49.94"E	20°54'27.14"N
16.	85°35'51.35"E	20°54'27.95"N
17.	85°35'53.44"E	20°54'28.92"N
18.	85°35'55.71"E	20°54'29.90"N
19.	85°35'56.58"E	20°54'30.32"N
20.	85°35'58.01"E	20°54'30.34"N
21.	85°35'58.42"E	20°54'30.46"N
22.	85°36'01.02"E	20°54'30.47"N
23.	85°36'02.90"E	20°54'30.49"N
24.	85°36'05.56"E	20°54'30.02"N
25.	85°36'05.61"E	20°54'29.63"N
26.	85°36'06.24"E	20°54'29.26"N
27.	85°36'06.82"E	20°54'29.32"N
28.	85°36'08.85"E	20°54'28.64"N
29.	85°36'09.01"E	20°54'28.90"N
30.	85°36'09.25"E	20°54'28.79"N
31.	85°36'09.35"E	20°54'28.57"N
32.	85°36'09.78"E	20°54'28.46"N
33.	85°36'10.31"E	20°54'28.42"N
34.	85°36'11.46"E	20°54'28.06"N
35.	85°36'12.39"E	20°54'27.85"N
36.	85°36'12.51"E	20°54'27.66"N
37.	85°36'13.90"E	20°54'27.72"N
38.	85°36'14.48"E	20°54'27.62"N
39.	85°36'16.55"E	20°54'27.85"N
40.	85°36'18.48"E	20°54'28.18"N
41.	85°36'19.64"E	20°54'27.91"N
42.	85°36'20.99"E	20°54'28.25"N
43.	85°36'21.60"E	20°54'28.24"N
44.	85°36'21.75"E	20°54'28.60"N
45.	85°36'22.34"E	20°54'28.56"N
46.	85°36'23.04"E	20°54'28.76"N
47.	85°36'23.50"E	20°54'28.80"N
48.	85°36'24.46"E	20°54'28.48"N
49.	85°36'25.17"E	20°54'28.10"N
50.	85°36'26.04"E	20°54'27.41"N

	51.	85°36'26.36"E	20°54'27.58"N	
	52.	85°36'28.53"E	20°54'25.81"N	

1.3.2 SIZE OF THE PROJECT

The area is 5.435Ha/13.43 acres. The proposed Sand production is 10902m³ per year. The mining of sand from Ramial River Sand Quarry, Baligorad will be carried out by open cast manual method.

1.3.3 LOCATION OF THE PROJECT

The total extent area of the lease for this quarry is 5.435 Ha at Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District and Odisha State and has been granted by Tahasildar, Kamakhyanagar. In this proposal, Tahasildar Kamakhyanagar is the applicant and the lease will be auctioned and granted to the successful bidder after obtaining statutory clearance for a period of total 5 years. The area under discussion is featured in Survey of India Topo Sheet No-73H/9 and is bounded between the Latitude -20° 54' 21.93" N to 20° 54' 30.49" N, Longitude-85° 35' 49.94" E to 85° 36' 30.71" E. The lease area is located at a distance of 1.49 km from village Baligorad and at a distance of 5 kms from Kamakhyanagar, 45 kms from the District Headquarters Dhenkanal and 99 kms from the State Capital Bhubaneswar. Dhenkanal Railway station is the nearest railway station located at a distance of 25.6 kms from the lease area. Nearest Road Bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.

1.3.4 NEED FOR THE PROJECT AND ITS IMPORTANCE

Ordinary sand is used as a raw material in all type of construction and infrastructure project. The need of ordinary sand is in all fields are very essential as it is a compulsory for all types of construction, and industries fields. Proposed production of sand is contributing enhancing state production of ordinary sand. A mine is providing employments to the local labour in rural area, thus the villagers of nearby villages have more employment opportunities.

1.4 SCOPE AND METHODOLOGY OF THE STUDY

The Environmental Impact Assessment has been prepared to assess the current environmental scenario of the area, will identify and address the impacts, where these are adverse in nature, and there after design imitative measures to manage such impacts in a manner as to conserve environment and ecology of the area. The EMP has been prepared with

a view to ultimately ensure that the adverse impacts are minimized if these cannot be prevented altogether.

The Environmental Impact Assessment report has been prepared as per TOR recommended and issued by the State Level Environmental Impact Assessment Authority, Odisha on 26th of February 2021. The base line monitoring study has been carried out during the Winter season (October 2020 to December 2020) for various environmental components so as to assess the anticipated impacts of the proposed project on the environment

Primary data collection coupled with secondary data collection so as to establish the baseline environmental status of the study area;

- ❖ Identify various existing pollution loads in and domestic activities in the study area.
- ❖ Predict incremental levels of pollutants in the study area due to the mining activity.
- ❖ Evaluate the predicted impacts on the various environmental attributes in the study area by using scientifically developed and widely accepted Environmental Impact.
- ❖ Identification of mitigation measures and preparation of an Environmental Management Plan (EMP) outlining the measures for improving environmental quality and scope for future projects for environmentally sustainable development.
- ❖ Identify critical environmental attributes required to be monitored regularly.

1.5 STRUCTURE OF EIA REPORT

The EIA report has been presented in order to group the environmental parameters under physical, biological, demographic & socio-economic environments, anticipated impacts and mitigation measures. The EIA report has been prepared as contents given in EIA Notification 2006 and subsequent amendments. The structure of EIA Report is as given below:

Chapter 1 - Introduction: This chapter gives the basic information about the project and project site. It also discusses the justification of the project and the purpose of the EIA study including the scope of the study.

Chapter 2 - Description of the Project: This chapter deals with the details of the mine plan and various mining parameters like mineral reserves, exploration, year wise mining plan, excavation method etc. and also the facilities to monitor and treat the pollutants. The features of the proposed project are described in this chapter.

Chapter 3 - Description of the Environment: The methodology for assessing various baseline Environmental components in the study area prior to the commencement of the

project has been identified in this chapter. The various parameters of present environmental status are identified under different aspects, which include location and regional setting of the area, physical aspect which include land use, land cover and soil quality of the study area. Hydrology aspect consists of surface and ground water quality. Meteorological aspect contains all the climatic factors and ambient air quality of the study area. Ecological environment describes the flora and fauna of the region. Human aspect includes the demographical features, socioeconomic environment and infrastructure facilities of the study area.

Chapter 4 - Anticipated Environmental Impacts and its Mitigation Measures: This chapter provides the details of the Environmental Impact Assessment of the project during construction and operation stages. It ascertains the impacts of the proposed project on the various components of environment. The mathematical modelling exercises pertaining to ground level concentrations of air pollutants have been presented in this chapter with suitable mitigation measures.

Chapter 5 - Analysis of Alternatives: This chapter gives details of various alternatives in respect of technologies to be deployed are considered in this project.

Chapter 6 - Environment Monitoring Plan: This chapter emphasizes the formation of an Environment Management Cell with trained staff equipped with all monitoring facilities for monitoring of all environmental parameters during construction project monitoring. Organization structure for environmental management and frequency of monitoring has also been provided.

Chapter 7 - Additional Studies: A summary of the additional studies/activities conducted as per the requirements of the TOR is given in this chapter. A brief description of the Public Hearing is described in this chapter. The additional studies conducted are Risk Assessment and Disaster Management Plan and Hydro-geology Study. Although separate reports will be submitted for the Hydro-geology Study, a brief account has been given in the chapter. The Risk Assessment section provides information regarding the activities associated with the project likely to pose a risk to man, environment or property. Such activities include displacement, transport of raw materials, storage. It also provides details regarding precautionary measure to be taken. On-site disaster management describing the on-site and off-site emergencies commands and controls have also described in this chapter.

Chapter 8 - Project Benefits: The benefits that will be accrued from the project in the locality in particular and society in general as well as development will be identified and described in this chapter.

Chapter 9 Environmental Cost & Benefit Analysis: Not applicable as this chapter is needed if recommended at the scoping stage.

Chapter 10 - Environmental Management Plan: In this chapter, an environmental strategy to mitigate the adverse effects likely to occur on environmental parameters during mining phase has been drawn up for the proposed mining project.

Chapter 11 -Summary &Conclusion- Over all justification for implementation of the project. Explanation of how, adverse effects have been mitigated.

Chapter 12 -Disclosure of the Consultant: The detailed profile of the environment consultant along with their professional capabilities and expertise as well as work experiences are highlighted in this chapter.

1.6 COMPLIANCE OF TOR

Compliance of TOR Issued by SEIAA, Odisha vide F.No. 663/SEIAA dated: 26.02.2021.

STANDARD TERMS OF REFERENCE		
1.	Year wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed there had been any increase in production after the EIA Notification 1994 came into force, w.r.t the highest production achieved prior to 1994.	Not applicable as it is a proposed mine.
2.	A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.	Ramial River Sand Quarry, Baligorad is a sand mining project over an area of 13.43acres/ 5.435Ha. Located in village - Baligorad, Tahasil - Kamakhyanagar in District - Dhenkanal of Odisha. The mining lease granted by Tahasildar, Kamakhyanagar, Dhenkanal will be auctioned and leased out

		to the successful bidder after obtaining statutory clearances by Tahasildar Kamakhyanagar, District- Dhenkanal. The mining lease will be granted on for long term basis for 5 years and the lease period will start from the date of registration of executed lease deed and letter details attached as Annexure-I .
3.	All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mines lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.	While preparing EIA it has been ensured that all the documents including approved mine plan and EIA is compatible with one another in terms of the mine lease area, production levels and mining methodology etc. and are in the name of lessee.
4.	All corners co-ordinates of the mine lease area, superimposed on High Resolution Imagery/ toposheets, topographic sheets, geomorphology and geology of the area should be provided. Such an Imagery of the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).	All corner co- ordinates of the mine lease area are given in the section 1.3.1 of chapter 1. Satellite map and Topomap of the project area is given in the Figure 2.2 and Figure 2.3 of chapter 2 respectively. Geology of the study area is given in the section no.2.5 of chapter 2.
5.	Information should be provided in Survey of India Topo sheets in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.	The area is located in the Topo sheet of 73 H/9. Topo map of the study is area is given in the Figure 2.3 of Chapter 2.
6.	Details about the land proposed for mining activities should be given with information as to whether mining confirms to the land	The Sand mine is over an extent of 5.435ha located in Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District and Odisha State.

	use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.	The area is marked in the survey of India Topo sheet No.73 H/9. The mine area falls in the Ramial River and the details of area are given in Table 1.1. The geographical coordinates of the mine lease areas are given in Table 1.2 of chapter 1.
7.	It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/violation of the environment or forest norms/condition? The hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliance/ violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA report.	The project proponent is committed to safe guard and sustainable development. Environment Monitoring Cell shall be established for reporting Environmental Issues. Responsibilities of Environmental Monitoring Cell are given in the section 6.3 of chapter 6.
8.	Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.	Method of Mining is Manual. Mine safety details are given in the section 7.6 of chapter 7.
9.	The study area will comprise of 10km zone	The study area is taken as 10km Radius

	around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine/lease period.	around the proposed project area. Since it is Sand mining project, waste generation is not involved.
10.	Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass, preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.	Land use of the study area is given in the Chapter 3 of EIA report.
11.	Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.	Over burden generation is not involved because it is Sand mining project.
12.	A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry of ascertain the status of forests, based on which, the Certificate in this regards as mentioned above be issued. In all such cases, it would be desirable for representative of the State	There is no forest land in the project site. Project site located in the Ramial River.

	Forest Department to assist the Expert Appraisal Committees.	
13.	Status of forestry clearance for the broken up area and virgin forest land involved in the project including deposition of Net Present Value (NPV) & Compensatory Afforestation (CA) should be indicated. A copy of the forest clearance should also be furnished.	Proposed mining area is in Ramial River. Hence forest clearance is not required.
14.	Implementation status of recognition of forest right under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Acts, 2006 should be indicated.	Not Applicable
15.	The vegetation in the RF/PF areas in the study area, with necessary details, should be given.	<p>Details of forests falling in 10km Radius of project area</p> <ul style="list-style-type: none"> • Jiridamali RF – 1.96 km, N • Jiridamali RF – 4.5 km NW • Mahulabhanja RF A Block – 4.1 km NNE • Mahulabhanja RF B Block -6.3 km ENE • Sunajhari RF -3.13 km ,S • Bhairipur RF -4.8 km SSE • Suniamaru RF – 3.03 km ,S • Madhi RF – 7.7 km NNW <p>Details are given in the Table 2.1 of chapter 2.</p>
16.	A study shall be got done to ascertain the impact of the mining project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the	There is no wildlife sanctuary within the study area. Details of fauna existing within the study area are given in the Chapter 3. Anticipated impact of mining on the same

	surrounding and any other protected area and accordingly, detailed mitigate measures required, should be worked out with cost implications and submitted.	along with suggested mitigation measures are incorporated in the chapter 4.
17.	Location of National Parks, Sanctuaries, Biosphere Reserves, wildlife Corridors, Ramsar site Tiger/Elephant Reserves (existing as well as proposed), if any, within 10km of the mines lease should be clearly indicated, supported by a location map duly authenticated by chief wildlife warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the standing committee of National Board of Wildlife and copy furnished.	There are no National parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Tiger /Elephant Reserves (existing as well as proposed) in the core.
18.	A detailed biological study area [core zone and buffer (10km radius of the periphery of the mines lease)] shall be carried out. Details of the flora and fauna, endangered, endemic and RET species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the schedule of the fauna present. In case of any scheduled I fauna found in the study area, the necessary plan along with budgetary provisions for their conservation should be prepared in consultation with state forest and Wildlife	There are no schedule-I fauna present in the study area. A detailed biological study is discussed under Chapter-3.

	Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.	
19.	Proximity to areas declared as 'Critically Polluted' or the project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations) should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Department should be secured and furnished to the effect that the proposed mining activities could be considered.	Not Applicable. The proposed project does not fall within 10 Km radius of any CRITICALLY POLLUTED area and also project area does not fall in Aravali hill ranges.
20.	Similarly, for coastal projects, a CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mines lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: the mining projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).	The proposed project does not fall within CRZ area. Not Applicable.
21.	R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SC's/ST's and other weaker sections of the society in the study area, a need based sample survey, family-wise should be undertaken to assess their	Since the project area is falling in Ramial river, there will be no resettlement or rehabilitation involved in the project area, hence compensation details are not applicable.

	<p>requirements and their action programmes prepared and submitted accordingly, integrating the sectoral programmes of the line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.</p>	
<p>22.</p>	<p>One season (non monsoon) i.e. March- May (summer season), October- December (post monsoon season), December-February (Winter season) primary baseline data on ambient air quality as per CPCB notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so complied presented date wise in the EIA and EMP report. Site specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre- dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.</p>	<p>One season data of ambient air quality, water quality, noise level, metrology, soil and flora and fauna has been collected during post monsoon season October 2020 to December 2020. Details are given in Chapter 3.</p>

23.	Air quality modeling should be carried out for prediction of impacts of the project on the air quality of the area. It should also take into account the impact of the movement of vehicles for transportation of minerals. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on allocation map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may be also indicated on the map.	Prediction of impacts on air Environment has been carried out by using AERMOD was done and mentioned in section 4.2.2 of Chapter -4. Wind rose map showing pre-dotminant wind direction has been carried out and the results are given in Chapter-3 under Figure no.3.2.
24.	The water requirement for the project, its availability and sources should be furnished. A detailed water balance should be provided. Fresh water requirement for the project should be indicated.	Water requirement for the project will be 2.5 KLD. Water required in the project will be for drinking purpose and dust suppression, which will be sourced from water tanker.
25.	Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the project should be provided.	Total requirement of water will be 2.5 KLD, which will be met from water tanker; NOC will be obtained from Gram Panchayat.
26.	Description of water conservation measures proposed to be adopted in the project should be given. Details of rainwater harvesting proposed in the project, if any, should be provided.	The project is River bed sand mining. No rainwater harvesting proposed.
27.	Impact of the project on the water quality, both surface and ground water, should be assessed and necessary safeguard measures, if any required, should be provided.	The project is River bed sand mining. No infrastructure development on surface water to obstruct the flow of river. No mining Operations during rainy season. The ground water quality will not be changed because mining activity will not

		<p>intersect the ground water table as it is restricted to 1m depth as per SSMMG 2016 and its subsequent amendment.</p> <p>Impact of project on surface & ground water is monitored and mitigation measure are also provided in Chapter-4.</p>
28.	<p>Based on actual monitored data, it may clearly be shown whether working will intersect ground water. Necessary data and documentation in this regards may be provided. In case the working will intersect ground water table, a detailed Hydro Geological Study should be undertaken and report furnished. The report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of groundwater should also be obtained and copy furnished.</p>	<p>Ground water will not be disturbed by the mining activity of the proposed project. As per SSMMG 2016 sand mining is not allowed below 03m or 1m above ground water level. It will not intersect the ground water table. Below ground water working is not proposed and pumping will not be required. Permission from GGWA is not required.</p>
29.	<p>Details of any stream, seasonal or otherwise, passing through the lease area and modification/diversion proposed, if any, and the impacts of the same on the hydrology should be brought out.</p>	<p>The proposed project is for the riverbed sand mining at Ramial River. No diversion or modification of water channel is proposed or expected due to mining activities from the proposed project. Any river crossing shall be done after due permission of the Irrigation Department. No stream is passing through lease area.</p>
30.	<p>Information on site elevation, working depth, groundwater table etc. should be provided both in AMSL and bgl. A scientific diagram may also be provided for the</p>	<p>Working depth is restricted to 1m only as per SSMMG 2016 and its subsequent amendment.</p>

	same.	
31.	A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the project. Phase- wise plan of plantation already done should be given. The plant species selected for greenbelt should have greater ecological value and should be of good utility value to local population with emphasis on local and native species and the species which are tolerant to pollution.	Greenbelt will be developed in the buffer zone of mine lease area and village haulage roads side also. Quarrying of river sand does not involve any drilling and blasting. Any adverse impact on account of loading, transportation and extraction of sand from river bed may alter the flow of water and it may reduce bank erosion. As the quarry lease area is not suitable for afforestation and green belt development, no greenbelt is planned. Quarrying of sand will be done as per the approved quarrying plan and strictly in accordance with the rules and regulations so that the adverse impacts could be minimized.
32.	Impact on local transport infrastructure due to the project should be indicated. Projected increase in truck traffic as a result of the project in the present road network (including those outside the project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as state government) should be covered. Project proponent shall conduct impact of Transportation study as per Indian Road Congress Guidelines.	Impact on the local Transport infrastructure is given in the Chapter 4.
33.	Details of the onsite shelter and facilities to be provided to the mines workers should	All the site services and other facilities including regular & periodic health checkup,

	be included in the EIA Report.	Eye camp, Adult & Female education & training programmes shall be provided outside nearer to the lease. For transportation of mineral product, roads will be strengthened.
34.	Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.	Post mining land use will be not be changed. Sand will be replenished every year. Although bank protection measures will be included.
35.	Occupational Health impacts of the project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.	These points are in EMP of project and implementation of the same would be done in discussion with authorities. Periodical medical examination and health camp is proposed. EMP cost details are given in the section no. 10.4 of chapter 10.
36.	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.	Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures are given in the chapter 4 and budgetary allocations are given in the EMP cost in chapter 10.
37.	Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.	Socio- economic details are given the section 3.5 of chapter 3.

38.	Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.	Detailed EMP is given in the chapter 10 and EMP cost details are given in the section no 10.4 of chapter 10.
39.	Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.	Public hearing details will be given in the final EIA report.
40.	Details of litigation pending against the project, if any, with direction/order passed by any Court of Law against the project should be given.	There is no litigation pending against the project.
41.	The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Project cost is 40 Lakhs and EMP cost will be 6,00,000/-.
42.	A Disaster Management Plan shall be prepared and included in the EIA/EMP report.	Disaster Management Plan is given in the section no. 7.5 of chapter 7.
43.	Benefits of the Project if the Project is implemented should be spelt out. The benefits of the project shall clearly indicate environmental, social, economic, employment potential, etc.	<ul style="list-style-type: none"> ✓ Improve physical and social infrastructure of the area. ✓ Generate direct as well as indirect employment. ✓ Green belt development
44.	Besides the above, the below mentioned general points are also to be followed:	
a)	Executive Summary of the EIA/EMP report.	Complied.
b)	All documents to be properly	Complied

	referenced with index and continuous page numbering.	
c)	Where data are presented in the report especially in Tables, the period in which the data were collected and the sources should be indicated.	Complied
d)	Project Proponent shall enclose all the analysis/testing reports of Water, Soil, Air, Noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.	Complied
e)	Where the documents provided are in a language other than English, an English translation should be provided.	Noted and agreed
f)	The Questionnaire for environmental appraisal of mining projects as devised earlier by the ministry shall also be filled and submitted.	Noted and agreed
g)	While preparing the EIA report, the instructions for the Proponents and instructions for the consultants issued by MoEF&CC vide O.M No. J- 11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.	Complied
h)	Changes if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public	Noted and agreed

	Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H process) will entail conducting the PH again with the revised documentation.	
i)	As per the circular no J- 11011/618/2010-IA.II(I) dated 30.5.2012, certified report of the status of compliance of the condition stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional office of Ministry of Environment, Forest and Climate Change, as may be applicable.	Noted and agreed
j)	The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.	Attached as Annexure IV
Specific ToRs		
1.	Whether it is an existing mine? If yes, submit the copy of Environmental Clearance and compliance to EC conditions from the Regional Office, SPCB. The year which last operated. 1(a) The project proponent has to carry by engaging appropriate consultant a study of the annual replenishment rate of sand by collecting pre-monsoon & post monsoon data from the field to know the quantum or volume of sand deposited/replenished &	It is a New Project.

	<p>extracted in the mining lease area. The detailed comparison of both pre monsoon and post monsoon elevation data shall be included in the study report. The replenishment rate of sand may be studied as per the procedure laid down in the Enforcement and Monitoring Guidelines for Sand Mining, 2020 (www.moef.gov.in) issued by the MoEF &CC, Govt. of India. The finding of the study shall be submitted to SEIAA along with the final EIA/EMP report to assess the rate of replenishment to mined out sand.</p>																																																																														
2.	<p>Area of the 'no mining zone' specially demarcated within the list out area for safety of the river bank/any bridge or such other structure nearby; and the dimensions and geo-co-ordinates of this zone w.r.t lease boundary.</p>	<table border="1"> <thead> <tr> <th>BP</th> <th>LONGITUDE</th> <th>LATITUDE</th> </tr> </thead> <tbody> <tr><td>1.</td><td>85°36'30.71"E</td><td>20°54'24.22"N</td></tr> <tr><td>2.</td><td>85°36'29.66"E</td><td>20°54'21.93"N</td></tr> <tr><td>3.</td><td>85°36'26.85"E</td><td>20°54'24.89"N</td></tr> <tr><td>4.</td><td>85°36'24.02"E</td><td data-bbox="1159 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		28.	85°36'08.85"E	20°54'28.64"N
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		30.	85°36'09.25"E	20°54'28.79"N
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		34.	85°36'11.46"E	20°54'28.06"N
		35.	85°36'12.39"E	20°54'27.85"N
		36.	85°36'12.51"E	20°54'27.66"N
		37.	85°36'13.90"E	20°54'27.72"N
		38.	85°36'14.48"E	20°54'27.62"N
		39.	85°36'16.55"E	20°54'27.85"N
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		45.	85°36'22.34"E	20°54'28.56"N
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		51.	85°36'26.36"E	20°54'27.58"N
		52.	85°36'28.53"E	20°54'25.81"N
3.	Any approach road existing or will be constructed inside the safety zone?	<p>Nearest Road bridge is at a distance of 0.19 km from the mining lease area.</p> <p>Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.</p>		
4.	Mitigation measures to be taken to ensure not to disturb free flow of river	<p>Mitigation measures are given in the chapter 4.</p>		

5.	Distance of the river bank/ embankment from the lease boundary. It is a river bank or embankment?	Distance of the river bank/ embankment from the lease boundary is 50 m.
6.	Any ramp existing or will be constructed on the river bank/ embankment for movement of vehicles to reach the nearest road.	Ramp will be constructed on the river bank/ embankment for movement of vehicles to reach the nearest road.
7.	Distance of the village road/city road/district road/public road for the river bank. Is this road single road/double road.	Nearest Road bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village - Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.
8.	No. of village (s) and name of village (s) or the city (s) or urban place (s) or semi urban place (s) through which the sand carrying vehicles will ply and the distance of it from the river bank or embankment whether there is any forest land in the intervening area through which the sand carrying trucks will ply.	Nearest Road bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village - Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.
9.	Whether schools/colleges/hospitals/ health centers/ bus stops/ religious places existing nearby and if so, the distance of it from the bank or the road through which the vehicle will ply or existing alongside the road?	The mining lease is at a distance from areas occupied by sensitive man-made land uses - All amenities are available at Baligorad.
10.	Any plantation done in the safety zone or embankment in case of an existing mines and if so, the area of plantation, number of species? If not, the plan for it to arrest bank	Green belt details are given in Chapter 2.

	erosion.	
11.	Any stone packing in the river bank/ embankment existing in case of existing mines and if not, the plan for it.	Not applicable
12.	Whether, any alternative mine exists or explored or can be explored if this mine is otherwise found unsuitable? Please furnish details.	Not applicable
13.	(i) Whether permission taken or will be taken from water resource authority or the concerned authority of the roads to be used for plying of vehicles loaded with sand or empty vehicles for the same after the river bank. (ii) Responsibility of perennial maintenance of these roads and the mechanism for the same.	All statutory permissions will be obtained for mining operations.
14.	No. and type of vehicles to be used daily and the frequency for the purpose of transportation and the time and duration of such transportation. Whether permission taken or will be taken for the appropriate authority for the purpose.	5/10 number of trucks and tractors are used transportation of sand mineral and frequency of plying will be 30 minutes.
15.	Intersection point of the haulage roads with the main SH/NH/public road and the traffic density study at appropriate locations by domain expert with remedial measures for decongestion and road safety.	Nearest Road bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.

16.	(i) Any bridge (road/rail) existing and the distance of it from the lease boundary. (ii) Any culvert of small bridge will be used by the plying vehicles carrying the sand minerals.	Nearest Road bridge is at a distance of 0.19 km from the mining lease area.
17.	Any High Transmission Electric line existing and if yes, the distance of the same from the boundary of the lease.	There is no High Transmission Electric line existing in the mine lease area. Nearest Electrical Transmission line is at distance of 0.37 km from mine lease area.

2 PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

This project is proposed for the excavation of sand from the bed of river Ramial. The mining operations will be carried open excavation with manual method only in its existing form for direct usage as an aggregate with cement and steel in construction of structures. The total extent of area is 5.435ha for which Environmental Clearance is required with proposed total production capacity 54510 M³ for five years with 10902M³ per annual production. The total project cost is Rs. 40 Lakhs only.

2.2 NEED OF THE SAND MINING PROJECT

The ordinary sand is to be used for construction purpose and the government wishes to minimize the gap between demand and supply, thereby facilitating the availability of sand to the public. In order to meet the statutory requirements, the lessee intends to obtain Environmental Clearance from Statutory Authorities.

The ordinary sand is used as an aggregate with cement and steel in construction of structures.

2.3 LOCATION OF THE PROJECT

The total extent area of the lease for this quarry is 5.435Ha at Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District and Odisha State. Quarry Land is classified as Government land and leased by Tahasildar, Dhenkanal, and Odisha. The area under discussion is featured in Survey of India Topo Sheet No-73H/9 and is bounded between the Latitude -20° 47" 49.07" N to 20° 47" 58.23" N, Longitude-85° 36" 46.34" E to 85° 36" 55.38" E.

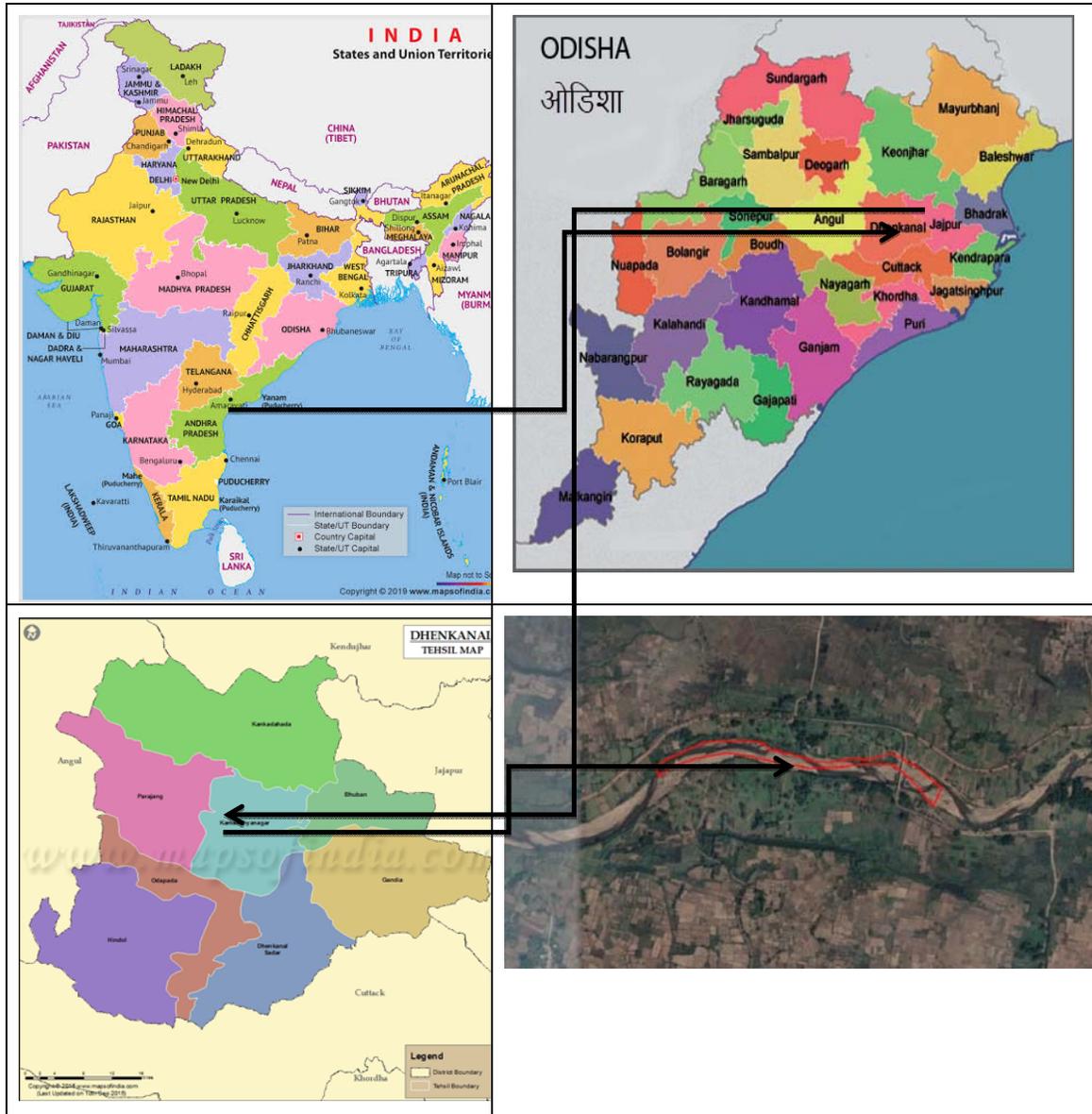


FIGURE 2-1 Location Map of the Project Site

The area under discussion is featured in Survey of India Topo Sheet No –73H/9 and is bounded between the Latitude -20° 54’ 21.93” N to 20° 54’ 30.49” N, Longitude–85° 35’ 49.94” E to 85° 36’ 30.71” E. The lease area is located at a distance of 1.49 km from village Baligorad and at a distance of 5 kms from Kamakhyanagar, 45 kms from the District Headquarters Dhenkanal and 99 kms from the State Capital Bhubaneswar. Dhenkanal Railway station is the nearest railway station located at a distance of 25.6 kms from the lease area. Nearest Road Bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH –20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.

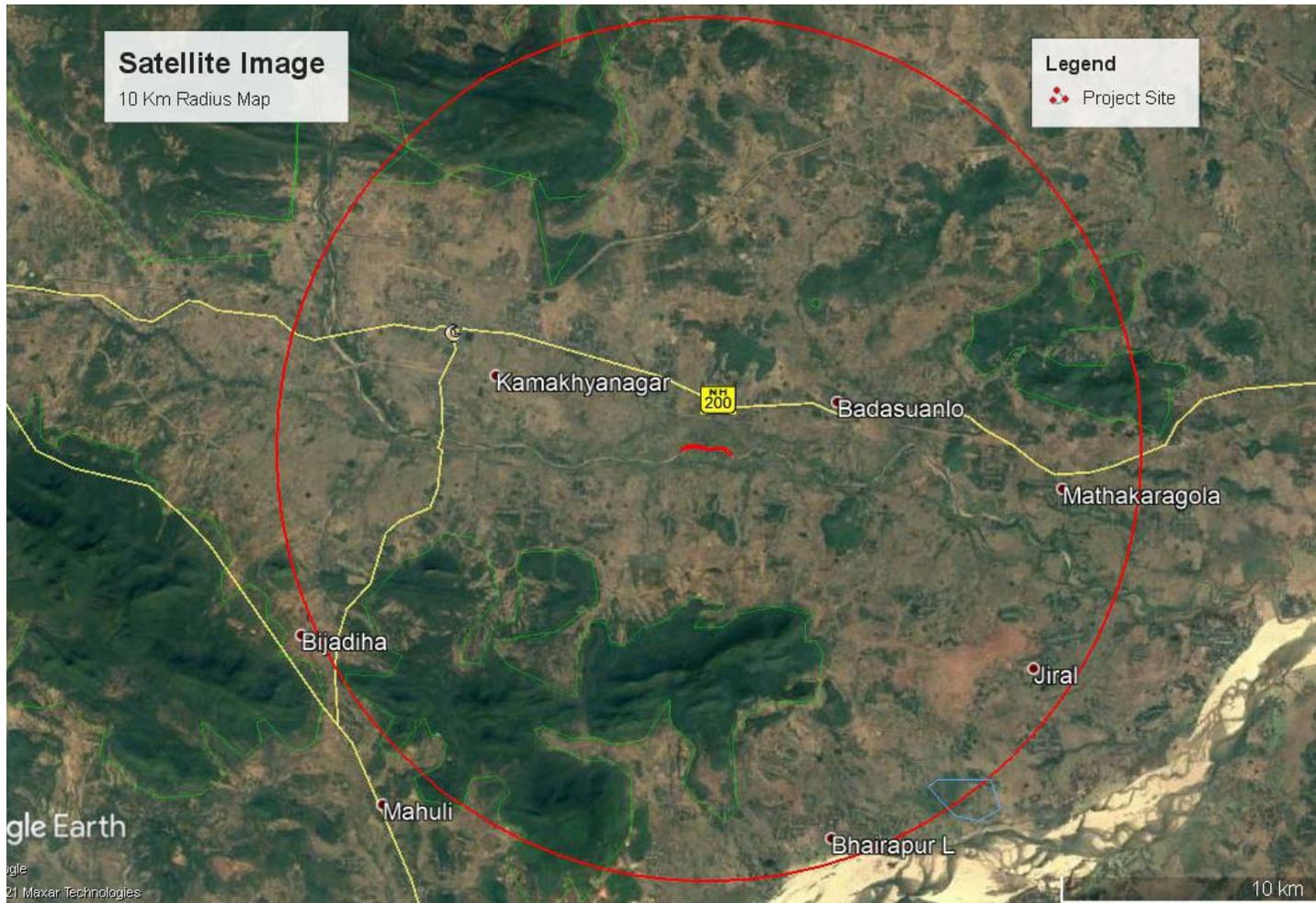


FIGURE 2-2 SATELLITE MAP 10 KM FROM THE PROJECT SITE

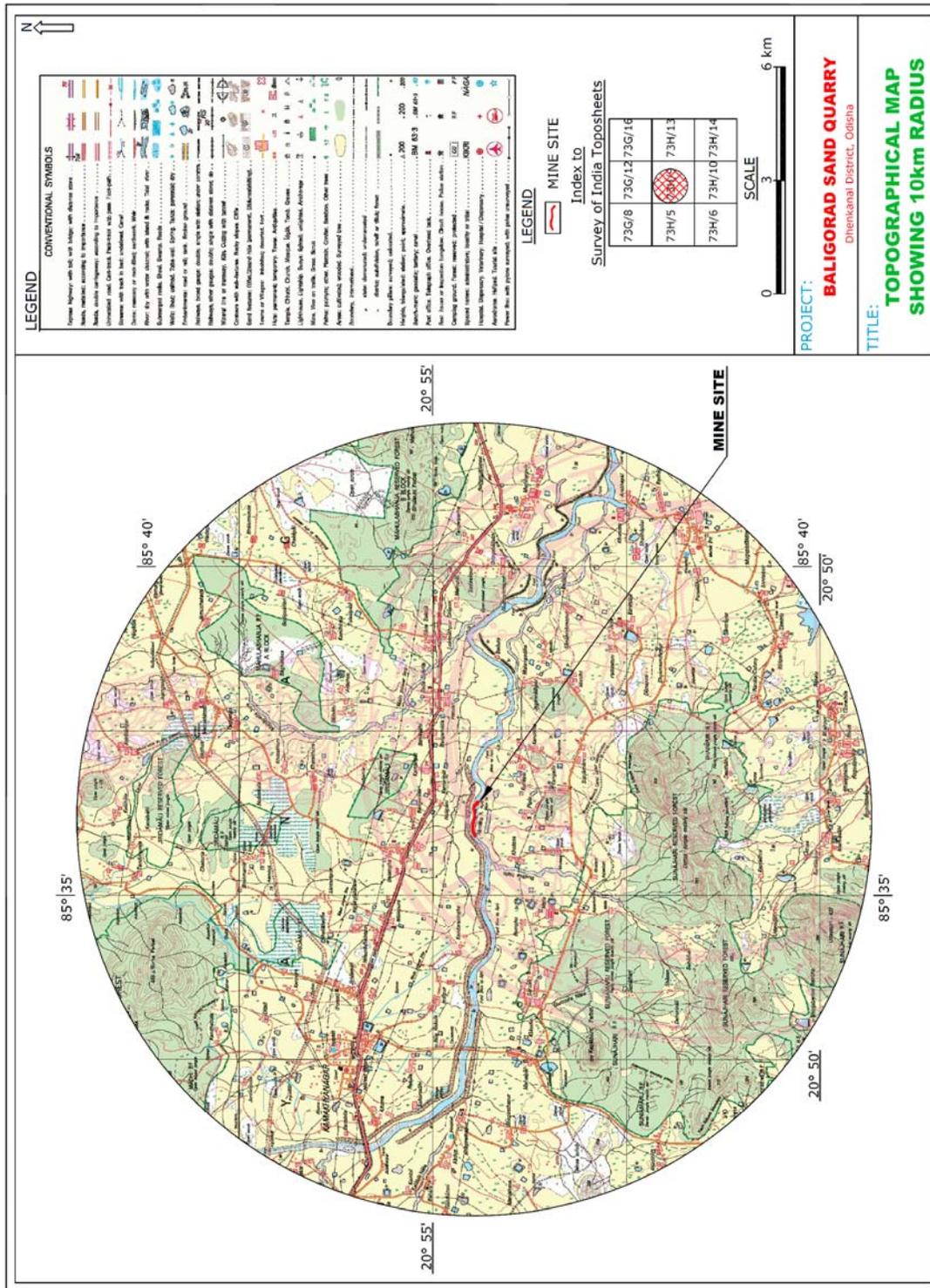


FIGURE 2-3 TOPO MAP 10 KM FROM THE PROJECT SITE

TABLE 2-1 PROJECT SUMMARY & SALIENT FEATURES WITHIN 15KM RADIUS OF THE LEASE AREA BOUNDARY

S.No.	Particulars	Details
1.	Land use at the Project Site	Mining will be carried out at the site for ordinary sand as construction material (Aggregate)
2.	Nearest Highway	Nearest Road bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village - Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.
3.	Nearest Railway station	Dhenkanal Railway station located at a distance of 25.6 kms from the lease area in SW direction.
4.	Nearest Village	Baligorad is 1.49 km from the proposed area in N direction
5.	Nearest Major Settlement	Baligorad is 1.49 km from the proposed area in N direction
6.	Nearest Major Town	Kamakhyanagar is 5 km from the proposed area in NW direction.
7.	Communication Network	Amenities like Telephone, Post and Telegraph Office, Police Station, Primary Health Center etc., are available at Kamakhyanagar.
8.	Education	Primary School Education is available at nearby village. Higher Education are available at Kamakhyanagar.
9.	Medical Facility	RMP Doctor is available at Renthapat, Nursing Homes and Hospitals are located at Kamakhyanagar.

Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Mine, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State

10.	Availability of Water	The ground water level is about 4m to 14m below sand level.
11.	Availability of Electricity	Electricity is available in all human settlements
12.	Hills/Valleys	Nil
13.	Ecologically Sensitive Zone (Wild Life Sanctuaries)	Nil
14.	Reserved Forests	<ul style="list-style-type: none"> • Jiridamali RF – 1.96 km, N • Jiridamali RF – 4.5 km NW • Mahulabhanja RF A Block – 4.1 km NNE • Mahulabhanja RF B Block -6.3 km ENE • Sunajhari RF -3.13 km ,S • Bhairipur RF -4.8 km SSE • Suniamaru RF – 3.03 km ,S • Madhi RF – 7.7 km NNW
15.	Water Bodies	<ul style="list-style-type: none"> • Ramial River – Mine lease area • Budhia Nala – 0.76 km SW • Mahapatia Jora – 2.9 km NE • Betali Nadi – 9.1 km WNW
16.	Defence Installation/ Historical Monuments/ Archaeological/ Ports	Charbatia Air Base, Cuttack is the nearest defense installations from the mining lease located at a distance of 50.0 kms.
17.	Historical Places	Nil
18.	Areas occupied by sensitive man-made land uses (Hospitals, schools, places worship, community facilities)	The mining lease is at a distance from areas occupied by sensitive man-made land uses – There is a temple, Govt. Hospital, Educational institutions- Govt. High School, Govt. College, Communication facilities- 5 kms in NW direction.
19.	Nearest River	Ramial River
20.	Areas susceptible to natural	The area is not sensitive to earthquakes,

Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Mine, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State

hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions) similar effects	subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions. Zone-II (Least Active)
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The total extent area of the lease for this quarry is 5.435Ha at Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District and Odisha State.

In this mining lease area only 5.435hectare area is available for mining as per Terms of Reference approved by SEIAA; Odisha for the proposed production capacity of 10902M³ per year and 54510 M³ for five years. It is an open cast mine and it is proposed to do mining by manual method.

TABLE 2-2 QUARRY LAND DETAILS

District & State	Village	Tahasil	Sy. No.	Extent	Ownership	Nature of Excavation
Dhenkanal, Odisha State	Baligorad Village.	Kamakhyanagar	Khata No:361 Ramial River	5.435Ha	Govt. Land	Open Excavation

2.4 EXISTING LAND USE PATTERN:

The proposed specified sand bearing area is over the river bed which will be submerged under water during monsoon and floods. The adjacent areas are classified as agricultural lands by the revenue authorities.

Type of land use	Area (Ha.)
Water channel area	Nil
Left over area adjacent to water channel	Nil
Quarry Safety zone area	2.765
Potential Mineable surface area within the plan period	2.67
Total	5.435

2.5 GEOLOGY AND EXPLORATION

2.5.1 RESERVE

The reserve is estimated based on local parameters. The lease area belongs to recent quaternary River bed deposits consisting of sand, silt, clay, gravel and alluvial deposits.

2.5.2 PHYSIOGRAPHY

The sand bed is on the river Ramial. The Baligorad Sand bed deposit represents a gently sloping to almost flat terrain with highest altitude of 41mRL towards southern part. The general slope is towards north. Vegetation is scanty with small bushes existing in the auction hold area. There is no human settlement within the area.

2.5.3 REGIONAL GEOLOGY

Gondwana Group Palaeozoic-Mesozoic Upper Mahanadi valley basin which is in this basin, the Gondwana sediments unconformably overlie the Precambrian basement; the latter comprising migmatitic granitic gneiss, amphibolite, schist and quartzite traversed by pegmatite and quartz veins. Era (Upper Carboniferous-Early Permian)- Glacio-lacustrine and fluvial sediments were deposited in linear basins along faulted troughs over the Precambrian basement. These sediments, characterized by fluvial assemblages of interbedded sandstone-shale sequence. While the lower Gondwana rocks are a vast repository of coal, the Upper Gondwana witness sandstones of Palaeozoic-Mesozoic era. Gondwana rocks are exposed over a large area along NW-SE trending linear belt in the Mahanadi valley rift/graben in three major basins (Talcher, Ibriver & Athgarh). Besides these, a number of small patches (outliers) of Gondwana rocks occur in Angul, Dhenkanal districts and others. The lower Gondwana rocks have vast resources of coal. The stratigraphic successions are as below;

Stratigraphic set-up

Upper Gondwana	Migmatitic granitic gneiss, amphibolite, schist and quartzite	Palaeozoic Mesozoic
	Conglomerate, sandstone, shale fireclay	Lower Cretaceous

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Middle Gondwana	Conglomerate, ferruginous sandstone, red shales	Lower to Middle Triassic
-----Un-Conformity-----		
Lower Gondwana	Fine to medium grained sandstone, siltstone, clay-beds, coal	Upper permian
	Sandstone, shale, clay, ironstone shale	Middle Permian
	Conglomerate, sandstone, shale, fireclay, coal	Lower Permian
-----Un-Conformity-----		
	Boulder Bed, green shale, sandstone, marlstone	Upper carboniferous to lower Permian
-----Un-Conformity-----		
	Grinite, greisses, amphibolites, migmatites	Precambrian

The Quaternary consists of both Pleistocene and Holocene formations spanning over a period of about 1.8 million years up to present time. Studies on the Quaternary sediments of the state for nearly two decades have led their classification into five formations. These, arranged in order of decreasing antiquity area i) Naira (ii) Bolgarh (iii) Kaimundi (iv) Bankigarh and (v) Recent formations.

The alluvial valley facies include the flood plain deposit which occur parallel to the present river courses. The sediments are represented by alternate bands of silt, fine white sand and mottled clay. The sediments display nominal oxidation implying immature pedogenic alteration. The lower delta facies passes seaward into their coastal equivalents.

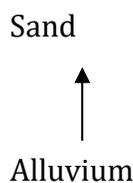
The above are best developed around Barkul, Jaipur and Paradip areas. The alluvial valley facies include the flood plain deposit which occur parallel to the present river courses. The sediments are represented by alternate bands of silt, fine white sand and mottled clay. The sediments display nominal oxidation implying immature pedogenic alteration. The lower delta facies passes seaward into their coastal equivalents (Younger Coastal Facies), represented by yellow, medium to fine sands of the stranded beach-ridge segments.

Litho-Stratigraphy of Quaternary sequence in Odisha

Morpho Units	Litho Units	Tentative age
Present day Surface	Present day channel fill (Fine to medium sand with little clay and silt).	Late Holocene
Bankigarh Surface	Bankigarh Formation (Brownish sandy clay)	Late to Middle Holocene
Kaimundi Surface	Kaimundi Formation (Caliche bearing sandy clay).	Late Pleistocene to early Holocene
Bolagarh surface/ Naira Surface	Bolgarh Formation (Secondary laterite formation). (Semi-consolidated Pebbly sandstone with ash bed).	Middle to Early Pleistocene
~~~~~ Unconformity ~~~~~		
Basement	Precambrian to Tertiary rocks.	

**LOCAL GEOLOGY**

The sand deposit in Ramial River near Baligorad belongs to recent to sub recent deposits of Holocene age. The proposed area is occupied by a gently sloping to almost flat deposits of sand. The sequence of litho units encountered in the auction hold area is as follows:



**LITHOLOGY:**

The characteristic features of the litho units of the area are described below:

**Sand:** The area under reference is covered with grey to white sand deposits with average probable thickness of 1.7m within the lease area. Sand by definition is a loose, incoherent mass of mineral materials and is a product of natural processes. These processes are the disintegration of rocks and corals under the influence of weathering and abrasion. When sand is freshly formed, the particles are usually angular and sharply pointed, but they grow

gradually smaller and more rounded as they become constantly worn down by the wind or water. Sand particles tend to settle quite rapidly because of their shape, density and size. Therefore, the concentration of sand is highest near the bed of a river and lowest near the surface.

The composition of sand is highly variable in nature, depending on the local rock types/sources and conditions, but the most common constituent of sand in inland continental settings and non-tropical coastal settings is silica (silicon dioxide or SiO₂), usually in the form of quartz which because of its chemical inertness and considerable hardness, is the most common mineral resistant to weathering.

**Alluvium:** Decomposed vegetal materials admixed with clay and soil constitutes alluvium which is underlain by the sand bed with some clayey matter.

#### **2.5.4 RESERVE**

The Geological reserve has been estimated by considering the following parameters.

- i. Outcome of geological mapping; Fresh patches of unexploited river sand occurrences are observed within the area. The maximum RL of the surface sand zones is around 39m.
- ii. It is observed that, the difference in elevation between the highest and lowest points is much less. Gradient of the river is also very low. Therefore, surface area method has been adopted for estimation of reserve of this river bed sand
- iii. Thickness of sand zone: The mRL of the surface sand zone is around 41m. Considering the observations of thickness of sand bed of the area the maximum possible thickness of sand bed that can be mined out i.e. 1.7m is assumed as the thickness of sand over the area for estimation of reserve.
- iv. The present document is being prepared for the lessee which would be decided through auction by the competent authority and the process would require at least 2 to 3 months from now. Also, the pattern of sand deposition in the ensuing years of the lease period is impossible to ascertain right now. To overcome this, the total lease area has been considered as potential zone for sand deposition excluding the

water channel areas, if any located within the area and Geological resource has been calculated based on this area and the present thickness of sand deposit.

- v. In the absence of any monitored database, it is assumed that 100% of the above calculated resource would be replenished cumulatively which the total QL period of 5 years. Considering the above, the total geological resource of the QL area for the lease period has been calculated by doubling the above calculated resource.
- vi. The resource of river sand over the area has been categorized as probable reserve.
- vii. The foreign particles in the sand such as wood and other floating waste have been considered as waste. However, the volume of waste is negligible in quantity and in practice the waste will not be separated during mining. So recovery factor has been taken as 100% for sand.
- viii. Total volume of excavation of sand is saleable.

**Mineable Reserve:**

- ix. The sand resource within safety zone area of 7.5m barrier all along the proposed area boundary and 10m barrier the water channel (if any) present within the proposed area have been excluded from the above calculated geological resource for computation of mineable reserve. Besides, 60% of the computed mineable reserve as above has been taken as available mineable reserve over the area as per MoEF Notification dated 25.07.2018 which can be extracted during the total span of the plan period.

**Calculation of Reserve:**

Based on the above Considerations, site specificity & chosen local parameters, the reserve has been calculated for river bed sand zone by surface area method.

Volume of Sand is  $V=A \times T \times R$

Where,  $V$ =Volume of sand  $m^3$

$A$ = Surface area of potential sand patch

$T$ = Average thickness of sand bed in m

R= Replenishment factor for the QL period of five years

Total estimated geological resources as 184790 cum.

Similarly, total extractable mineable reserve of river bed sand is worked out to be 54511 cum.

**TABLE 2-3 CATEGORY WISE GEOLOCAL RESERVE OF SAND BED**

<b>Geological Resources Calculation of sand for the QL period</b>				
<b>Area of Potential sand zone (m²)</b>	<b>Thickness of sand in m</b>	<b>Replenishment Factor (100%)</b>	<b>Geological Resources of sand in m²</b>	<b>Category</b>
A	B	C	D=AxBxC	E
54350	1.7	2	184790	Probable

**TABLE 2-4 CATEGORY WISE MINEABLE RESERVE OF SAND BED**

<b>Mineable Reserve Calculation of sand for the QL period</b>					
<b>Area of Potential sand zone excluding safety zone (m²)</b>	<b>Thickness of sand in m</b>	<b>Replenishment Factor (100%)</b>	<b>Mineable Reserve of sand in m²</b>	<b>Extractable Mineable reserve</b>	<b>Category</b>
A	B	C	D=AxBxC	E=Dx0.6	F
26721	1.7	2	90851	54511	Probable

Right now, the sand resources available within the source is  $15000\text{m}^2 \times 1.7\text{m} = 25500 \text{ m}^3$  which is more than the MGQ provided by the Tahasildar.

## **2.6 MINING & METHOD OF MINING**

**Semi-Mechanized-** Mining shall be undertaken to extract sand, mainly through an open pit spread over the river course devoid of water or nominal water that may be encountered below.

### **Mining Method:**

The mode of the deposit, geomorphology of the area and its hydrological condition are some of the factors that favours the open cast method of mining.

Mining will be done by excavators for excavation & loading into trucks/tractors and manually also. The sand will be transported from Ramial River sand bed to the users/destination through trucks /tractors. The mining will be undertaken on single shift basis. The local man power shall be engaged in the mine. The machines to use. The details are given below.

<b>Sl.No.</b>	<b>Name</b>	<b>Capacity</b>	<b>No. of Fleet</b>
1	Trucks/Tractors	6 Cum/3 Cum	5/10
2	Safety gears helmets, safety shoes, Goggles & hand gloves	-----	As required
3	Excavator	0.9m ³	1

As such the river bed sand are loose, no drilling & blasting is required. Benching pattern is not feasible in case of sand, as the angle of repose of sand is 35°, based on this the Ultimate pit slope limit has been taken as 35°. The maximum depth of mining will be of 1.7m or up to water table whichever is less. There will be no existing quarry within the proposed area after replenishment. Total available minable reserve over the area has been estimated considering the probable zone of occurrence of river sand bed within the proposed area as revealed during field visit and assuming uniform rate of year wise replenishment over the area. Yearwise development of quarries for five-year plan period will be decided depending upon the occurrences of sand bed over the proposed area during the respective year to achieve the target production. Therefore, quarry lay out will be over the whole proposed area depending upon the probable sand bed after replenishment leaving stipulated safety zones. 39.3 mRL or upto water table whichever is less. The present level of the lease area is 41mRL. During plan period, the quarry floor will be 39.3mRL or upto water table whichever is less. The proposed pit lay out have been shown in the development plan and also in progressive Mine Closure Plan.

**TABLE 2-5 YEARWISE PRODUCTION OF SAND DURING PLAN PERIOD**

<b>Year</b>	<b>Production in m³</b>
1 st	10902
2 nd	10902
3 rd	10902
4 th	10902
5 th	10902
<b>Total</b>	<b>54510</b>

**Over Burden Removal**

No overburden is anticipated.

**Loading**

The ordinary Sand will be loaded by manually by labours.

**Hauling**

Ordinary Sand is transported through tractors with trailers.

**2.7 STOCK YARD**

The applicant should obtain permission from the competent authority for stock yard under Mineral Dealer Rules '2000 if the sand is to be transported for long distance as per the norms of the Concerned Department.

**2.8 WATER REQUIREMENT**

Water requirement for the project will be 2.0 KLD. Water required in the project will be for drinking purpose and dust suppression, which will be sourced from water tanker.

**2.9 POWER REQUIREMENT AND SOURCE**

Power Requirement will not be required for operations as the mining will be worked out during day time only. Minimal power required for office shall be taken from the general electric supply of the area.

## **2.10 MAN POWER REQUIREMENT**

Employment Generation from the project is 11 nos. of people. OMS has been assumed to be 4.90cum. Indirect employment through creation of shops/ stalls, hired vehicles, etc. also can be generated to full fill the day-to-day requirements of the mining personals.

## **2.11 MINE DRAINAGE**

The shallow depth excavation on dry/ nominally wet sand has been proposed, which will have negligible or no impact on drainage. Abandoned stream channels on terrace and inactive flood plains have been preferred rather than active channels.

Water that might percolate (if any) into excavation area has to be pumped out to channelize to river course during excavation. Stream will not be diverted to form inactive channels. Mining below subterranean water level will be avoided as a safeguard against any water contamination. Source has been finalized avoiding concave side of river bank/channel to prevent bank erosion.

It is observed from the dug well in the adjacent plain area and in the nearby villages that the ground water table varies between 4m to 14m from the surface level depending upon seasonal variations. During dry season the water table falls to 14m from the surface where as during rainy season the water table remains at 4m from the surface. As the mining activities presently proposed are maximum up to 1.7m that to within the river course and the total mining operation will be achieved through manual means, so there will be no effect on ground water table.

## **2.12 STACKING OF MINERAL REJECTS AND DISPOSAL OF WASTE**

- a. Nature of Topsoil/Waste and Mineral Rejects: There is no topsoil and no mineral rejects are anticipated.**
- b. Solid waste during the plan period:** No waste is anticipated in Ordinary Sand excavation.
- c. Storage and utilization of topsoil:** No topsoil is going to be generated in this plan period.
- d. Proposal for reclamation of land effected by Mining:** The reclamation of the excavated sand will be a natural process as the flowing water during rainy days will fill the mined out pits.

- e. Afforestation Programme:** Afforestation is not possible as the entire area is occupied by the sand. Plants will be developed on either side of the approach road on the banks of river.
- f. Measure to control to erosion /sedimentation of watercourses:** There will not be any erosion/ sedimentation in the subject area because; there will not be any water discharge form mine workings.
- g. Treatment and Disposal of water from Mine:** No water will be disposed from mine.

### **2.13 SITE SERVICES**

Temporary Site Services will be provided by the applicant. Make shift Office. First Aid and Rest shed will be constructed by the ramp side of the specified sand bearing area.

### **2.14 Green Belt**

The lease area is a river sand quarry and the total lease area will be used for mining of sand. Plantation work will be carried out along the safety zone of the lease area. 50 number of saplings proposed during plan period will be planted. Plantation shall be done with suitable local species like teak, mango, neem, Jammu, jhaun etc. per year. Plantation can also be done along the approach road during the plan period.

### **2.15 Project Cost**

Project cost of the project is 40 Lakhs.

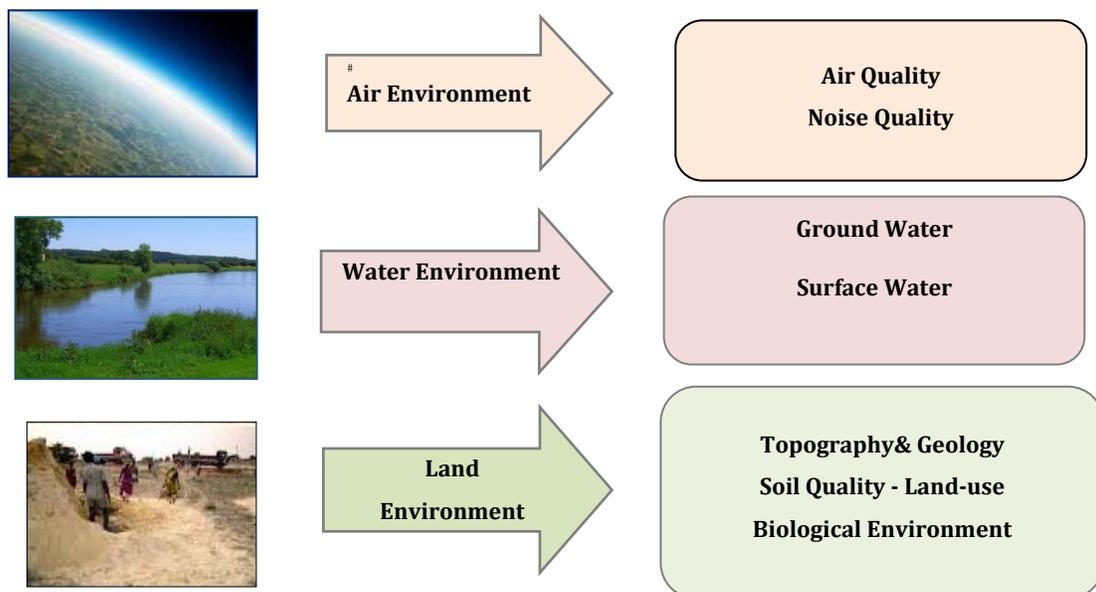
### 3 DESCRIPTION OF ENVIRONMENT

#### 3.1 SCOPE

Collection of baseline data of different Environmental Attributes like Air, Water, Noise, and Soil, Socio-economic etc., proposed production capacity is an important stage in the preparation of Environmental Impact Assessment (EIA), which helps to predict the changes which may occur after the implementation of the project.

EIA report contains a description of existing environment that would be or might be affected directly or indirectly by proposed project. Environmental baseline monitoring is a very important stage of EIA. Environmental baseline monitoring, during the operational phase, helps in judging the success of mitigation measures in protecting the environment. The main objectives of describing the environment, which may be potentially affected, are (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors. The chapter contains information on existing environmental scenario of the proposed project study area.

Environmental facets that are considered in relation to mining can be categorized into following groups:



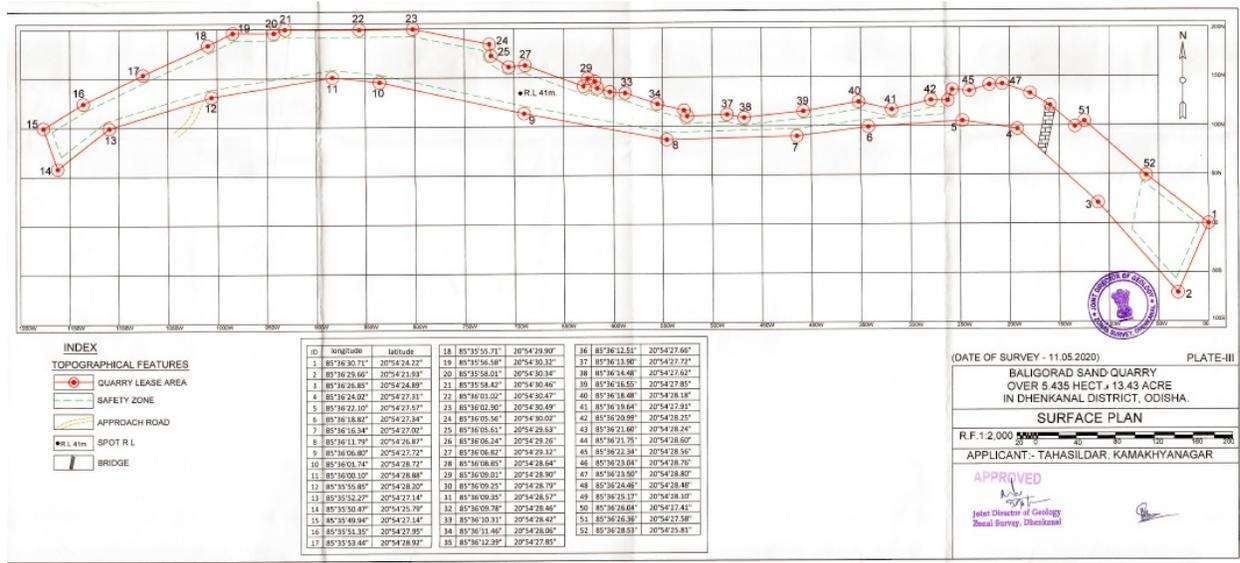
**TABLE 3-1 SALIENT FEATURES OF BASELINE ENVIRONMENTAL STUDIES**

Attribute	Parameter	Frequency of Monitoring
Micro meteorological Studies	Wind Details like speed, direction, Temperature, Relative Humidity and Rainfall	3 months data has been collected to assess air pollution impacts on the surrounding environment.
Ambient Air Quality	PM ₁₀ PM _{2.5} Sulphur Dioxide (SO ₂ ) Oxides of Nitrogen (NO _x )	3 months data has been collected to assess baseline Air Quality status of the area.
Noise Quality Data	Noise levels	1 middle month data has been collected to identify noise producing areas.
Water Quality, Soil Quality Data and Land Use pattern	Physical & Chemical parameters along with measurement of heavy metals and land use parameters.	To establish baseline Water Quality, Soil Quality for future reference and Land Use Pattern in the area.
Socio-Economic & Demographic Studies	Socio-Economic parameters	To know the present Socio Economic status of the study area

### 3.2 STUDY AREA

The proposed mine lease boundary is considered as a center, a radial distance of 10 km is considered as study area for baseline data collection and environmental monitoring. Topographical map of study area is given in figure 2.1The surface plan of mining area map is given in below **Figure 3.1**.

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Mine, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**



**FIGURE 3-1 SURFACE PLAN OF BALIGORAD SAND MINE PROJECT AREA**

**3.3 STUDY PERIOD**

The baseline data generation for the EIA-EMP has been carried out during October 2020 to December 2020 for the period of three months.

**3.4 COMPONENTS AND METHODOLOGY**

To achieve the objectives of ToR, M/S Rightsource Industries Private Limited team members visited the study area and monitored the environmental parameters as per of ToR Letter and accordance with the Guidelines for EIA, issued by the Ministry of Environment, Forests and Climate Change, Government of India. The components of the study are given below:

**TABLE 3-2 COMPONENTS OF BASELINE STUDY**

Sl.No.	Component	Sl.No.	Component
1	Land use	6	Water Environment
2	Hydrogeology	7	Land Environment
3	Air Quality and Meteorology	8	Biological Environment
4	Air Environment	9	Socio-economic Environment
5	Noise Environment		

### **Data Collection Methodology**

The baseline information on micro-meteorology, ambient air quality, water quality, noise levels, soil quality and floristic descriptions are largely drawn from the data generated by NABL Accredited Lab. The FAEs are also involved in selection of monitoring locations and data collection. Micrometeorological data at site was recorded using automatic weather station. Apart from these, secondary data have been collected from Census Handbook, Revenue Records, Statistical Department, Soil Survey and Land use Organization, District Industries Centre, Forest Department, Central Ground Water Authority, etc.

### **3.5 LAND USE LAND COVER OF THE STUDY AREA**

Land Use (LU) refers to man's activities and various uses, which are carried on land. Land Cover (LC) refers to natural vegetation, water bodies, rock / soil, artificial cover and others resulting due to land transformation. Although land use is generally inferred based on the cover, yet both the terms land use and land cover are closely related and interchangeable.

Information on the rate and kind of change in the use of land resources is essential to the proper planning, management and regulation of the use of such resources. Knowledge about the existing land use and trends of change is essential if the nation is to tackle the problems associated with the haphazard and uncontrolled growth. A systematic framework is needed for updating the land use and land cover maps that will be timely, relatively inexpensive and appropriate for different needs at both national and state levels. The rapidly developing technology of remote sensing offers an efficient and timely approach to the mapping and collection of basic land use and land cover data over large area. The satellite imageries are potentially more amenable to digital processing because the remote sensor output can be obtained in digital format. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved from or maintained at current levels.

It is required to carry out the land use / land cover study for the project study area (10 km radius) to obtain the necessary environmental clearances from statutory authorities. The objective of the study is to carryout land use / land cover study for the proposed project. The LU / LC study is carried out using the Satellite Imageries (IRS RS2 LISS III / IV Rabi and

Khariff) in addition to Survey of India toposheets. Appropriate guidelines are followed while preparing the LU / LC map for the project study area.

#### **A) SCOPE OF THE WORK**

##### **(Standard Operation Procedure for Land Use / Land Cover Study)**

- The LU/LC study shall be carried out for a study area of 10km radius taking site as centre using the satellite imageries (IRS RS2 III/IV 5.8m Resolution) for Rabi/ Khariff season.
- Procurement of latest satellite imagery (IRS RS2 III/IV 5.8m Resolution) based on availability) Rabi or Khariff seasons.
- Satellite imagery processing and interpretation of land use as per land use classification covering 10km radius of proposed Project Site.
- Calculation of land use breakup w. r. t. each land use category covering 10km of proposed Project Site.
- Preparation and submission of reports, satellite imageries and maps.

##### **Pre-Field Interpretation:**

- Collection of Survey of India Topographical maps on 1: 50,000 scale from Survey of India (SOI).
- Procurement of Satellite Imagery from National Remote Sensing Agency (NRSC) site Geo Co-ordinates from site center taken 10 Km radius.
- Using ERDAS image processing software processed the raw satellite data.
- Using ARCGIS software converting the all base features from the toposheet, and overlaying the same features on the satellite imagery.
- Using remote Sensing techniques tone, color, texture and shadow etc. draft land use map is prepared.
- Before site/ground truthing randomly mark field, data checked. With which field work will be carried out.

##### **SITE/ground trothing:**

- Site visit - capture the Geo-Coordinates of Boundary Pillars and record in field note book.

- Take traverses and observe the land use categories and map it on the field map on draft map with field photographs.
- Observe the each land use category like single crop/double crop, industrial area, settlements, forest lands, water bodies, waste lands and etc.
- The buffer zone area will randomly traverse for correlating mapping units.
- Collecting secondary data from agricultural department and local people.

### **ROLE OF REMOTE SENSING AND GIS**

Remote sensing and GIS are the modern techniques of terrain analysis and information generation. They not only ensure faster and easier analysis / interpretation but also help to modify / manipulate the data at will so as to meet the objective of the study.

#### **A. REMOTE SENSING (RS)**

Remote Sensing (RS) generally involves in processing of remotely sensed data in digital form using image-processing techniques, which created a new and wider dimension in analysis and interpretation. Remote sensing enables one to acquire information about an object or phenomena from a distance through detection or measurement of electromagnetic energy coming from the object. The use of remote sensing techniques for the study of natural resources has been found to be of considerable value. The information derived from the remote sensing is compatible with topographic maps of Survey of India on 1:50,000 or 1:25,000 scale. With the use of high-altitude sensor platform, it is now possible to record extensive areas on a single image, which covers a maximum of 34,000 sq. km (185x185km) and minimum of 3600-sq.km area. Thus, one can have a synoptic view over large area and also an integrated picture of the landscape. By using the satellite imagery, it is possible to conduct surveys in areas, which are difficult to access. Some of the advantages of utilizing remote sensing techniques are given below:

- Satellite image serves as a permanent record of a landscape at a point of time from which land use changes can be monitored and evaluated.
- Satellite data is cost effective when compared to conventional methods. It can be obtained quickly; its information is accurate, reliable and up to date.

- Preparation of thematic layers by using satellite imagery is time saving when compared to conventional method.
- Satellite data can be effectively integrated with the conventional data for analysis, planning and decision-making.

## **B. GIS**

Geographic Information System (GIS) is a powerful set of tool, which can perform correlation. GIS is a system for manipulating and analyzing spatial data to provide information to support planning and decision-making. GIS can also be defined as “decision support system involving the integration of spatially referenced data in a problem solving environment’ (Cowen, 1988). It comprises facilities for the input, management, retrieval, manipulation, analysis and display of spatial data. Its functions can be grouped as data acquisition, data utilization, data management, output and display.

GIS technology is useful as planning / decision-making tool for resource management. The selective retrieval and analysis capabilities of GIS are used to manipulate the database and provide a variety of information for resource management. GIS is an aid to analyze the thematic maps prepared through remote sensing and field visits. It stores all the maps prepared and database attached to them in digital format, which permits rapid access and processing. Combination of Remote sensing and GIS technologies are very important for assessment and management of natural resources, where integration of data from different sources is an essential requirement.

### **DATA USED DETAILS**

The data is used for the preparation of different maps for the study natural resources. The data is used by using the application of Remote Sensing and GIS technologies.

**TABLE 3-3 DETAILS OF SOURCES & THE MAPS PREPARED**

<b>Sl.No.</b>	<b>Source</b>	<b>Maps Prepared</b>
1.	Survey of India’s topographic maps and satellite imageries	Base map and Drainage map
2.	Satellite Imageries	Land use / Land cover

**TABLE 3-4 SURVEY OF INDIA'S TOPOGRAPHIC MAPS**

Sl.No.	Topographic Map No.	Scale	Year of Survey	Year of Publication
1.	73 H/9	1: 50,000	2010	2011

**TABLE 3-5 SATELLITE DATA OF NATIONAL REMOTE SENSING CENTRE**

Sl.No.	Season	Sensor path/row	Satellite/Sensor	Date of Pass
1.	Winter	105/57	IRS RS2 LISS III	October 2019

### 3.5.1 LAND USE / LAND COVER

Land use/land cover map is prepared by visual interpretation of high-resolution satellite data with the help of Survey of India Topographic maps on 1:50,000 scale. Two seasons' data is used for the delineation of different units. The units are confirmed by the ground truth/field visits.

Level-II classification of National (Natural) Resources Information System (NRIS) has been followed for the delineation of units.

Land use/Land cover map of the study area is integrated with village map and analyzed with the help of GIS to get the village wise findings of the present land use of the study area, which is given elaborately in the following tables:

Land use refers to man's activities and various uses, which are carried on land. Land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others resulting due to land transformation. Although land use is generally inferred based on the cover, yet both the terms land use and land cover are closely related and interchangeable. Information on the rate and kind of change in the use of land resources is essential to the proper planning, management and regulation of the use of such resources.

Knowledge about the existing land use and trends of change is essential if the nation is to tackle the problems associated with the haphazard and uncontrolled growth. A systematic framework is needed for updating the land use and land cover maps that will be timely, relatively inexpensive and appropriate for different needs at national and state level. The rapidly developing technology of remote sensing offers an efficient and timely approach to

the mapping and collection of basic land use and land cover data over large area. The satellite imageries are potentially more amenable to digital processing because the remote sensor output can be obtained in digital format. Land use data are needed in the analysis of environmental processes and problems that must be understood if living conditions and standards are to be improved or maintained at current levels.

### **Basic Concepts of Land Use**

Clawson has given nine major ideas or concepts about land. These are:

- Location or the relation of a specific parcel of land to the poles, the equator, and the major oceans and landmasses. There is also relationship between various tracts of land, as well as a political location.
  - Activity on the land, for what purpose this piece of land or tract is used.
  - Natural qualities of land, including its surface and subsurface characteristics and its vegetative cover.
  - Improvements to and on the land. This is closely related to the activity.
  - Intensity of land use or amount of activity per unit area.
  - Land tenure, i.e. who owns the land, which uses it.
  - Land prices, land market activity and credit as applied to land.
  - Interrelations between activities on the land and other economic and social activities.
  - Interrelations in the use between different tracts of land.

### **METHODOLOGY FOR LAND USE / LAND COVER MAPPING**

The land use/land cover map is prepared by adopting the interpretation techniques of the image in conjunction with collateral data such as Survey of India topographical maps and census records. Image classification can be done by using visual interpretation techniques and digital classification using any of the image processing software. For the present study, ERDAS 9.1 version software is used for preprocessing, rectification, enhancements and classifying the satellite data for preparation of land use land cover map for assessing and monitoring the temporal changes in land use land cover and land developmental activities.

The imagery is interpreted and ground checked for corrections. The final map is prepared after field check. Flow chart showing the methodology adopted is given in the different land

use / land cover categories in the study area has been carried out based on the NRSC land use / land cover classification system.

For analysis and interpretation, and preparation of LU/LC map, two types of data are needed:

1. Basic data
2. Ground data

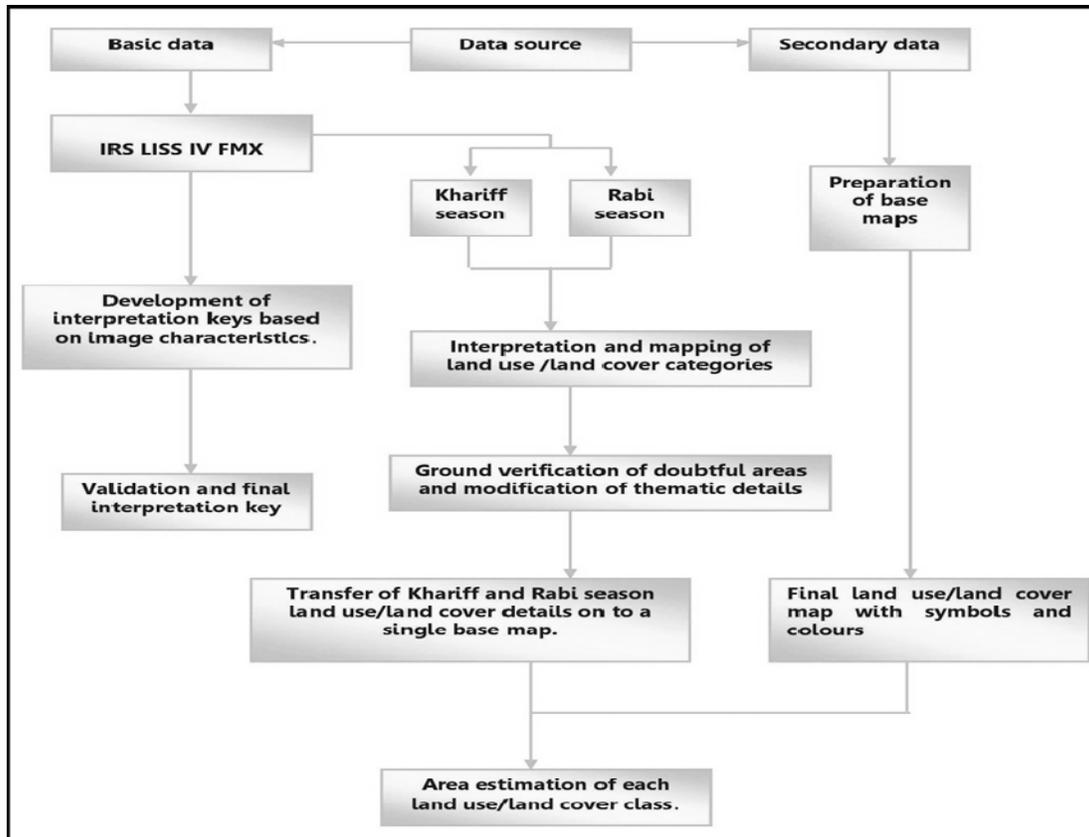
**Basic data includes:**

- Fused data of LISS III
- Toposheets on 1 : 50,000
- Local knowledge
- Area map on any scale to transfer details
- Reports and other literature of the study area

**Ground data:** Ground data is very much essential to verify and to increase the accuracy of the interpreted classes and also to minimize the field work.

**Data analysis:** For analysis and interpretation of satellite data, the study can be divided into three parts:

- A. Preliminary work
- B. Field work
- C. Post field work



**FIGURE 3-2 METHODOLOGY ADOPTED FOR LAND USE CLASSIFICATION AND MAPPING**

### 3.5.2 RESULTS

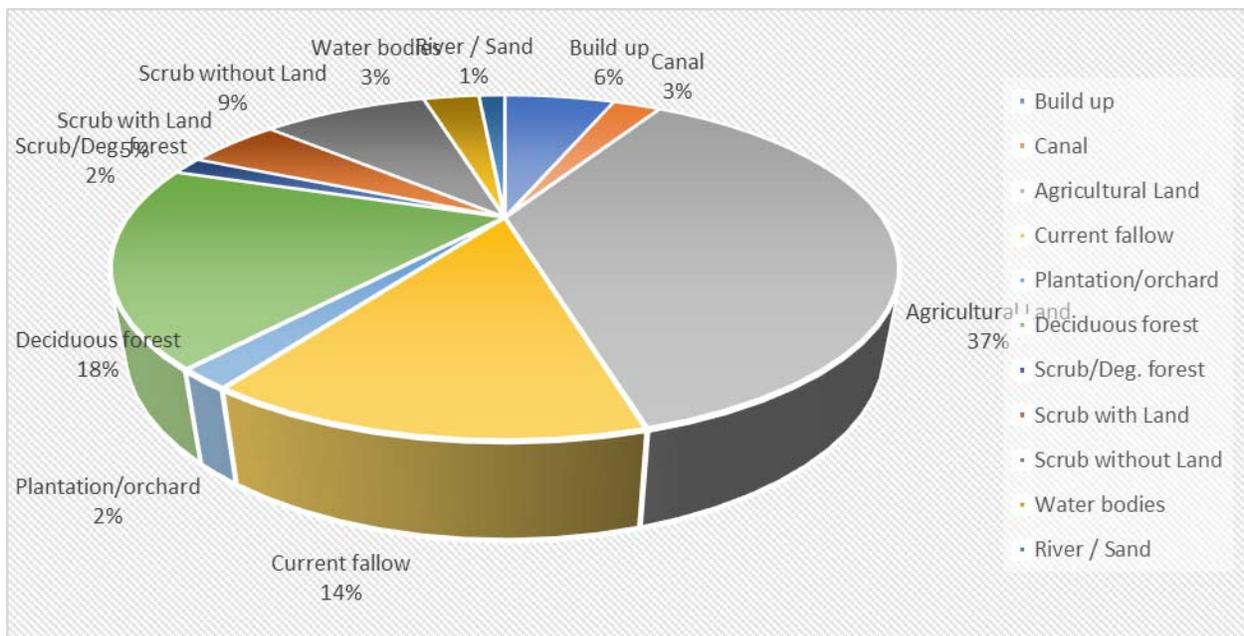
In the present study, both digital image processing and using visual interpretation technique were used to generate output of Land use cover map of study area. A land use/land cover details of the study area is shown in **Figure- 3.4**. A land use pattern of the study area (10 km from the project site) is shown in **Figure- 3.5** standard False Colour Composite (FCC) image has also been generated on the same scale and is shown in **Figure- 3.4**. The land use pattern of the study area is given in **Table 3.6**.

**TABLE 3-6 LAND USE (AREA & PERCENTAGE) PATTERN OF 10KM AREA**

S No	Description	Area_Ha	%
1	Build up	2011	5.964527
2	Canal	874	2.592241
3	Agricultural Land	12501	37.07735
4	Current fallow	4710	13.96963

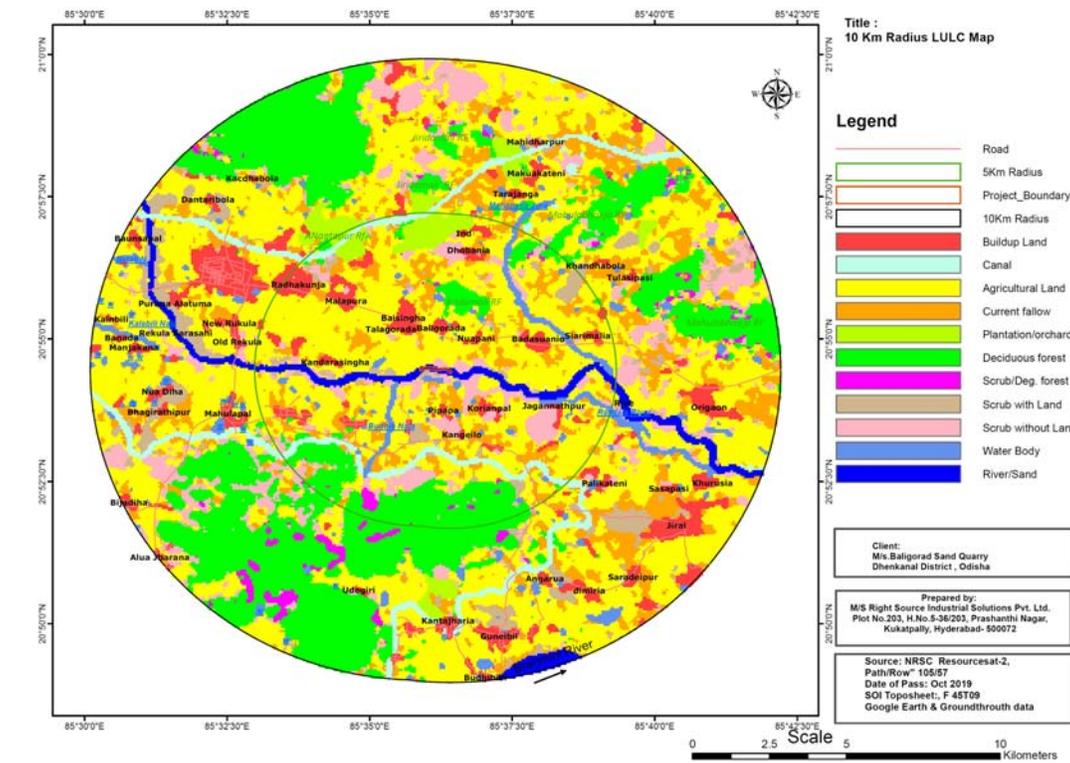
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5	Plantation/orchard	621	1.841855
6	Deciduous forest	6268	18.59058
7	Scrub/Deg. forest	569	1.687626
8	Scrub with Land	1663	4.932376
9	Scrub without Land	3001	8.900819
10	Water bodies	1019	3.022304
11	River / Sand	479	1.42069
Total Area		33716	100

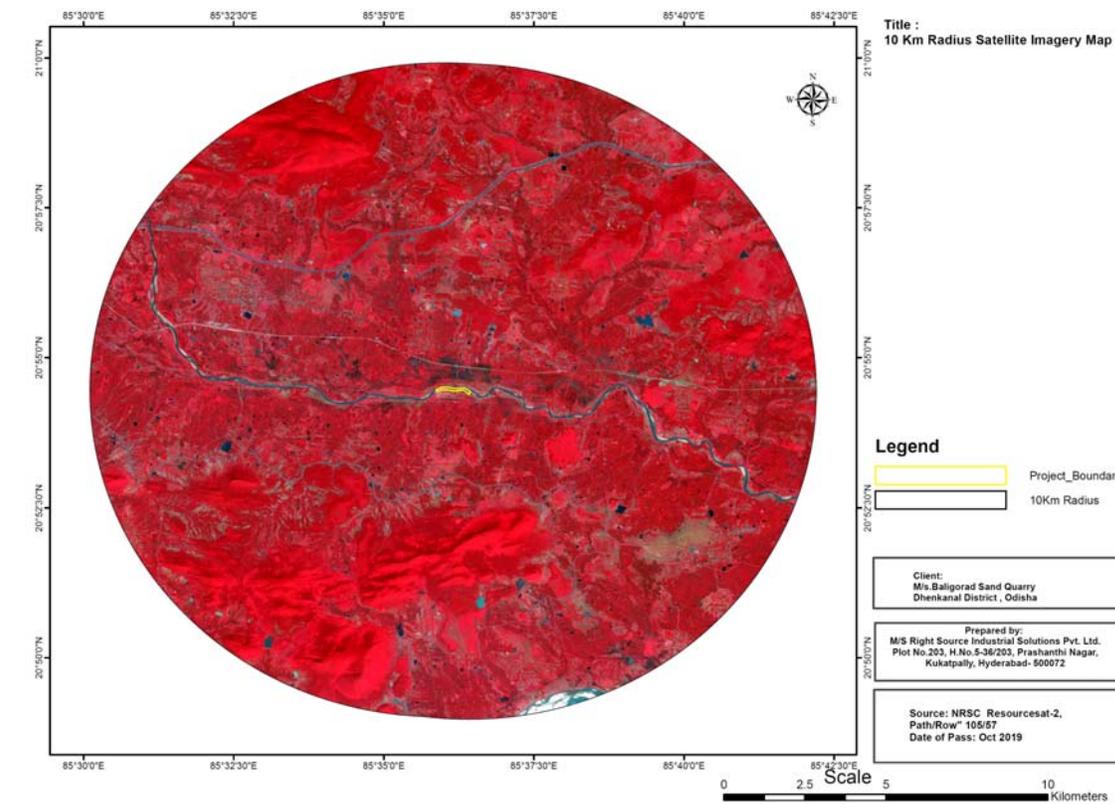


**FIGURE 3-3 LAND USE /LAND COVER (IN PERCENTAGE) PATTERN OF 10KM STUDY AREA DIAGRAM**

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**FIGURE 3-4 LAND USE /LAND COVER PATTERN IMAGE OF 10 KM RADIUS OF AREA**



**FIGURE 3-5 SATELLITE IMAGERY OF 10KM STUDY AREA**

### **3.6 HYDRO GEOLOGY**

The geological set-up of the area, to a large extent, governs the occurrence as well as the movement of groundwater in the district. The major part of the district is underlain by hard crystalline rocks and is devoid of any primary porosity and hence when weathered and fractured, secondary porosity is developed. The semi-consolidated Gondwana sandstone forms moderately good aquifer, when weathered and fractured. The recent alluvium, which occurs in limited patches, sustains very good yield. Since major part of the district is underlain by hard rocks of diverse lithological compositions and structures, the water-bearing properties of the formations vary widely. Hydrogeological surveys reveal the lithological characteristics and the role of the tectonic deformation thus resulting deep-seated intersecting fractures, on the occurrence and distribution of groundwater reservoirs and their water-bearing as well as water-yielding properties. The lineaments formed due to tensile deformations have been picked up from the Remote Sensing Studies. Groundwater occurs under water table condition in recent alluvium as well as in the semi-consolidated formations whereas in the deeper fractured rocks, the groundwater occurs under semi-confined to confined condition. Depending on the different aquifer systems and their parameters in different lithounits, the major hydrogeological units in the state can be divided into three categories: i) Consolidated formations, ii) Semi-consolidated formations and iii) Un-consolidated formations.

#### **Water-bearing properties of the Consolidated Formations**

The crystalline rocks like granite, granite gneiss, khondalite etc that comprise most part of the district is devoid of any primary porosity. But the process of weathering and fracturing imparts secondary porosity in these rocks, permitting storage and transmission of groundwater. The thickness of the weathered zone is usually more in the topographic lows and undulating plains than in the highland areas. Groundwater occurs under water table condition in the weathered zone and under semi-confined to confined condition in the deeper fractured zones. The wateryielding capacity of the fractured rocks largely depends on the degree of fracturing, their horizontal extent as well as their interconnection.

### **Aquifer System and Aquifer Parameters of the Different Litho-units**

**Granite and Granite Gneiss:** Major parts in the district are occupied by the granite, granite gneiss that are highly weathered and fractured. The thickness of the weathered zone varies from 5m to 20 m, which form the repository of groundwater at shallow depth. Groundwater occurs under phreatic condition in this zone and can be developed through dug wells. The depth of dug wells varies from 4.5 m to 14.0 m and the water level varies from 1.26 to 13.70 m below ground level during premonsoon and from 0.60 to 13.43 m below ground level during post-monsoon period. The deep bore wells yield up to 12.0 litre per second depending upon the topographic setting, proximity to major lineaments, thickness of weathered zone and number as well as potential of saturated fracture zones. The result of shallow deposit wells constructed by CGWB in this district indicates that weathered as well as semi-weathered granite gneiss form moderately potential aquifer.

**Khondalite:** These rocks are restricted to higher elevations forming steep linear ridges and hence groundwater potential is limited although foliated nature of the rock facilitates deep weathering. In pediment areas, the thickness of the weathering varies widely. The average depth of dug wells is about 10 m. The water level varies from 7.0 to 8.0 m below ground level during pre-monsoon and from 3.0 to 6.0 m below ground level during post-monsoon period.

### **Water-bearing Properties of the Semi-consolidated Formations**

These are represented by rocks of Gondwana formation, which have faulted contact with the Pre-Cambrian rocks. It consists mainly of sandstone and shale. The friable and loosely cemented sandstone forms the aquifer. Ground water occurs in phreatic condition in the weathered zone and semi-confined to confined condition in deeper fractured and friable sandstone beds. The aquifer in these formations may sustain limited to moderate yield. Auto-flowing condition has been encountered at Kumuda. The average depth of dug wells in these formations range from 7.40 to 8.60 m below ground level. The depth of wells drilled by CGWB varies from 28.24 m (Kusponga) to 289.0 m (Kumuda) and the yield ranges from 0.50 to 12.0 litres per second.

### **Water-bearing Properties of the Un-consolidated Formations**

Laterites and alluvium of Sub-Recent to Recent age constitute the unconsolidated formations which occur as thin, discontinuous patches adjoining the rivers. Laterites occur as capping over the older formations and tapped through dug wells. The depth to water level ranges from 3.34 to 10.12 m below ground level during pre-monsoon and from 0.97 to 6.87 m below ground level during postmonsoon period. The thickness of alluvium is about 25 m and form shallow potential aquifer. The aquifer sustains moderate yield. Recent alluvium occurs in thin, discontinuous patches as valley fills and also along the course of major rivers and streams.

### **Aquifer Characteristics of Crystalline Rocks**

In the hard crystalline rocks, the recharge of ground water from precipitation or seepage from surface water bodies percolate into the weathered and semiweathered (Saprolite) zone. The presence of fractures in the basement rock, which opens up to the overlain saprolite zone facilitates downward percolation and movement of the water, which can be tapped through dug wells in the weathered and semi-weathered zone and through bore wells in the deeper horizons. At places, confined condition gives rise auto flowing wells (Kumuda). The groundwater potential of various zones i.e. saprolite (tapped through dug wells), weathered basement rock and shallow fractured rocks (tapped mostly through hand pumps) and deeper fractured rock (tapped through deep bore wells) vary considerably depending upon their lithological and structural characteristics. By conducting pumping tests both in dug wells and in bore wells in different litho-units and by analysing the data adopting various methods, it has been concluded that granite gneiss forms the most potential aquifer followed by khondalites. Yield is poor in Gondwana sediments in deeper horizons whereas moderate yield can be obtained in the weathered zone. But the un-consolidated alluvium forms the most prolific aquifer.

### **Ground Water Exploration**

Exploratory drilling has been taken up CGWB in Dhenkanal district with an objective to delineate the nature and degree of connectivity of fractures and their yield potential down to a depth of 200 m. Till March 2011, 25 no. of bore wells have been constructed in the crystalline as wells as semi-consolidated formation in this district under normal and also

accelerated ground water exploration programmes. The depth range of these wells varies from 70 to 200 m and the yield of these wells varies from negligible to 5.9 lps. The yield range of these wells is given as under:

No. of wells	Depth ranges (m)	No. of wells with yield (lps)		
		<2	2 to 5	>5
25	38-202	15	6	4

Depth to Water Level (Pre-monsoon and Post- monsoon), 2011. The depth to water level is measured from the National Hydrograph Stations located in different blocks of Dhenkanal district. The pre-monsoon, 2011 water level data varies 3.34 to 10.99 meter below ground level. The post monsoon, 2011 water level data varies 1.08 to 8.0 meter below ground level.

### **Seasonal Fluctuations**

The fluctuations in the depth to water level in 2011 shows rise in water level from 1.10 to 7.30 m in all the NHS wells.

### **Long Term Water Level Trend in last 10 years in Ground Water monitoring Wells**

The long-term trend in depth to water level in Dhenkanal district over the last 10 years period shows that i) a rise of 0.03 to 0.30 m in 68% of wells and 0.02 to 0.16 m fall in 32% of wells during the pre-monsoon period and ii) a rise of 0.03 to 0.30 m in 31% of wells and 0.02 to 0.58 m fall in 67% of wells during the post-monsoon period.

### **Ground Water Resources**

The groundwater resources of the district have been assessed adopting the methodology recommended by the Ground Water Estimation Committee (1997), constituted by the Govt. of India. The task was jointly carried out by the Central Ground Water Board and the Ground Water Survey & Investigation, Dept. of Water Resources, Govt. of Orissa. The block wise computation of ground water resources has been presented in the following table. The net annual replenishable ground water resources in the district has been computed as 44264 Ha m, out of which the Ground Water Draft for irrigation is 2745 Ha m. The ground water draft for irrigation is through dug wells and shallow tube wells. A large number of hand pumps, fitted in PHED bore wells and tube wells, also cater to the rural and urban

water supply needs. On the basis of the estimated ground water potentials, a detailed scheme for ground water development may be launched in the district. So far, ground water development in the district has been meagre and all the blocks fall under the safe category. The stage of ground water development varies from 13.55% to 39.55% in different blocks. The overall stage of ground water development of the district is 16.82%. Hence, there is ample scope for stepping up ground water development in the district.

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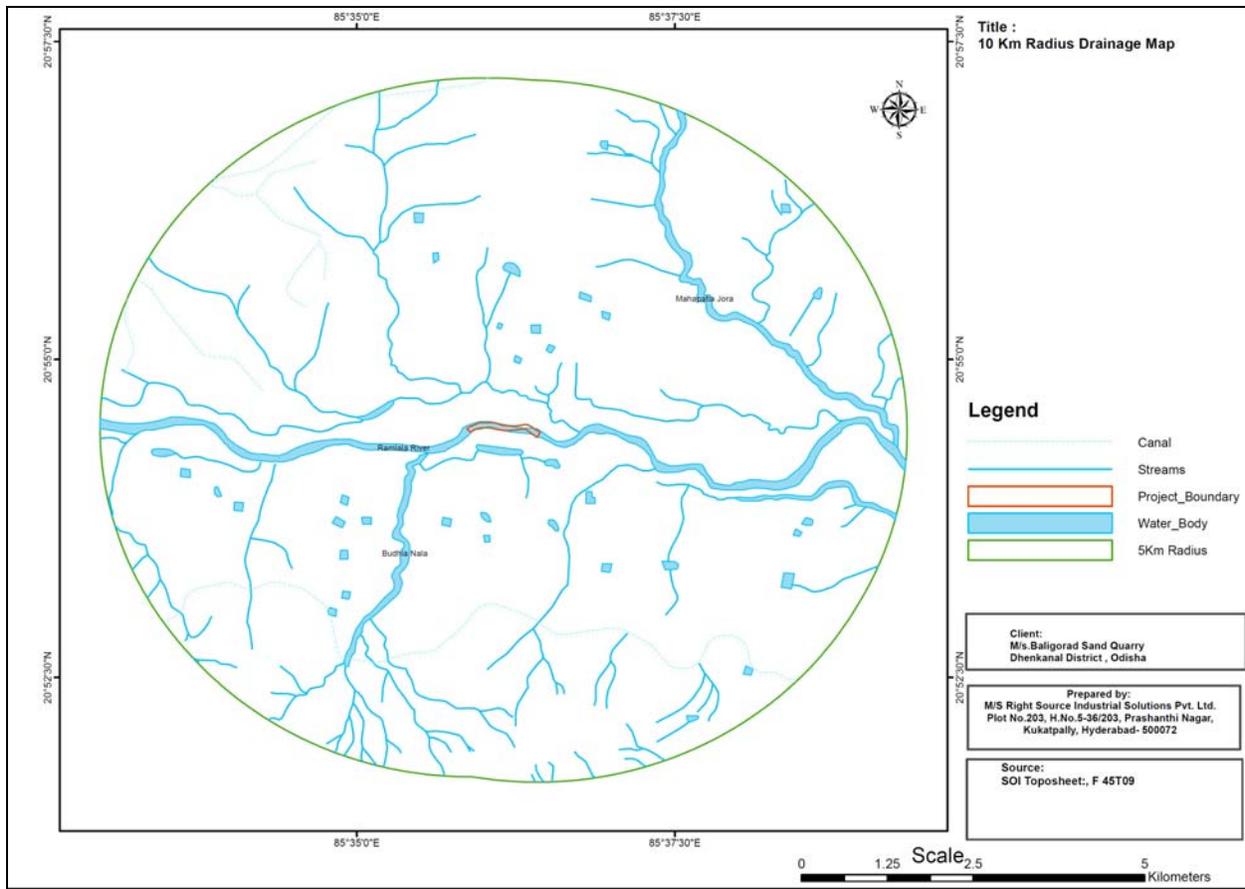
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**FIGURE 3-6 DRAINAGE MAP**

### **3.7 AIR QUALITY AND METEOROLOGY**

#### **Climate**

The climate of the area is characterized by a hot and dry summer from March to May, a south-west monsoon or rainy season from June to September, a pleasant post-monsoon or retreating monsoon from October to November and a cool winter from December to February. Therefore, climatologically, four seasons viz. summer (pre-monsoon), monsoon, post-monsoon and winter could be deciphered comprising the following months:

- Summer : March, April, May
- Monsoon : June, July, August, and September
- Post-monsoon : October and November
- Winter : December, January, and February

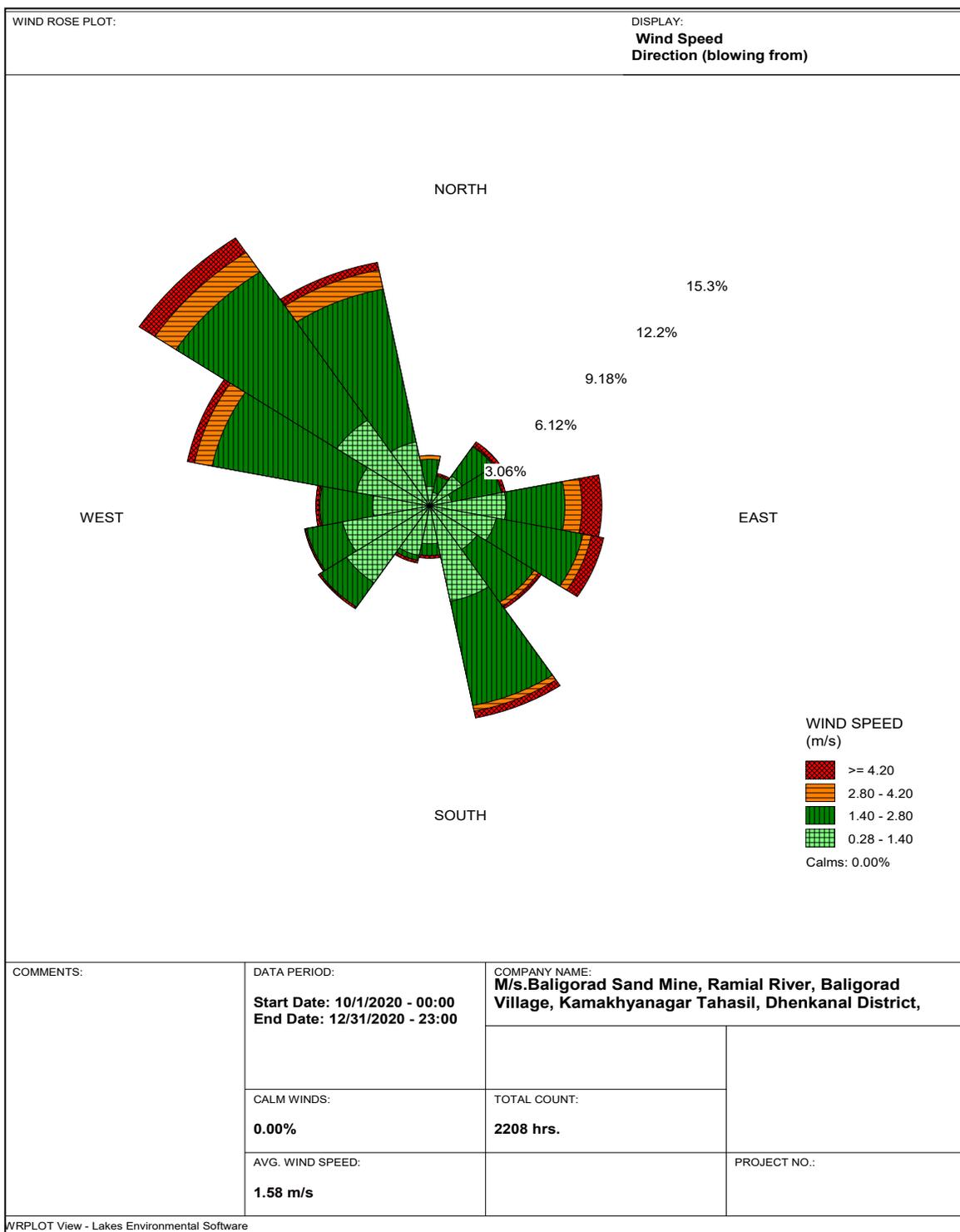
Air Pollutants upon discharge to atmosphere pass through a number of mechanisms, which include diffusion and transportation leading to dispersion. These mechanisms are governed by the local atmospheric conditions. All these result in the necessity to collect the meteorological parameters like ambient temperature, wind speed, wind direction, and other weather conditions (relative humidity, atmospheric pressure etc.), which will be ultimately used for the prediction of the ground level concentrations of the air pollutants through mathematical modeling.

For this purpose a temporary auto weather station was installed to record micro meteorological data on wind speed, wind direction, Ambient Temperature, Solar Insulation and Relative Humidity on hourly basis.

The primary data from the site was matched with secondary data of IMD station, for data proofing.

A sophisticated on-site meteorological observatory was established near project site and operated continuously for three months' period (October 2020 to December 2020). The observatory was located about 10 m above the ground level and ensured to be free from any obstruction to wind. Besides, this location was found to be most suitable one being close to the project site. The Wind rose diagram for the entire period is shown in **Figures 3.7**.

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**FIGURE 3-7 WIND ROSE (OCTOBER 2020 TO DECEMBER 2020)**

### **3.8 AMBIENT AIR ENVIRONMENT**

An assessment of the existing air quality is required to establish the reference level. To accomplish this, Ambient Air Quality Monitoring (AAQM) Stations were set up within 10 km radius of ongoing mining area. Data over baseline status of ambient air quality was generated with following objectives:

- Qualitative analysis of air environment of the area.
- Representation of regional back ground levels
- Influence of existing sources of pollution

The major contributors/sources of air pollution in the area are

- Vehicular traffic
- Windblown Dust

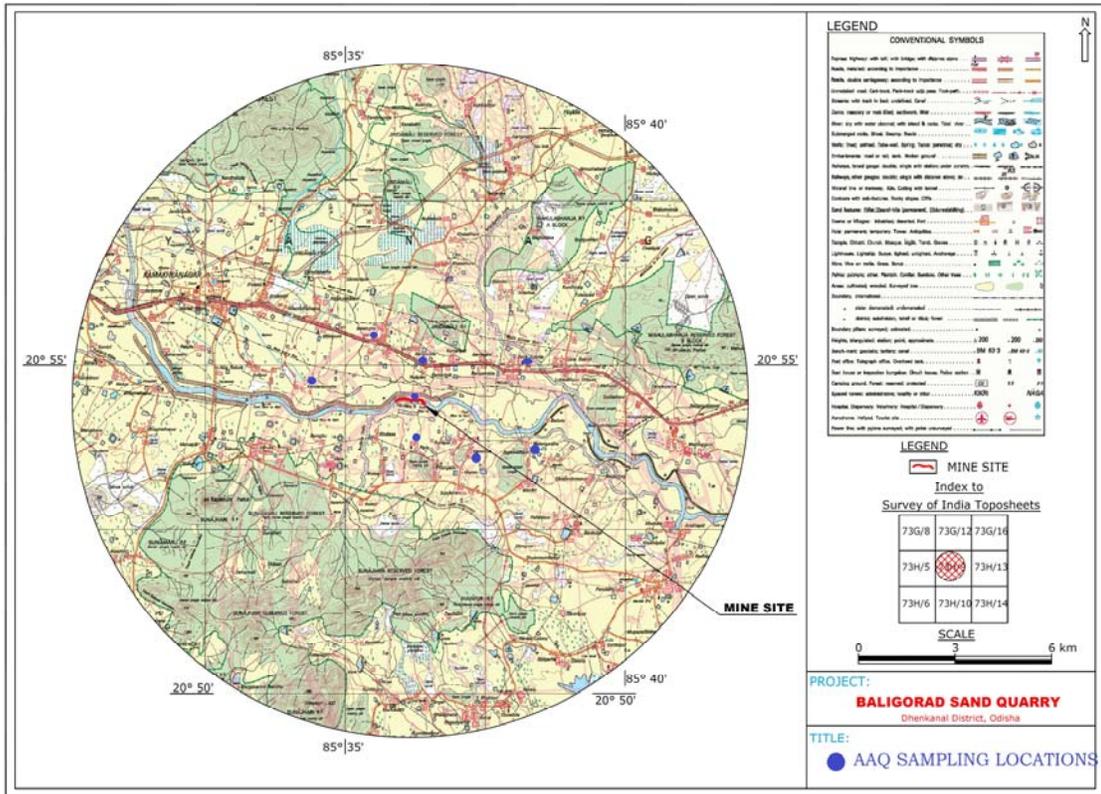
#### **Ambient Air Quality**

The ambient air quality monitoring was carried out at 8 locations. The location and descriptions of AAQM stations is shown in **Table 3.7 & Figure 3.7**. The parameters monitored during the study period were Particulate Matters (PM₁₀), Particulate Matter (PM_{2.5}), Sulphur dioxide (SO₂) and Oxides of nitrogen (NO_x). The results of AAQM are depicted in the **Table 3.8 to 3.11**.

**TABLE 3-7 AMBIENT AIR QUALITY MONITORING LOCATIONS**

<b>S.No.</b>	<b>Code</b>	<b>Sampling Locations</b>	<b>Distance</b>
1	A1	Mine site	-
2	A2	Baligorad	1.49 km ,N
3	A3	Kandarasingha	2.5 km ,W
4	A4	Baisingha	0.96 km NW
5	A5	Badasuanlo	1.6 km NE
6	A6	Kanchhie	1.2 km SE
7	A7	Malangadiha	1.9 km ESE
8	A8	Pipala	0.75 km S

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**FIGURE 3-8 AMBIENT AIR QUALITY MONITORING LOCATION MAP**

**TABLE 3-8 PARTICULATE MATTER - PM₁₀**

Location Name	Minimum	Maximum	Average	98th Percentile
Mine site	57.1	63.0	60.8	62.8
Baligorad	54.3	59.3	56.9	59.2
Kandarasingha	54.1	58.2	56.1	57.8
Baisingha	54.3	59.3	56.9	59.2
Badasuanlo	53.0	57.5	54.9	57.0
Kanchhie	53.0	56.3	54.8	56.3
Malangadiha	49.3	53.9	51.9	53.8
Pipala	51.2	55.5	53.6	55.5

**TABLE 3-9 PARTICULATE MATTER - PM_{2.5}**

Location Name	Minimum	Maximum	Average	98th Percentile
Mine site	22.8	25.2	24.3	25.1
Baligorad	21.7	23.7	22.7	23.7
Kandarasingha	21.6	23.3	22.5	23.1
Baisingha	21.7	23.7	22.7	23.7
Badasuanlo	21.2	23.0	22.0	22.8
Kanchhie	21.2	22.5	21.9	22.5
Malangadiha	23.7	28.8	26.4	28.7
Pipala	20.5	22.2	21.4	22.2

**TABLE 3-10 SULPHUR DIOXIDE - SO₂**

Location Name	Minimum	Maximum	Average	98th Percentile
Mine site	12.7	14.0	13.5	14.0
Baligorad	12.1	13.2	12.6	13.2
Kandarasingha	12.0	12.9	12.5	12.9
Baisingha	12.1	13.2	12.6	13.2
Badasuanlo	11.8	12.8	12.2	12.7
Kanchhie	11.8	12.5	12.2	12.5
Malangadiha	17.2	22.7	20.0	22.6
Pipala	11.4	12.3	11.9	12.3

**TABLE 3-11 OXIDES OF NITROGEN - NO_x**

Location Name	Minimum	Maximum	Average	98th Percentile
Mine site	20.1	21.4	20.9	21.4
Baligorad	19.5	20.6	20.0	20.6
Kandarasingha	19.4	20.3	19.9	20.3
Baisingha	19.5	20.6	20.0	20.6
Badasuanlo	19.2	20.2	19.6	20.1
Kanchhie	19.2	19.9	19.6	19.9
Malangadiha	22.5	28.2	25.4	28.1
Pipala	18.8	19.7	19.3	19.7

### Conclusion

The analysis of ambient air quality data for three months consequently indicates excellent ambient air conditions at site as well as around the site upstream as well as downstream. Particulate matter PM₁₀ as well as PM_{2.5} is within limits prescribed. SO₂ and NO_x levels are

well below the limits prescribed hence overall picture as far as ambient air is concerned is positive.

### **BASELINE SCENARIO**

#### **a) Particulate Matter (PM₁₀)**

Suspended particulate matter in general terms is the particulate matter in suspension in ambient air. It includes dust, smoke etc. In general, some of the important sources of suspended particulate matter are mines. The following sources of suspended particulate matter in the study area are identified:

- ✓ Emission due to vehicular movement
- ✓ Dust generation from ground or other mining operations

Particulate matter (PM₁₀) monitored in the study area showed 98th percentile values in the range of 53.8-62.8µg/m³. Highest value of 62.8µg/m³ was recorded at mine site.

The 24 hourly average values of PM₁₀ were compared with the National Ambient Air Quality Standards (NAAQS) and found that all sampling stations recorded in the study area are within the applicable limits i.e., 100 µg/m³ for SPM in rural areas.

#### **b) Sulfur Dioxide (SO₂)**

Sulfur dioxide gas is an inorganic gaseous pollutant. Sulfur dioxide emissions are expected to be emitted wherever combustion of any fuel containing sulfur takes place. The sulfur in the fuel will combine with oxygen to form sulfur dioxide. The following sources of sulfur dioxide in the study area are identified:

- ✓ Emissions from domestic/consumption of fuel (coal, diesel, etc.)
- ✓ Emissions from Machinery equipment's used for mining activity and local residents

Sulfur dioxide in atmosphere is significant because of its toxicity; sulfur dioxide is capable of producing illness and lung injury. Further it can combine with water (moisture) in the air to form toxic acid aerosols that can corrode metal surfaces, fabrics and the leaves of plants. Sulfur dioxide is an irritant to the eyes and respiratory system. Excessive exposure to sulfur dioxide can cause bronchial asthma and other breathing related diseases as it affects the lungs.

98th percentile values of Sulphur dioxide in the study area were in the range of 12.3-22.6µg/m³. Maximum value of Sulphur dioxide 22.6µg/m³ recorded at Malangadiha.

The 24 hourly average values of SO₂ were compared with the National Ambient Air Quality Standards (NAAQS) and it was found that all sampling stations recorded values are below the applicable limits 80 µg/m³ for rural areas.

### **c) Oxides of Nitrogen (NO_x)**

The important sources of oxides of Nitrogen are from utilities and auto exhaust due to vehicular movement in mine lease area. The following sources of oxides of nitrogen in the study area are identified.

- ✓ Emissions from field burning of coal.
- ✓ Emissions from vehicular movements in the study area.

Oxides of Nitrogen in the presence of sunlight will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NO_x has inherent ability to produce deleterious effects by themselves like toxicity. It causes asphyxiation when its concentration is great enough to reduce the normal oxygen supply from the air.

98th percentile value of Nitrogen dioxide in the study area was in the range of 19.7 - 28.1µg/m³. Maximum value of Nitrogen dioxide, was found 28.1µg/m³ at the Malangadiha.

The 24 hourly average values of NO_x were compared with the National Ambient Air Quality Standards (NAAQS) and it was found that all sampling stations recorded values are below the applicable limits 80 µg/m³ for rural areas.

## **3.9 NOISE ENVIRONMENT**

Noise survey has been conducted in the study area covering residential transportation commercial and calm zones. The main objective of noise monitoring in the study area is to establish the baseline noise level, which is needed for assessing impact of total noise which is expected to be generated in the proposed project activities. Noise is measured in terms of loudness of the sound. Sound is a form of energy that propagates through an elastic medium at a speed that is determined by the properties of that medium. Since loudness of sound is important to the effects of noise on people, dependence of loudness upon frequency must be taken into account in environmental noise assessments. Several methods have been developed by researchers using the frequency spectrum of sound arrive

at the loudness index or the given sound. For measuring the intensity of the sound “Sound level meter” is used which gives intensity of sound in terms of dB (A).

The basic step associated with impact assessment on the noise components of the environment involves identification and evaluation of the present noise status on the general population. Therefore noise level measurement was carried out at each ambient air quality station and also at site. The objectives of Noise environment studies are:

- To assess the ambient noise level in the study area.
- To characterize the noise pollution area.
- To predict the temporal changes in the ambient noise level of the area.

Noise pollution in the study area is associated with the Industrial activities, Vehicular traffic. To judge the ambient noise level of the area, noise levels were recorded at 8 locations in dB (A). The details of location are given in **Table 3.12**. Monitoring results of the Noise level recorded at 8 locations is given in **Table 3.12**.

**TABLE 3-12 LOCATION OF NOISE MONITORING STATIONS**

S.No	Code	Location
1	N1	Mine site
2	N2	Baligorad
3	N3	Kandarasingha
4	N4	Baisingha
5	N5	Badasuanlo
6	N6	Kanchhie
7	N7	Malangadiha
8	N8	Pipala

**TABLE 3-13 NOISE LEVELS DURING STUDY PERIOD**

Code	Location	Equivalent Noise Levels dB(A)	
		Day Equivalent (Ld)	Night Equivalent (Ln)
N1	Mine site	50.4	40.8
N2	Baligorad	52.4	41.2
N3	Kandarasingha	50.5	38.9
N4	Baisingha	52.4	41.2
N5	Badasuanlo	51.1	35.7
N6	Kanchhie	50.3	36.2
N7	Malangadiha	41.5	37.0
N8	Pipala	48.1	41.9

It is observed that the noise values obtained were within the prescribed Ambient Air Quality Standards with respect to Noise.

### **AMBIENT NOISE STANDARDS**

Ministry of Environment Forests & Climate Change (MoEF&CC) has notified the noise standards vide gazette notification dated February 14, 2000 for different zones under the Environment Protection Act (1986). These standards are given in **Table 3.14**.

**TABLE 3-14 NOISE STANDARDS IN RESPECT OF DIFFERENT ZONES**

Area Code	Category of Area	Noise dB (A) $L_{eq}$	
		Daytime*	Night time*
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

*Note:*

- 1. Daytime is from 6.00am to 10.00 pm and Nighttime is from 10.00 pm to 6.00 am.*
- 2. Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones*

### **NOISE LEVEL RESULTS**

The noise monitoring within the study area was recorded using sound level meter (Model No: SL 4030). Noise readings were taken at 8 different locations in the study area.

### **Conclusion**

The values of noise observed in some of the areas are primarily owing to vehicular traffic and other anthropogenic activities. Noise monitoring reveals that the Minimum & maximum noise levels at day time were recorded as 41.5 dB(A) & 52.4 dB(A) respectively. The minimum and maximum noise levels at night time were found to be 35.7 dB(A) & 41.9 dB(A) respectively. It is observed that the noise levels are well within the prescribed Ambient Air Quality Standards with respect to Noise.

### **3.10 WATER ENVIRONMENT**

Surface water and groundwater samples were collected from different sources within the study area and some important physical and chemical parameters were considered for depicting the baseline status of the study area.

### **WATER QUALITY ASSESSMENT**

Selected water quality parameters for water resource of the study area have been used for describing the water environment and assessing the impacts. About 8 ground water samples were collected in the study area to assess the water quality. Water samples are drawn from the hand pumps being used by the villagers for domestic needs.

### **GROUND WATER MONITORING METHODOLOGY**

To evaluate the physico-chemical characteristics of the water resources existing in the study area, water samples of ground water sources were collected during the post-monsoon season and characterized for physico-chemical parameters. These samples were taken as grab sample and were analyzed for various parameters and compared with standards IS: 10500. The locations of water sampling stations have been shown in **Table 3.15**

### **3.15**

**TABLE 3-15 GROUND WATER SAMPLING LOCATIONS IN THE STUDY AREA**

<b>S.No</b>	<b>Code</b>	<b>Location</b>	<b>Source</b>
1	GW1	Baligorad	Bore well Water
2	GW2	Kandarasingha	
3	GW3	Baisingha	
4	GW4	Badasuanlo	
5	GW5	Kanchhie	
6	GW6	Malangadiha	
7	GW7	Pipala	
8.	GW8	Khokasa	

The quality of ground water was studied by collecting 8 water samples from representative hand pump and tanks. The physico-chemical characteristics of ground water samples presented in **Table 3.16**.

**TABLE 3.16 GROUNDWATER QUALITY IN THE STUDY AREA**

S. No	Parameter	Method	Unit	Baligorad	Kandarasingh a	Badasuanlo	Baisingha	IS 10,500 Limits	
								Acceptable	Permissible
1	pH	APHA 23rd Edition 4500 H+ B	--	7.21	7.44	7.22	7.21	6.5-8.5	No Relaxation
2	Color	APHA 23rd Edition 2120 B	CU	<1.0	< 1.0	< 1.0	<1.0	5	15
3	Total Dissolved Solids	APHA 23rd Edition 2540 C	mg/l	795.0	565.8	675.0	795.0	500	2000
4	Total Alkalinity (as CaCO ₃ )	APHA 23rd Edition 2320 B	mg/l	300.0	280	270.0	300.0	200	600
5	Total Hardness (as CaCO ₃ )	APHA 23rd Edition 2340 C	mg/l	425.0	280	305.0	425.0	200	600
6	Calcium (as Ca )	APHA 23rd Edition 3500 Ca B	mg/l	125.435	50.24	80.02	125.435	75	200
7	Magnesium (as Mg)	APHA 23rd Edition 3500-Mg B	mg/l	25.40	36.45	25.0	25.40	30	100
8	Sulphate (as SO ₄ )	APHA 23rd Edition 4500 SO ₄ D	mg/l	32.6	24.64	80.0	32.6	200	400
9	Chloride (as Cl)	APHA 23rd Edition 4500 Cl- C	mg/l	170.5	94.76	121.9	170.5	250	1000
10	Lead as Pb	APHA 23rd Edition 3111B	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	0.01	No Relaxation
11	Cadmium as Cd	APHA 23rd Edition 3111B	mg/l	<0.001	< 0.001	< 0.001	<0.001	0.003	No Relaxation
12	Total Chromium as Cr	APHA 23rd Edition 3111B	mg/l	<0.05	< 0.05	< 0.05	<0.05	0.05	No Relaxation
13	Copper as Cu	APHA 23rd Edition 3111B	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	0.05	1.5
14	Zinc as Zn	APHA 23rd Edition 3111B	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	5	15
15	Nickel as Ni	APHA 23rd Edition 3111B	mg/l	<0.01	< 0.01	< 0.01	<0.01	0.02	No Relaxation
16	Fluorides as F	APHA 23rd Edition 4500 F- D	mg/l	<0.5	<0.5	1.0	<0.5	1	1.5
17	Aluminium as Al	APHA 23rd Edition 3500 Al B	mg/l	<0.03	< 0.03	< 0.03	<0.03	0.03	0.2
18	Boron as B	APHA 23rd Edition 4500 B B	mg/l	<0.2	<0.2	<0.2	<0.2	0.5	1
19	Manganese as Mn	APHA 23rd Edition 3111B	mg/l	<0.02	<0.02	<0.02	<0.02	0.1	0.3
20	Iron as Fe	APHA 23rd Edition 3500 Fe B	mg/l	<0.05	< 0.05	< 0.05	<0.05	0.3	No Relaxation
21	Nitrate Nitrogen	APHA 23rd Edition 4500 NO ₃ B	mg/l	5.8	5.12	4.41	5.8	45	No Relaxation
22	Sodium as Na	APHA 23rd Edition 3500 Na B	mg/l	154.5	82.14	118.0	154.5	--	--
23	Potassium as K	APHA 23rd Edition 3500 K B	mg/l	10.5	< 5.0	8.0	10.5	--	--
24	Odour	APHA 23rd Edition 2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	--	--
25	Electrical Conductivity	APHA 23rd Edition 2510 B	µmho/cm	1230.0	855	1010.0	1230.0	--	--
26	Phosphorus as P	APHA 23rd Edition 4500 P C	mg/l	1.25	<0.1	0.55	1.25	--	--

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**Table 3.16 GROUNDWATER QUALITY IN THE STUDY AREA**

S. No	Parameter	Method	Unit	Kanchhia	Malangadiha	Pipala	Khokasa	IS 10,500 Limits	
								Acceptable	Permissible
1	pH	APHA 23rd Edition 4500 H+ B	--	7.28	7.93	7.41	7.23	6.5-8.5	No Relaxation
2	Color	APHA 23rd Edition 2120 B	CU	< 1.0	<1.0	<1.0	<1.0	5	15
3	Total Dissolved Solids	APHA 23rd Edition 2540 C	mg/l	640.0	575.0	590.0	465.0	500	2000
4	Total Alkalinity (as CaCO ₃ )	APHA 23rd Edition 2320 B	mg/l	415.0	240	310.0	290.0	200	600
5	Total Hardness (as CaCO ₃ )	APHA 23rd Edition 2340 C	mg/l	440.0	235	325.0	300.0	200	600
6	Calcium (as Ca )	APHA 23rd Edition 3500 Ca B	mg/l	105.04	58.0	92.18	70.14	75	200
7	Magnesium (as Mg)	APHA 23rd Edition 3500-Mg B	mg/l	41.0	21.73	21.87	27.94	30	100
8	Sulphate (as SO ₄ )	APHA 23rd Edition 4500 SO ₄ D	mg/l	40.0	37.34	32.14	28.45	200	400
9	Chloride (as Cl)	APHA 23rd Edition 4500 Cl- C	mg/l	54.0	126.9	72.9	62.99	250	1000
10	Lead as Pb	APHA 23rd Edition 3111B	mg/l	<0.001	< 0.001	< 0.001	<0.001	0.01	No Relaxation
11	Cadmium as Cd	APHA 23rd Edition 3111B	mg/l	<0.001	< 0.001	<0.001	<0.001	0.003	No Relaxation
12	Total Chromium as Cr	APHA 23rd Edition 3111B	mg/l	<0.05	< 0.05	<0.05	<0.05	0.05	No Relaxation
13	Copper as Cu	APHA 23rd Edition 3111B	mg/l	<0.01	< 0.01	< 0.01	<0.01	0.05	1.5
14	Zinc as Zn	APHA 23rd Edition 3111B	mg/l	<0.5	< 0.5	< 0.5	<0.5	5	15
15	Nickel as Ni	APHA 23rd Edition 3111B	mg/l	<0.01	< 0.01	<0.01	<0.01	0.02	No Relaxation
16	Fluorides as F	APHA 23rd Edition 4500 F- D	mg/l	0.80	1.1	0.36	0.33	1	1.5
17	Aluminium as Al	APHA 23rd Edition 3500 Al B	mg/l	<0.03	< 0.03	<0.03	<0.03	0.03	0.2
18	Boron as B	APHA 23rd Edition 4500 B B	mg/l	<0.2	<0.2	<0.2	<0.2	0.5	1
19	Manganese as Mn	APHA 23rd Edition 3111B	mg/l	<0.02	< 0.02	<0.02	<0.02	0.1	0.3
20	Iron as Fe	APHA 23rd Edition 3500 Fe B	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	0.3	No Relaxation
21	Nitrate Nitrogen	APHA 23rd Edition 4500 NO ₃ B	mg/l	4.8	5.6	5.2	6.0	45	No Relaxation
22	Sodium as Na	APHA 23rd Edition 3500 Na B	mg/l	46.0	112.0	68.0	58.2	--	--
23	Potassium as K	APHA 23rd Edition 3500 K B	mg/l	6.0	< 5.0	< 5.0	<5.0	--	--
24	Odour	APHA 23rd Edition 2150 B	--	Agreeable	Agreeable	Agreeable	Agreeable	--	--
25	Electrical Conductivity	APHA 23rd Edition 2510 B	µmho/cm	1050.5	870.0	920.0	755.0	--	--
26	Phosphorus as P	APHA 23rd Edition 4500 P C	mg/l	0.17	0.52	0.11	0.15	--	--

### Observation of Ground Water

Ground water samples collected from four locations within 10 km radius of the proposed site showed all parameters well within the drinking water standards specified in IS 10500. So, all sites of water are suitable for drinking purposes.

### SURFACE WATER

The collected surface water samples were analyzed and results of surface water analysis are given in Table 3.17.

#### ✓ Physical Parameters

- **Colour:** The colour of surface water samples was found in the range of 2 Hazen unit to 3 Hazen unit.
- **Odour:** Surface water samples were found odourless.
- **Turbidity:** The turbidity of surface water samples was found in the range 2.1 to 2.8 NTU.
- **pH:** The pH value of all surface water samples ranges from 7.63 to 7.78.
- **Electrical Conductivity:** Electrical conductivity in surface water samples ranges from 242  $\mu\text{S}/\text{cm}$  to 280  $\mu\text{S}/\text{cm}$ .
- **Total Dissolved Solids (TDS):** The TDS in surface water samples range from 129 to 151 mg/l.

#### ✓ Chemical Parameters

- **Total Alkalinity:** The total alkalinity of surface water samples range between 50mg/l to 60 mg/l.
- **Total Hardness:** The total hardness of surface water samples range between 60 mg/l to 70 mg/l.
- **Calcium:** The Calcium content in surface water samples range from 17 mg/l to 20 mg/l.
- **Magnesium:** The Magnesium content in surface water samples range from 4.2 mg/l to 5.1 mg/l.
- **Chloride:** The chloride content in surface water samples range from 39 mg/l to 45 mg/l.
- **Sulphate:** Sulphate content in surface water sample ranges from 8 to 9 mg/l.

- **Nitrate:** Nitrate content in surface water samples ranges from 1 mg/l to 3 mg/l.
  - **Iron as Fe:** The iron content in all surface water sample ranges from 0.08 to 0.12 mg/l.
  - **Manganese as Mn:** The Manganese content in all surface water sample were BDL(<0.02 mg/l).
  - **Fluoride as F:** Fluoride content in surface water samples ranges from 0.26 mg/l to 0.31 mg/l.
  - **Sodium:** Sodium content in surface water samples ranges from 24 mg/l to 29 mg/l.
  - **Potassium:** Potassium content in surface water samples ranges from 1.6 mg/l to 2.7 mg/l.
  - **Zinc:** Zinc content in all surface water samples found to be 0.09 mg/l to 0.16 mg/l.
  - **Chemical Oxygen Demand (COD):** The COD level of the SW samples found to be in the range between 8 mg/l to 11 mg/l.
  - **Dissolved Oxygen (DO):** The DO level of the SW samples found to be in the range between 6.9 mg/l to 7.1 mg/l.
  - **Bio-chemical Oxygen Demand (BOD):** The BOD level of the SW samples found to be <2.0 mg/l.
- ✓ **Biological Parameters**
- **Total Coliform Count:** Total Coliform Count in surface water samples ranges from 33 to 60 MPN/ 100ml.
  - **Coli:** E. Coli in surface water samples ranges from 4 to 8 MPN/ 100ml.
- ✓ **Other Parameters :**Aluminum, Selenium, Phenolic Compounds, PCBs, PAH, Mineral oil, Pesticides and Cadmium, Mercury, Nickel, Total Arsenic, Total Chromium, Selenium, Cyanide in all surface water samples were found below detection limit (BDL).

The results of surface water samples were compared to CLASS – C category. Analysed parameters meet permissible limits.

**TABLE 3-17 RESULTS FOR SURFACE WATER ANALYSIS**

S.No	Parameters	Unit	Test method	SW1 Ramiala River (Kandarasingha Upstream)	SW2 Ramiala River (Mathkargola Downstream)	SW3 Ramiala River (Project Site)
1	Colour	Hazen	IS 3025 Part 4	2	3	2
2	Odour	-	IS 3025 Part 8	No Odour Observed	No Odour Observed	No Odour Observed
3	Turbidity	NTU	IS : 3025 Part 10-1984 (Reaff: 2017)	2.1	2.5	2.8
4	pH at 25°C	-	IS : 3025 Part 11- 1983 (Reaff:2017)	7.63	7.74	7.78
5	Electrical Conductivity,	µS/cm	IS : 3025 Part 10-1984 (Reaff: 2012)	262	242	280
6	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2017)	135	129	151
7	Total Hardness as CaCO ₃	mg/l	IS : 3025 Part 21-2009 (Reaff: 2019)	66	60	70
8	Total Alkalinity as CaCO ₃	mg/l	IS : 3025 Part 23- 1986(Reaff:2019)	54	50	60
9	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2019)	43	39	45
10	Sulphate as SO ₄	mg/l	APHA 23 rd EDN -4500- SO42- E	8	8	9
11	Fluoride as F	mg/l	APHA 23 rd EDN -4500-F B&D	0.31	0.26	0.29
12	Nitrate as NO ₃	mg/l	APHA 23 rd EDN -4500- NO3- B	3	1	2
13	Ammonia as NH ₃	mg/l	APHA 23 rd EDN -4500- NH3 B&C	0.09	0.05	0.10
14	Phosphate as PO ₄	mg/l	IS : 3025 Part 31-1988 (Reaff:2019)	0.02	0.01	0.04
15	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2019)	26	24	29
16	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2019)	2.2	1.6	2.7
17	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2019)	18	17	20
18	Magnesium as Mg	mg/l	APHA 23 rd EDN 3500 Mg B	5.1	4.2	4.8
19	Iron as Fe	mg/l	APHA 23 rd EDN -3111 B	0.12	0.1	0.08
20	Manganese as Mn	mg/l	APHA 22 nd EDN -3111 B	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
21	Phenolic compounds as Phenol	mg/l	APHA 22 nd EDN 5530 B,C	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)

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22	Copper as Cu	mg/l	APHA 23 rd EDN -3111 B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
23	Mercury as Hg	mg/l	APHA 23 rd EDN -3112B	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
24	Cadmium as Cd	mg/l	APHA 23 rd EDN -3111 B	BDL(<0.003)	BDL(<0.003)	BDL(<0.003)
25	Selenium as Se	mg/l	APHA 23 rd EDN -3113B	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
26	Total Arsenic as As	mg/l	APHA 23 rd EDN -3113 B	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
27	Cyanide as CN	mg/l	APHA 23 rd EDN -4500-CN E	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
28	Lead as Pb	mg/l	APHA 23 rd EDN -3111 B	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
29	Zinc as Zn	mg/l	APHA 23 rd EDN -3111 B	0.11	0.09	0.16
30	Total Chromium as Cr	mg/l	APHA 23 rd EDN -3111 B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
31	Nickel as Ni	mg/l	APHA 23 rd EDN -3111 B	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)
32	Aluminum as Al	mg/l	APHA 23 rd EDN -3500-Al-B	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
33	Total Suspended Solids	mg/l	IS : 3025 Part 17-1984 (Reaff: 2019)	5	7	5
34	Anionic Surfactants as MBAS	mg/l	APHA 23 rd EDN -5540 C	BDL(<0.025)	BDL(<0.025)	BDL(<0.025)
35	Dissolved Oxygen as O ₂	mg/l	IS:3025:Part-38:1989 (Reaff:2019)	6.9	7.1	7
36	Chemical Oxygen Demand	mg/l	IS:3025:Part-58:2006 (Reaff:2019)	11	10	8
37	Bio-Chemical Oxygen Demand at 27°C for 3 days	mg/l	IS:3025:Part-44:1993 (Reaff:2019)	<2	<2	<2
38	Oil and Grease	mg/l	IS:3025:Part-39:1991 -Reaff:2019)	<1	<1	<1
39	Total Coliforms	MPN/100ml	IS: 1622 -1981 (Reaff - 2014)	60	33	60
40	E coli	MPN/100ml	IS: 1622-1981(Reaff - 2014)	8	4	6

### **3.11 LAND ENVIRONMENT (SOIL CHARACTERISTICS)**

The present study on soil quality establishes the baseline characteristics in the study area surrounding the mining lease area. The study has been addressed with the following objectives.

- To determine the base line characteristics.
- To determine the soil characteristics of proposed project site.
- To determine the impact of industrialization/urbanization on soil characteristics.
- To determine the impacts on soils from agricultural productive point of view.

Soil samples were collected from 6 locations to assess the existing soil conditions representing various land use conditions and geological features and each these locations were identified randomly from where soil was collected from 30 cm below the surface. The samples were collected, labeled in the field with number and site name and sent to laboratory for analysis. The soil sampling locations are given in **Table 3.18**

**TABLE 3-18 SOIL SAMPLING LOCATIONS IN THE STUDY AREA**

<b>S.No</b>	<b>Code</b>	<b>Location</b>
1	S1	Baligorad
2	S2	Kandarasingha
3	S3	Badasuanla
4	S4	Malangadiha
5	S5	Kanchhie
6	S6	Pipala

Soil analysis was carried out and the results are given in Table 3.19

**TABLE 3-19 SOIL ANALYSIS RESULTS**

<b>S.No</b>	<b>Parameters</b>	<b>S1</b>	<b>S2</b>	<b>S3</b>	<b>S4</b>	<b>S5</b>	<b>S6</b>
1	pH (1:5 Soil Suspension)	7.52	7.68	7.23	7.56	7.82	7.41
2	Bulk Density, g/cc	1.36	1.34	1.47	1.51	1.39	1.45
3	Moisture Content, %	3.66	4.17	2.68	3.02	2.78	2.54
4	Electrical conductivity, mS/cm (1:5 Soil Suspension)	0.073	0.104	0.056	0.063	0.125	0.084
5	Total Nitrogen as N, kg/ha	278	251	214	207	341	284
6	Available Phosphorous as P, kg/ha	29.4	23.6	15.6	18	25.3	17.2
7	Available Potassium as K, kg/ha	281	312	214	198	242	274
8	Exchangeable Calcium as Ca, m.eq/100g	11.4	12	8.71	9.23	10.7	8.62
9	Exchangeable Magnesium as Mg, m.eq/100g	3.22	2.84	2.61	2.44	3.01	2.19
10	Exchangeable Sodium as Na, m.eq/100g	1.14	1.51	0.84	0.96	1.41	1.12
11	Organic matter (%)	1.04	0.75	0.61	0.78	1.11	0.92
12	Organic Carbon as C, %	0.60	0.43	0.35	0.45	0.64	0.53
13	Texture Classification	Loam	Loam	Sandy Loam	Sandy Loam	Loam	Sandy Loam
14	Sand (%)	45.2	43.6	65.8	60.1	40.4	62.4
15	Clay (%)	14.2	16	7.68	7.1	17.3	8.5
16	Silt (%)	40.6	40.4	26.52	32.8	42.3	29.1

*BDL - Below Detection Limit; DL – Detection Limit*

### **3.11.1 OBSERVATION**

- The pH values ranging from 7.23 to 7.82 indicating the moderate and ideal of plant growth properties.
- The texture of the soil sample is predominantly Sandy Loam in most of the places with Loam in some locations. The sand, silt and clay properties were found to be in the range of 40.4% to 65.8%, 26.52% to 42.3% and 7.1% to 17.3%.
- The conductivity of the soil ranges from 0.056 mS/cm to 0.125 mS/cm.
- The moisture content in the study locations ranged from 2.54% to 4.17%.
- The available nitrogen content ranges between 207 kg/Ha to 341 kg/Ha in the locality and the value of phosphorus content varies between 15.6 kg/Ha to 29.4 kg/Ha. This indicates that the soil has very high quantities of Nitrogen and Phosphorus.
- The potassium content varies from 198 kg/Ha to 312 kg/Ha, which indicates that the soils have medium levels of potassium.
- The organic carbon properties of the soil was found to be in the range of 0.35% to 0.64% and Organic Matter was found to be in the range of 0.61% to 1.11%.

From the above observations, it was found that the soil in the Study area shows moderate fertility and ideal for plant growth.

### **3.12 ECOLOGY AND BIODIVERSITY**

Ecological studies are one of the important aspects of Environmental Impact Assessment with a few conserve environment quality and biodiversity. Ecological systems show complex inter-relationships between biotic and abiotic components including dependence, competition and mutualism. Biotic components comprise of both plant and animal communities, which interact not only within and between themselves but also with the abiotic components viz. physical and chemical components of the environment.

Generally, biological aspects of ecosystems are important in Environment Impact Assessment for safely of natural flora and fauna. The biological environment includes terrestrial and aquatic ecosystems.

The animal and plant communities co-exist in a well-organised manner. Their natural settings can get disturbed by any externally induced anthropological activities or by

naturally occurring calamities or disaster. So, once this setting is disturbed, it sometimes is either practically impossible or may take a longer time to come back to its original state. Hence changes in the status of flora and fauna are an elementary requirement of Environmental Impact Assessment studies. In view of the need for conservation of environmental quality and biodiversity. Information on flora and fauna was collected within study area.

### **3.12.1 OBJECTIVES OF ECOLOGICAL STUDIES**

The objective of the present study was undertaken with a view to understand the present ecosystem on the following lines:

- To assess the distribution of vegetation in and around the proposed plant;
- To assess the distribution of animal life in the proposed plant areas as well as surrounding areas;
- To assess the biodiversity and to understand the resource potential; and
- To understand the nature of pollution and the impact on the ecosystem.

### **3.12.2 METHODOLOGY ADOPTED FOR THE STUDY**

To achieve above objectives a detailed study of the area was undertaken in 10 km radius area with the proposed project site as its centre. The different methods adopted were as follows;

- Compilation of secondary data with respect to the study area from published literature and government agencies;
- Generation of first hand data by undertaking systematic ecological studies in the area;
- Interrogating local people so as to elicit information for local plants, animals and their uses

The present report gives the review of published secondary data and the results of field sampling conducted during December 2020.

### 3.12.3 TERRESTRIAL ECOLOGY

#### 3.12.3.1 Study area

As per Champion & Seth Classification, Odisha state has 18 forest types belonging to four forest type groups, viz. Tropical Dry Deciduous Forests (Group 5), Tropical Moist Deciduous Forests (Group 3), Tropical Semi Evergreen Forests (Group 2) and Littoral & Swamp Forests (Group 4). Major forests are found mainly in the districts of Gajpati, Khandamal, Sambalpur and Deogarh. A total of 50,347 km² forest cover recorded in the State which is about 32.33% of the total state's geographical area.

Among the total forest area, most of the forest area in the district comes under Moderately Dense Forest category (1,350 km² ) followed by open forest and very dense forest.⁵ The ecological surveys were carried out based on various secondary sources (Forest Department Data, Scientific Studies etc.) which further validated from various primary surveys including consultation with local people. The biological studies were carried out in two zones: core zone (Within Project Area) and buffer zone (10 km surrounding the core area). As per the revised classification of Champion and Seth, the most of the area falls within the study area comes under Tropical Dry Deciduous forest.

#### 3.12.3.2 Forest blocks in study area

The details of forest blocks in study area are presented below in the Table 3.20. Small plantations agro forestry) could also be seen in the buffer zone of the project (*Leucaena leucocephala*, *Eucalyptus globulus*, *Tectona grandis*).

**TABLE 3-20 DETAILS OF THE FOREST BLOCKS IN THE STUDY AREA**

S.No	Details of forest blocks	Distance (Km)	Direction
1	Mahulabanja RF A-Block	4.1	NNE
2	Mahulabanja RF B-Block	6.3	ENE
3	Jirdamali RF	4.5	NW
4	Bhairipur RF	4.8	SSE

#### 3.12.4 CROPPING PATTERN

The agriculture is dependent on the moderate monsoon. Irrigation facilities in form of canals/ponds/wells are available in the study area. The main crop of the area is paddy. The area under major field crops and horticulture is given in Table 3.21.

**TABLE 3-21 AREA UNDER MAJOR FIELD CROP & HORTICULTURE IN DHENKANAL DISTRICT**

S.No.	Particulars
<b>Major field crop cultivated</b>	
1	Paddy
2	Horse gram
3	Green gram
4	Black gram
5	Groundnut
6	Mustard
<b>Horticulture crops - fruits</b>	
1	Mango
2	Citrus
3	Cashew
4	Coconut
5	Banana
<b>Horticulture crops - Vegetables</b>	
1	Potato
2	Onion
3	Sweet potato
4	Vegetables
<b>Medicinal and Aromatic crops</b>	
1	Garlic
2	Turmeric
3	Ginger
4	Coriander
<b>Plantation crops</b>	
1	Eucalyptus
2	Teak

### 3.12.5 METHODOLOGY

#### 3.12.5.1 Flora

A comprehensive list of the plant species of the study area was made based on the plant species collected during winter season by the survey teams. The species were further separated in to trees and shrubs (perennials), herbaceous species, medicinal and aquatic plants. These plants were identified with the help of Flora of Orissa (Saxena and Brahman 1994), Flora of the presidency of the Madras (Gamble and Fischer 1915-1936), and eFlorAs (2014). For the purpose of calculation of Importance Value Index (IVI), quadrat sampling and line intercept methods were used for estimation of frequency, density and cover. For determination of frequency and density of herbaceous species, a nested quadrat of 1 m x 1

m was used. A total of 20 quadrats from each sampling locations were taken at random. However, for calculating the frequency and density of different shrubs, 20 quadrats of 5m x 5 m were used. For determination of the frequency and density of different trees 20 quadrats of 20m x 20m were taken. Density was calculated as the number per m² in case of herbaceous plants and as number per hectare in case of trees and tree like plants.

The IVI values were calculated as the sum of relative frequency, relative density and relative dominance (dominance was based on cover). Frequency, density, abundance, IVI values and the indices of diversity of the plant species in the study area including the area of submergence were determined basing on standard ecological methods (Curtis and Mc Intosh, 1950) widely used in phytosociology as outlined hereunder:

$$\text{Frequency} = \frac{\text{Total number of quadrats in which a species occur}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Density} = \frac{\text{Total number of individuals of a species}}{\text{Total number of quadrats studied}} \times 100$$

$$\text{Abundance} = \frac{\text{Total number of individuals of the species occurring}}{\text{Total number of quadrats in which the species occur}} \times 100$$

$$\text{Relative frequency (RF)} = \frac{\text{Frequency of one species}}{\text{Sum of all frequencies}} \times 100$$

$$\text{Relative density (RD)} = \frac{\text{Number of individuals of a species}}{\text{Total number of individuals of all species}} \times 100$$

$$\text{Relative dominance (RDom)} = \frac{\text{Combined basal area of a single species}}{\text{Total basal area of all species}} \times 100$$

$$\text{Importance Value Index (IVI)} = \text{RF} + \text{RD} + \text{RDom}$$

Based on the IVI values, Shannon –Wiener Indices of Diversity and Simpson Index of dominance were calculated by using a computer programme called “PAST”. The data collected were also used to compute community indices like species diversity (H') of different tree species was calculated by using the Shannon- Weiner Index (Shannon and Weiner, 1963), as such:

$$H' = -\sum (ni/N) / n (ni/N),$$

Where, ni/N, which denotes the importance probability of each species in a population, ni= Importance of value of species and N is the total number of individuals of all species in that vegetation type. Species dominance (Cd) was calculated following Simpson (Simpson, 1949): Such that

$$Cd = \sum (ni/N)^2,$$

Where, ni and N are the same as those for Shannon-Weiner information function.

**TABLE 3-22 TERRESTRIAL AND AQUATIC SAMPLING LOCATIONS**

S.No.	Location	Latitude	Longitude
<b>Terrestrial Ecology</b>			
1	Badura	20°54'18.30"N	85°39'22.90"E
2	Arasahi	20°54'4.21"N	85°39'44.48"E
3	Mahulabanja RF	20°55'39.80"N	85°39'45.89"E
4	Mahulabanja RF	20°56'51.78"N	85°39'9.80"E
5	Bhairipur RF	20°52'11.88"N	85°37'23.42"E
6	Bhairipur RF	20°52'20.31"N	85°35'51.99"E
7	Baligorada	20°55'36.54"N	85°37'0.88"E
<b>Aquatic Ecology</b>			
1	Mine site	20°54'22.49"N	85°39'6.18"E
2	Downstream of Ramial river	20°53'42.31"N	85°39'29.45"E
3	Upstream of Ramial river	20°54'1.12"N	85°38'17.83"E

### **3.12.5.2 Fauna**

A linear transect of 1 km each was chosen for sampling at each site. Each transect was trekked for 1.5 hr for the sampling of faunal diversity through following methods for different categories. For the sampling of butterflies, the standard ‘Pollard walk’ method was employed and all the species that could not be identified in the field were collected using a butterfly net besides photographing them.

For bird's sampling 'point sampling' along the fixed transect (foot trails) was carried out. All the species of birds were observed through a binocular and identified with the help of field guide book and photographs.

For the sampling of mammals, direct count on open width (20m) transect was used. In addition, information on recent sightings/records of mammals by the villagers/locals was also collected. For carnivores, indirect sampling was carried out and the mammals were identified by foot marks, faeces and other marks/sign created by them. In case of reptiles mainly lizards were sampled by direct count on open width transects.

The study of fauna takes substantial amount of time to understand the specific faunal characteristics of area. The assessment of fauna has been done by extensive field survey of the area. During survey, the presence of wildlife was also inhabitants depending on animal sightings and frequency of their visits in the project area which was later confirmed from forest department, Wildlife department etc.

### **3.12.6 TERRESTRIAL ECOLOGY**

#### **Flora**

The core zone of the study area is mine lease area. As the core area is river bed which comprised *Saccharum officinarum* and some aquatic annuals. The species which are observed nearby lease area are *Ammania baccifera*, *Ludwigia perennis*, *Cyperus iria*, *Cyperus rotundus*, *Calotropis gigantea*, *Ageratum conyzoides*, *Cleome viscosa* and *Scirpus* sps. There are no tree species in the mine lease area.

The structure and composition of vegetation in the buffer zone was studied by visual observations during the site visit. The buffer zone of 10km radius area composed hilly area, Deciduous Sal forests, Plain agriculture fields, barren lands, plantations and human habitation. No parks and sanctuaries exist within 10 km of the lease area.

The vegetation found in the study area varies from hilly to plain area. In the hilly region, vegetation is generally observed in the hill top and foot hill. The species observed in the hilly area are *Shorea robusta*, *Anogeissus latifolia*, *Bauhinia racemosa*, *Schleichera oleosa* etc. The main agricultural crops in the study area are Rice, Maize, Vegetables, Mango and Cashew plantations. The tree species are observed along the agriculture and human habitations are *Mangifera indica*, *Anacardium occidentale*, *Delonix regia*, *Anogeissus*

*acuminata, Thespesia populnea* etc. The shrubs and herbs species are observed in the study area are *Chromolaena odrata, Lantana camara, Combretum ovalifolium, Hyptis sauveolens, Randia dumetorum, Sida acuta, Justicia procumbens, Borreria hispida* etc. A detailed list of floral species observed in the buffer zone is given in Table 3.23.

**TABLE 3-16 FLORA OBSERVED IN THE STUDY AREA**

S.No.	Scientific name	Family	Vernacular name	Habit
1	<i>Abrus precatorius</i>	Fabaceae		Climber
2	<i>Acacia ferruginea</i>	Mimosaceae	Garkari	Tree
3	<i>Acacia leucophloea</i>	Mimosaceae	Gohira	Tree
4	<i>Acacia nilotica</i>	Mimosaceae	babul	Tree
5	<i>Acacia sinuata</i>	Mimosaceae	Dantari	Climber
6	<i>Achyranthes aspera</i>	Amaranthaceae		Herb
7	<i>Achyranthes porphyristachya</i>	Amaranthaceae		Herb
8	<i>Aeginetia indica</i>	Orobanchaceae		Herb
9	<i>Aegle marmelos</i>	Rutaceae	Bel	Tree
10	<i>Aerva lanata</i>	Amaranthaceae		Herb
11	<i>Aganosma caryophyllata</i>	Apocyanaceae	Malati	Climber
12	<i>Ageratum conyzoides</i>	Asteraceae	Pokesunga	Herb
13	<i>Ailanthus excelsa</i>	Simarubaceae	Mahalimb, hahal	Tree
14	<i>Alangium salvifolium</i>	Alangiaceae	Ankulo	Tree
15	<i>Albizia chinensis</i>	Mimosaceae	Gharalanjia	Tree
16	<i>Albizia lebbeck</i>	Mimosaceae	Siris	Tree
17	<i>Albizia odoratissima</i>	Mimosaceae		Tree
18	<i>Alysicarpus monilifera</i>	Fabaceae		Herb

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19	<i>Ammania baccifera</i>	Lythraceae		Herb
20	<i>Andrographis paniculata</i>	Acanthaceae	Bhuineen (Chireita)	Herb
21	<i>Annona squamosa</i>	Annonaceae	Ata	Shrub
22	<i>Anogeissus acuminata</i>	Combretaceae	Phasi	Tree
23	<i>Anogeissus latifolia</i>	Combretaceae	Dhaura	Tree
24	<i>Anthocephalus chinensis</i>	Rubiaceae	Kadamba	Tree
25	<i>Antidesma acidum</i>	Euphorbiaceae	Mamuri	Tree
26	<i>Aphanamixis polystachya</i>	Meliaceae	Panikusum	Tree
27	<i>Apluda mutica</i>	Poaceae		Grass
28	<i>Ardisia solanacea</i>	Myrsinaceae	Narasingh Khara	Shrub
29	<i>Argemone mexicana</i>	Papaveraceae	Sarpuni	Herb
30	<i>Argyreia nervosa</i>	Convolvulaceae		Climber
31	<i>Argyreia setosa</i>	Convolvulaceae	Baghchaar	Climber
32	<i>Aristida funiculata</i>	Poaceae		Grass
33	<i>Artocarpus heterophyllus</i>	Moraceae	Panasa	Tree
34	<i>Artocarpus lacucha</i>	Moraceae	Jeutha	Tree
35	<i>Arundo donax</i>	Poaceae		Grass
36	<i>Arundo sectosa</i>	Poaceae		Grass
37	<i>Asparagus racemosus</i>	Liliaceae	Satabari	Climber
38	<i>Atalantia monophylla</i>	Rutaceae	Narguni	Shrub
39	<i>Atylosia scaraboides</i>	Fabaceae	Banakolthi	Herb
40	<i>Azadirachta indica</i>	Meliaceae	Neem	Tree

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41	<i>Bambusa arundinacea</i>	Poaceae	Kanta bans	Shrub
42	<i>Barringtonia acutangula</i>	Barringtoniaceae	Hinjal	Tree
43	<i>Bauhinia racemosa</i>	Caesalpiniaceae		Tree
44	<i>Bauhinia vahlii</i>	Caesalpiniaceae	Siall	Climber
45	<i>Biophytum sensitivum</i>	Oxalidaceae		Herb
46	<i>Boerhavia diffusa</i>	Nyctaginaceae		Herb
47	<i>Bombax ceiba</i>	Bomabacaceae	Simili	Tree
48	<i>Borreria hispida</i>	Rubiaceae		Herb
49	<i>Boswellia serrata</i>	Burseraceae	Salai	Tree
50	<i>Brachiaria ramosa</i>	Poaceae		Grass
51	<i>Breynia vitis-idea</i>	Euphorbiaceae		Shrub
52	<i>Bridelia retusa</i>	Euphorbiaceae		Tree
53	<i>Bridelia squamosa</i>	Euphorbiaceae	Kasi	Tree
54	<i>Buchanania lanzan</i>	Anacardiaceae	Char	Tree
55	<i>Bulbostylis barbata</i>	Cyperaceae		Sedge
56	<i>Bursera serrata</i>	Burseraceae	Nimburumoi	Tree
57	<i>Butea monosperma</i>	Leguminosae	Palas	Tree
58	<i>Butea superba</i>	Fabaceae	Budli	Climber
59	<i>Crotalaria pallida</i>	Fabaceae	Jhunjhuka	Herb
60	<i>Calamus rotang</i>	Palmaceae	Kanta bet	Climber
61	<i>Calamus viminalis</i>	Palmaceae	pani bet	Climber
62	<i>Calotropis gigantea</i>	Asclepiadaceae	Arrkha	Shrub
63	<i>Calycopteris floribunda</i>	Combretaceae	Khukundia	Climber

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64	<i>Canavalia gladiata</i>	Fabaceae	Maharata	Climber
65	<i>Canscora decussata</i>	Gentianaceae	Kalmegh	Herb
66	<i>Canthium dicoccum</i>	Rubiaceae	Dalsingha	Shrub
67	<i>Canthium parviflorum</i>	Rubiaceae		Shrub
68	<i>Capparis zeylanica</i>	Capparidaceae	Asadhua	Climber
69	<i>Cardiospermum halicacabum</i>	Sapindaceae		Climber
70	<i>Careya arborea</i>	Lecythidaceae	Kumbhi	Tree
71	<i>Carissa carandas</i>	Apocynaceae		Shrub
72	<i>Carissa spinarum</i>	Apocynaceae	Ankhukoli	Shrub
73	<i>Caryota urens</i>	Arecaceae	Salapa	Tree
74	<i>Casearia elliptica</i>	Flacourtiaceae	Khakada	Tree
75	<i>Cassia auriculata</i>	Caesalpiniaceae		Shrub
76	<i>Cassia fistula</i>	Caesalpiniaceae	Sunari	Tree
77	<i>Cassia florida</i>	Caesalpiniaceae	Chakunda	Tree
78	<i>Cassia obtusifolia</i>	Caesalpiniaceae	Bhul Chakunda	Herb
79	<i>Cassia occidentalis</i>	Caesalpiniaceae		Herb
80	<i>Cassine glauca</i>	Verbenaceae	Chauli	Tree
81	<i>Catunaregam malabarica</i>	Rubiaceae	Phiriko	Shrub
82	<i>Catunaregam nutans</i>	Rubiaceae	Salara	Tree
83	<i>Catunaregam uliginosa</i>	Rubiaceae	Tolko	Shrub
84	<i>Ceiba pentandra</i>	Bomabacaceae		Tree
85	<i>Celastrus paniculatus</i>	Celastraceae	Pingo, Pengu	Climber
86	<i>Celosia argentea</i>	Amaranthaceae		Herb

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87	<i>Centella asiatica</i>	Apiaceae	Brahmi buti	Herb
88	<i>Cephalostachyum pergracile</i>	Poaceae	Bolongi bans	Tree
89	<i>Chloris barbata</i>	Poaceae		Grass
90	<i>Chloroxylon swietenia</i>	Flindersiaceae	Bheru	Tree
91	<i>Chromolaena odorata</i>	Asteraceae		Shrub
92	<i>Chrysopogon grylius</i>	Poaceae		Grass
93	<i>Cipadessa baccifera</i>	Meliaceae	Nalwali	Shrub
94	<i>Cissampelos pareira</i>	Menispermaceae	Akanbindu	Climber
95	<i>Cleistanthus collinus</i>	Euphorbiaceae	Karia	Tree
96	<i>Cleome gynandra</i>	Cleomaceae		Herb
97	<i>Clerodendrum viscosum</i>	Verbenaceae	Kumti	Shrub
98	<i>Clitoria ternatea</i>	Fabaceae		Climber
99	<i>Coccinia grandis</i>	Cucurbitaceae		Climber
100	<i>Cocculus hirsutus</i>	Menispermaceae		Climber
101	<i>Cochlospermum religiosum</i>	Cochlospermaceae	Genduli	Tree
102	<i>Combretum roxburghii</i>	Combretaceae	Atundi	Climber
103	<i>Commelina benghalensis</i>	Commelinaceae		Herb
104	<i>Corchorus acutangulus</i>	Tiliaceae		Herb
105	<i>Costus speciosus</i>	Costaceae		Herb
106	<i>Crateva religiosa</i>	Capparidaceae	baurna	Tree
107	<i>Crotalaria laburnifolia</i>	Fabaceae		Herb
108	<i>Crotalaria verrucosa</i>	Fabaceae		Herb
109	<i>Croton bonplandianum</i>	Euphorbiaceae		Herb

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110	<i>Cryptolepis buchanani</i>	Asclepiadaceae	Gopkan	Climber
111	<i>Curcuma sulcata</i>	Zingiberaceae		Herb
112	<i>Cyanotis cristata</i>	Commelinaceae		Herb
113	<i>Cycas circinalis</i>	Cycadaceae	Urguna	Shrub
114	<i>Cymbopogon martinii</i>	Poaceae	Dhanwantary	Grass
115	<i>Cynodon dactylon</i>	Poaceae	Duba	Grass
116	<i>Cyperus compressus</i>	Cyperaceae		Sedge
117	<i>Cyperus rotandus</i>	Cyperaceae		Sedge
118	<i>Dactyloctenium aegyptium</i>	Poaceae		Grass
119	<i>Dalbergia latifolia</i>	Leguminosae	Sissu	Tree
120	<i>Dalbergia paniculata</i>	Leguminosae	barbakulia	Tree
121	<i>Datura metal</i>	Solanaceae		Herb
122	<i>Dendrocalamus strictus</i>	Poaceae	Salia	Tree
123	<i>Dendronbium aphyllum</i>	Orchidaceae		Herb
124	<i>Denrothoe falcata</i>	Loranthaceae		Tree
125	<i>Pongamia paniculata</i>	Leguminosae	Karanja	Tree
126	<i>Desmodium gangeticum</i>	Fabaceae		Herb
127	<i>Desmodium triflorum</i>	Fabaceae		Herb
128	<i>Dicanthium annulatum</i>	Poaceae		Grass
129	<i>Digera muricata</i>	Amaranthaceae		Herb
130	<i>Dillenia aurea</i>	Dilleniaceae	Chotarai	Tree
131	<i>Dillenia pentagyna</i>	Dilleniaceae	Ral	Tree
132	<i>Dioscorea alata</i>	Dioscoreaceae	Khamba Alu	Climber

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133	<i>Dioscorea anguina</i>	Dioscoreaceae	Kossa Alu	Climber
134	<i>Dioscorea belophylla</i>	Dioscoreaceae	Kanta Alu	Climber
135	<i>Dioscorea bulbifera</i>	Dioscoreaceae	Pata Alu	Climber
136	<i>Dioscorea oppositifolia</i>	Dioscoreaceae	Pani Alu	Climber
137	<i>Dioscorea pentaphylla</i>	Dioscoreaceae	Karba Alu	Climber
138	<i>Dioscorea tomentosa</i>	Dioscoreaceae	Bana Alu	Climber
139	<i>Diospyros chloroxylon</i>	Ebenaceae	Karakendu	Tree
140	<i>Diospyros ferrea</i>	Ebenaceae	Guakuli	Shrub
141	<i>Diospyros malabarica</i>	Ebenaceae	Makharkendu	Tree
142	<i>Diospyros melanoxylon</i>	Ebenaceae	Kendu	Tree
143	<i>Diospyros montana</i>	Ebenaceae	Halda	Tree
144	<i>Diospyros sylvatica</i>	Ebenaceae	Kauchia	Tree
145	<i>Diptrocanthus prostratus</i>	Acanthaceae		Herb
146	<i>Drimia indica</i>	Hyacinthaceae		Herb
147	<i>Drypetes roxburghii</i>	Euphorbiaceae	Poichandia	Tree
148	<i>Eclipta prostrata</i>	Asteraceae		Herb
149	<i>Ehretia laevis</i>	Boraginaceae	Dambalu	Tree
150	<i>Elephantopus scaber</i>	Asteraceae		Herb
151	<i>Emilia sonchifolia</i>	Asteraceae		Herb
152	<i>Entada pursaetha</i>	Mimosaceae	Nato	Climber
153	<i>Eragrostis coarctata</i>	Poaceae		Grass
154	<i>Eranthemum purpurascens</i>	Acanthaceae		Shrub
155	<i>Erythrina variegata</i>	Leguminosae	Paldhua	Tree

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156	<i>Eucalyptus globulus</i>	Myrtaceae	Eucalyptus (patas)	Tree
157	<i>Eulaliopsis binata</i>	Poaceae	Panasi	Grass
158	<i>Euphorbia antiquorum</i>	Euphorbiaceae		Herb
159	<i>Euphorbia hirta</i>	Euphorbiaceae		Herb
160	<i>Euphorbia nivulia</i>	Euphorbiaceae	Kantasidhu	Shrub
161	<i>Euphorbia royleana</i>	Euphorbiaceae	Sijhu	Tree
162	<i>Evovlulus alsinoides</i>	Convolvulaceae		Herb
163	<i>Evovlulus nummularius</i>	Convolvulaceae		Herb
164	<i>Ficus benghalensis</i>	Moraceae	Bara	Tree
165	<i>Ficus hispida</i>	Moraceae	Tambal	Tree
166	<i>Ficus lutescens</i>	Moraceae	Jari	Tree
167	<i>Ficus parasitica</i>	Moraceae	Kaskasi Jhari	Shrub
168	<i>Ficus racemosa</i>	Moraceae	Dimiri	Tree
169	<i>Ficus religiosa</i>	Moraceae	Aswasth	Tree
170	<i>Ficus semicordata</i>	Moraceae	Purhai	Tree
171	<i>Ficus virens</i>	Moraceae	Kuajari	Tree
172	<i>Fimbristylis cymosa</i>	Cyperaceae		Sedge
173	<i>Fioria vitifolia</i>	Malvaceae	Banachanda	Shrub
174	<i>Firmiana colorata</i>	Sterculiaceae	Panikodala	Tree
175	<i>Flacourtia indica</i>	Flacourtiaceae	Baincha	Shrub
176	<i>Gardenia gummifera</i>	Rubiaceae	Gurudu	Tree
177	<i>Gardenia latifolia</i>	Rubiaceae	Damgurudu	Tree

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178	<i>Gardenia turgida</i>	Rubiaceae	Karadha	Tree
179	<i>Garuga pinnata</i>	Burseraceae	Patimoi	Tree
180	<i>Gisekia pharnaceodis</i>	Aizoaceae		Herb
181	<i>Glochidion lanceolarium</i>	Euphorbiaceae	Chikni (Kalicha)	Tree
182	<i>Gloriosa superba</i>	Colchicaceae		Climber
183	<i>Glycosmis pentaphylla</i>	Rutaceae	Chaidhua	Tree
184	<i>Gmelina arborea</i>	Verbenaceae	Gambhari	Tree
185	<i>Gouania tiliaefolia</i>	Rhamnaceae	pichhuli	Climber
186	<i>Grevillea robusta</i>	Proteaceae	Silveroak	Tree
187	<i>Grewia elastica</i>	Tiliaceae	Mirigachara	Tree
188	<i>Grewia rothii</i>	Tiliaceae		Shrub
189	<i>Grewia tiliaefolia</i>	Tiliaceae	Dhaman	Tree
190	<i>Gymnema sylvestre</i>	Asclepiadaceae	Gulmari	Climber
191	<i>Gynura lycopersifolia</i>	Asteraceae		Herb
192	<i>Haldina cordifolia</i>	Rubiaceae	Kurum	Tree
193	<i>Hedyotis corymbosa</i>	Rubiaceae		Herb
194	<i>Helicteres isora</i>	Sterculiaceae	Muraphal Murimuri	Shrub
195	<i>Hemidesmus indicus</i>	Asclepiadaceae	Anantamula	Climber
196	<i>Heteropogon contortus</i>	Poaceae	Sinkula Guguchhia	Grass
197	<i>Hiptage benghalensis</i>	Melastomaceae	Latanageshwar	Climber
198	<i>Holarrhena antidysenterica</i>	Apocynaceae	Korei	Shrub
199	<i>Holoptelia integrifolia</i>	Ulmaceae	Dhauranjo	Tree

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200	<i>Homalium nepalense</i>	Samydaceae	Khakaa	Tree
201	<i>Hybanthus ennaespermus</i>	Violaceae		Herb
202	<i>Hymenodictyon excelsum</i>	Rubiaceae	Kanso	Tree
203	<i>Hyptis suaveolens</i>	Lamiaceae	Gongatulashi	Herb
204	<i>Ichnocarpus frutescens</i>	Apocynaceae	Suam Noi	Climber
205	<i>Imperata arundinacea</i>	Poaceae	Chhana	Grass
206	<i>Imperata cylindrica</i>	Poaceae		Grass
207	<i>Indigofera cassioides</i>	Fabaceae	Gillira	Shrub
208	<i>Indigofera trita</i>	Fabaceae		Herb
209	<i>Iseilema prostratum</i>	Poaceae		Grass
210	<i>Ixora arborea</i>	Rubiaceae	Telkuruma	Tree
211	<i>Ixora pavetta</i>	Rubiaceae		Shrub
212	<i>Jatropha gossypifolia</i>	Euphorbiaceae		Herb
213	<i>Justicia adhatoda</i>	Acanthaceae	Basanga	Shrub
214	<i>Justisia betonica</i>	Acanthaceae		Herb
215	<i>Justisia glauca</i>	Acanthaceae		Herb
216	<i>Kalanchoe pinnata</i>	Crassulaceae	Amarpoi	Herb
217	<i>Kydia calycina</i>	Malvaceae	Banakopasia	Tree
218	<i>Kyllinga nemoralis</i>	Cyperaceae		Sedge
219	<i>Lagerstroemia parviflora</i>	Lythraceae	Sidha	Tree
220	<i>Lagerstroemia speciosa</i>	Lythraceae	Panipatuli	Tree
221	<i>Lannea coromandelica</i>	Anacardiaceae	Mal or Moi	Tree
222	<i>Lantana camara</i>	Verbenaceae	Bholupodi	Shrub

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223	<i>Leea asiatica</i>	Ampelidaceae	Banachiretia	Shrub
224	<i>Lepidagathis cristata</i>	Acanthaceae		Herb
225	<i>Leucas cephalotes</i>	Lamiaceae		Herb
226	<i>Leucas montana</i>	Lamiaceae		Herb
227	<i>Limonia acidissima</i>	Rutaceae	Kaitho	Tree
228	<i>Lindernia anagallis</i>	Scrophulariaceae		Herb
229	<i>Lindernia crustacea</i>	Scrophulariaceae		Herb
230	<i>Litsea glutinosa</i>	Lauraceae	Jaisanda	Tree
231	<i>Loranthus longiflorus</i>	Loranthaceae	Madanga	Epiphyte
232	<i>Ludwigia perennis</i>	Onagraceae		Herb
233	<i>Macaranga peltata</i>	Euphorbiaceae	Manda	Tree
234	<i>Madhuca indica</i>	Sapotaceae	Mohua, Mohul	Tree
235	<i>Mallotus philippensis</i>	Euphorbiaceae	Kamalagundi	Tree
236	<i>Mangifera indica</i>	Anacardiaceae	Amba	Tree
237	<i>Manilkara hexandra</i>	Sapotaceae	Khirkoli	Shrub
238	<i>Marsdenia tenacissima</i>	Asclepiadaceae	Ghaya	Climber
239	<i>Martynia annua</i>	Pedlaliaceae		Shrub
240	<i>Maytenus emarginata</i>	Celastraceae		Shrub
241	<i>Melastoma malabathricum</i>	Melastomataceae	Gangai	Shrub
242	<i>Melia composita</i>	Meliaceae	Batra	Tree
243	<i>Merremia tridentata</i>	Convolvulaceae		Herb
244	<i>Merremia umbellata</i>	Convolvulaceae		Herb
245	<i>Miliusa tomentosa</i>	Annonaceae	Patmossu	Tree

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246	<i>Milium velutinum</i>	Annonaceae	Gandhapalas	Tree
247	<i>Millettia exensa</i>	Fabaceae	Arkala	Climber
248	<i>Mimosa pudica</i>	Mimosaceae	Lajwanti	Herb
249	<i>Mimosa rubicaulis</i>	Mimosaceae	Kirkichikanta	Shrub
250	<i>Mitragyna parvifolia</i>	Rubiaceae	Mundi (Mitakania)	Tree
251	<i>Momordica charantia</i>	Cucurbitaceae		Climber
252	<i>Morinda pubescens</i>	Rubiaceae	Anchu	Tree
253	<i>Moringa oleifera</i>	Moringaceae	Sajna	Tree
254	<i>Mucuna pruriens</i>	Fabaceae	Baidank	Climber
255	<i>Mulugo nudicaulis</i>	Aizoaceae		Herb
256	<i>Mulugo pentaphylla</i>	Aizoaceae		Herb
257	<i>Murraya paniculata</i>	Rutaceae	Kamini	Shrub
258	<i>Naringi crenulata</i>	Rutaceae	Bentha	Tree
259	<i>Nyctanthes arbor-tristis</i>	Oleaceae	Gangasiuli	Tree
260	<i>Ochna obtusata</i>	Ochnaceae	Patharchampa	Tree
261	<i>Ocimum tenuiflorum</i>	Labiatae	Tulshi	Shrub
262	<i>Ocimum basilicum</i>	Lamiaceae		Herb
263	<i>Opismenus burmanii</i>	Poaceae		Grass
264	<i>Oroxylum indicum</i>	Bignoniaceae	Phanphana	Shrub
265	<i>Osbeckia stellata</i>	Melastomataceae		Herb
266	<i>Ougeinia oogeinsis</i>	Fabaceae	Bandhan	Tree
267	<i>Oxalis corniculata</i>	Oxalidaceae		Herb

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268	<i>Paederia scandens</i>	Rubiaceae	Prasarini	Climber
269	<i>Panicum repens</i>	Poaceae		Grass
270	<i>Pavetta tomentosa</i>	Rubiaceae	Kukurchatia	Shrub
271	<i>Pavonia zeylanica</i>	Malvaceae		Herb
272	<i>Pergularia daemia</i>	Asclepiadaceae		Climber
273	<i>Perotis indica</i>	Poaceae		Grass
274	<i>Phoenix acaulis</i>	Palmae	Bankhajuri	Shrub
275	<i>Phoenix sylvestris</i>	Arecaceae		Tree
276	<i>Phyllanthus emblica</i>	Euphorbiaceae	Amla	Tree
277	<i>Phyllanthus niruri</i>	Euphorbiaceae		Herb
278	<i>Phyllanthus reticulatus</i>	Euphorbiaceae		Shrub
279	<i>Piper longum</i>	Piperaceae	Pipali	Herb
280	<i>Pithecolobium dulce</i>	Mimosaceae		Tree
281	<i>Plumbago zeylanica</i>	Plumbaginaceae		Herb
282	<i>Pogostemon benghalense</i>	Labiatae	Pokusunga	Shrub
283	<i>Polyalthia cerasoides</i>	Annonaceae	Patmossu	Tree
284	<i>Polycarpea corymbosa</i>	Caryophyllaceae		Herb
285	<i>Portulaca oleracea</i>	Portulacaceae		Herb
286	<i>Portulaca quadrifida</i>	Portulacaceae		Herb
287	<i>Premna hamiltonii</i>	Verbenaceae		Shrub
288	<i>Premna tomentosa</i>	Verbenaceae		Tree
289	<i>Pseudarthria viscida</i>	Fabaceae		Herb
290	<i>Pseudosorghum fasciculare</i>	Poaceae		Grass

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291	<i>Pterocarpus marsupium</i>	Fabaceae	Bija	Tree
292	<i>Pterospermum xylocarpum</i>	Sterculiaceae	Giringa	Tree
293	<i>Pueraria tuberosa</i>	Fabaceae	Handiphuta	Climber
294	<i>Rauwolfia serpentina</i>	Apocynaceae	Pataigaruda	Shrub
295	<i>Rhynchosia minima</i>	Fabaceae		Herb
296	<i>Rothia indica</i>	Fabaceae		Herb
297	<i>Ruellia tuberosa</i>	Acanthaceae		Herb
298	<i>Saccharum spontaneum</i>	Poaceae	Tenda	Grass
299	<i>Sansevieria roxburghiana</i>	Agavaceae		Herb
300	<i>Sapindus emarginatus</i>	Sapindaceae		Tree
301	<i>Schefflera venulosa</i>	Araliaceae	Jari	Shrub
302	<i>Schleichera oleosa</i>	Sapindaceae	Kusum	Tree
303	<i>Securinega virosa</i>	Euphorbiaceae		Shrub
304	<i>Semecarpus anacardium</i>	Anacardiaceae	Bhalia	Tree
305	<i>Shorea robusta</i>	Dipterocarpaceae	Sal	Tree
306	<i>Sida acuta</i>	Malvaceae		Herb
307	<i>Sida cordifolia</i>	Malvaceae		Herb
308	<i>Sida rhombifolia</i>	Malvaceae		Shrub
309	<i>Smilax ovalifolia</i>	Liliaceae	Matri	Climber
310	<i>Smilax perfoliata</i>	Liliaceae	Mutri	Climber
311	<i>Smilax zeylanica</i>	Liliaceae	Mutri	Climber
312	<i>Solanum surattense</i>	Solanaceae	Ankaranti	Herb
313	<i>Solanum torvum</i>	Solanaceae		Shrub

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314	<i>Solena amplexicaulis</i>	Cucurbitaceae	Matka	Climber
315	<i>Soymida ferbrifuga</i>	Meliaceae	Rohini	Tree
316	<i>Sphaeranthus indicus</i>	Asteraceae		Herb
317	<i>Spondias pinnata</i>	Anacardiaceae	Ambada	Tree
318	<i>Sporobolus indicus</i>	Poaceae		Grass
319	<i>Stachytarpetta jamaicensis</i>	Verbenaceae		Herb
320	<i>Sterculia urens</i>	Sterculiaceae	Giridhini	Tree
321	<i>Sterculia villosa</i>	Sterculiaceae	Kidaia	Tree
322	<i>Stereospermum chelonoides</i>	bignoniaceae	Patuli	Tree
323	<i>Streblus asper</i>	Moraceae	Sahara	Tree
324	<i>Streblus taxioides</i>	Moraceae	Jhumpuri	Shrub
325	<i>Strobilanthes scaber</i>	Acanthaceae	Kakusia	Shrub
326	<i>Strychnos nux-vomica</i>	Loganiaceae	Kuchila	Tree
327	<i>Strychnos potatorum</i>	Loganiaceae	Kotokol	Tree
328	<i>Suregada multiflora</i>	Euphorbiaceae	Khakada	Tree
329	<i>Symphorema polyandrum</i>	Verbenaceae	badichang	Shrub
330	<i>Symplocos racemosa</i>	Styraceae	Ludha	Tree
331	<i>Syzygium cuminii</i>	Myrtaceae	Jambu (Jamun)	Tree
332	<i>Syzygium operculatum</i>	Myrtaceae	Paijamu	Tree
333	<i>Tamarindus indica</i>	Caesalpiniaceae	Tentuli	Tree
334	<i>Tarenna asiatica</i>	Rubiaceae	Jojoka	Shrub
335	<i>Tectona grandis</i>	verbenaceae	Saguan	Tree
336	<i>Tephrosia purpurea</i>	Fabaceae		Herb

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337	<i>Teramnus labialis</i>	Fabaceae		Herb
338	<i>Terminalia alata</i>	Combretaceae	Asan	Tree
339	<i>Terminalia arjuna</i>	Combretaceae	Arjuna	Tree
340	<i>Terminalia bellirica</i>	Combretaceae	Bahada	Tree
341	<i>Terminalia chebula</i>	Combretaceae	Harida	Tree
342	<i>Themeda triandra</i>	Poaceae		Grass
343	<i>Thysanolaena maxima</i>	Poaceae	Phulchanchani	Grass
344	<i>Tiliocora acuminata</i>	Menispermaceae		Climber
345	<i>Tragia involucrata</i>	Euphorbiaceae		Herb
346	<i>Tragia plukenetii</i>	Euphorbiaceae	Bichhuati	Climber
347	<i>Trewia nudiflora</i>	Euphorbiaceae	Panigrambhari	Tree
348	<i>Tribulus terrestris</i>	Zygophyllaceae		Herb
349	<i>Trichosanthes cucumerina</i>	Cucurbitaceae	Banakunduri	Climber
350	<i>Trichosanthes tricuspidata</i>	Cucurbitaceae	Makiria	Climber
351	<i>Tridax procumbens</i>	Asteraceae		Herb
352	<i>Triumfetta rhomboidea</i>	Tiliaceae		Herb
353	<i>Tylophora indica</i>	Asclepiadaceae		Herb
354	<i>Vanda tesellata</i>	Orchidaceae		Herb
355	<i>Vernonia aspera</i>	Compositae	Agnijhal	Shrub
356	<i>Vernonia cinerea</i>	Asteraceae		Herb
357	<i>Vitex negundo</i>	Verbenaceae	Begunia	Shrub
358	<i>Vitex peduncularis</i>	Verbenaceae	Charaiguri	Tree
359	<i>Wendlandia heynei</i>	Rubiaceae	Tilei	Tree

360	<i>Wendlandia tinctoria</i>	Rubiaceae		Tree
361	<i>Woodfordia fruticosa</i>	Myrtaceae	Dhatki or Jhatki	Shrub
362	<i>Wrightia arborea</i>	Apocynaceae	Pitakarichio	Tree
363	<i>Wrightia tinctoria</i>	Apocynaceae		Tree
364	<i>Xylia xylocarpa</i>	Mimosaceae	Kongra	Tree
365	<i>Zingiber purpureum</i>	Zingiberaceae		Herb
366	<i>Zizyphus glaberrima</i>	Rhamnaceae	Ghontol	Tree
367	<i>Zizyphus mauritiana</i>	Rhamnaceae	Borkuli	Tree
368	<i>Zizyphus oenoplia</i>	Rhamnaceae	Kontaikuli	Climber
369	<i>Zizyphus xylopyrus</i>	Rhamnaceae		Tree

### Phytosociology of the plants

In buffer area, the present study revealed that the species composition based on IVI in tree species such as *Pterospermum xylocarpum*, *Xylia xylocarpa*, *Shorea robusta* and *Dalbergia paniculata* are predominant and dominant species are *Semecarpus anacardium*, *Diospyros sylvatica*, *Bridelia montana* and *Dichrostachys cinerea* are dominant species (Table 3.24). In terms of shrubs and lainas, *Cipadessa baccifera*, *Eugenia bracteata*, *Acacia pennata* and *Allophyllus serratus* are the predominant species and *Catunaregam spinosa*, *Clerodendrum inerme*, *Carissa carindus* and *Zizyphus oenopolia* are dominant species (Table 3.25). In herbaceous vegetation, *Celosia argentia*, *Tephrosia purpurea*, *Leucas stricta* and *Parthenium hysterophorus* are predominant plant species and dominant species *Apluda mutica*, *Evolvulus alsinoides*, *Euphorbia hirta* and *Tribulus terrestris* (Table 3.26).

TABLE 3-24 IVI OF TREE SPECIES IN THE BUFFER AREA

Plant name	F	D	BA	RF	RD	Rdom	IVI
<i>Pterospermum xylocarpum</i>	90	10.55	4.203	3.152	10.646	10.75	24.55
<i>Xylia xylocarpa</i>	75	4.3	2.371	2.627	4.3391	6.065	13.03

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<i>Shorea robusta</i>	85	5.2	1.835	2.977	5.2472	4.692	12.92
<i>Dalbergia paniculata</i>	80	3.6	2.276	2.802	3.6327	5.822	12.26
<i>Semecarpus anacardium</i>	85	4.5	1.827	2.977	4.5409	4.671	12.19
<i>Diospyros sylvatica</i>	65	4.6	1.902	2.277	4.6418	4.865	11.78
<i>Bridelia montana</i>	90	3.55	1.132	3.152	3.5822	2.896	9.631
<i>Dichrostachys cinerea</i>	85	2.3	1.505	2.977	2.3209	3.849	9.147
<i>Cassia fistula</i>	80	2.85	1.357	2.802	2.8759	3.469	9.147
<i>Premna tomentosa</i>	95	3.45	0.705	3.327	3.4813	1.803	8.612
<i>Cleistanthus collinus</i>	70	2.4	1.461	2.452	2.4218	3.736	8.61
<i>Wrightia tinctoria</i>	70	3.05	1.174	2.452	3.0777	3.003	8.533
<i>Polyalthia suberosa</i>	85	3.3	0.675	2.977	3.33	1.726	8.033
<i>Lannea coromandelica</i>	70	2.25	1.03	2.452	2.2704	2.634	7.356
<i>Memecylon edule</i>	70	2.65	0.844	2.452	2.6741	2.159	7.284
<i>Ziziphus xylopyrus</i>	70	2.1	1.046	2.452	2.1191	2.674	7.245
<i>Ixora pavetta</i>	70	3.15	0.615	2.452	3.1786	1.572	7.203
<i>Bridelia retusa</i>	65	2.2	1.007	2.277	2.22	2.575	7.072
<i>Morinda pubescens</i>	65	2.65	0.743	2.277	2.6741	1.9	6.851
<i>Ficus tomentosa</i>	75	2	0.754	2.627	2.0182	1.928	6.573
<i>Gyrocarpus americanus</i>	70	1.7	0.892	2.452	1.7154	2.281	6.449
<i>Albizia chinensis</i>	85	1.5	0.556	2.977	1.5136	1.422	5.913
<i>Sterculia urens</i>	60	1.6	0.782	2.102	1.6145	1.999	5.715
<i>Syzygium cumini</i>	65	1.55	0.721	2.277	1.5641	1.843	5.684
<i>Diospyros melanoxylon</i>	50	1.65	0.843	1.751	1.665	2.155	5.572

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<i>Ficus racemosa</i>	55	1.8	0.679	1.926	1.8163	1.737	5.48
<i>Bauhinia racemosa</i>	70	1.5	0.583	2.452	1.5136	1.492	5.457
<i>Lagerstroemia parviflora</i>	65	1.75	0.52	2.277	1.7659	1.331	5.373
<i>Cochlospermum religiosum</i>	65	1.6	0.572	2.277	1.6145	1.463	5.354
<i>Ficus hispida</i>	70	1.7	0.344	2.452	1.7154	0.88	5.047
<i>Antidesma acidum</i>	60	1.3	0.633	2.102	1.3118	1.618	5.032
<i>Sapindus emarginatus</i>	65	1.25	0.463	2.277	1.2614	1.185	4.723
<i>Casearia tomentosa</i>	70	1.3	0.241	2.452	1.3118	0.617	4.381
<i>Gmelina asiatica</i>	55	1.35	0.392	1.926	1.3623	1.002	4.291
<i>Chloroxylon swietenia</i>	60	0.9	0.487	2.102	0.9082	1.246	4.256
<i>Azadirachta indica</i>	60	0.85	0.485	2.102	0.8577	1.24	4.2
<i>Alangium salvifolium</i>	65	1	0.356	2.277	1.0091	0.91	4.196
<i>Litsea glutinosa</i>	55	1.3	0.336	1.926	1.3118	0.859	4.097
<i>Acacia leucophloea</i>	65	0.95	0.297	2.277	0.9586	0.76	3.995
<i>Dolichandrone atrovirens</i>	50	0.95	0.273	1.751	0.9586	0.698	3.408
<i>Ochna obtusata</i>	55	0.95	0.177	1.926	0.9586	0.451	3.336
<b>Total</b>	<b>2855</b>	<b>99.1</b>	<b>39.09</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>300</b>

F-Frequency; D- Density; BA- Basal area; RD- Relative Density; RF- Relative Frequency;

Rdom- Relative dominance; IVI- Importance Value Index

**TABLE 3-17 IVI OF SHRUBS AND CLIMBERS IN THE BUFFER AREA**

<b>Species Name</b>	<b>D</b>	<b>F</b>	<b>BA</b>	<b>RD</b>	<b>RF</b>	<b>Rdom</b>	<b>IVI</b>
<i>Cipadessa bccifera</i>	14	100	0.204	8.36	4.35	7.91	20.62
<i>Eugenia bracteata</i>	11	100	0.174	6.57	4.35	6.75	17.66

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<i>Acacia pennata</i>	9	100	0.169	5.37	4.35	6.55	16.27
<i>Allophyllus serratus</i>	8.5	100	0.15	5.07	4.35	5.82	15.25
<i>Catunaregam spinosa</i>	7.5	100	0.142	4.48	4.35	5.49	14.31
<i>Clerodendrum inerme</i>	7.5	100	0.139	4.48	4.35	5.37	14.2
<i>Carissa carandus</i>	7.5	100	0.129	4.48	4.35	5	13.82
<i>Ziziphus oenopolia</i>	9.5	100	0.073	5.67	4.35	2.82	12.83
<i>Lantana camara</i>	8	100	0.092	4.78	4.35	3.56	12.69
<i>Calotropis gigantea</i>	7	100	0.105	4.18	4.35	4.06	12.59
<i>Olex scandens</i>	6.5	100	0.069	3.88	4.35	2.69	10.92
<i>Cayratia pedata</i>	6.5	50	0.122	3.88	2.17	4.72	10.78
<i>Cardiospermum corindum</i>	6	100	0.065	3.58	4.35	2.52	10.45
<i>Cassia auriculata</i>	6.5	50	0.098	3.88	2.17	3.78	9.837
<i>Cadaba fruticosa</i>	4	100	0.06	2.39	4.35	2.31	9.042
<i>Ventilago maderaspatana</i>	3.5	50	0.104	2.09	2.17	4.04	8.299
<i>Cassia montana</i>	3.5	100	0.045	2.09	4.35	1.73	8.163
<i>Glycosmis pentaphylla</i>	4.5	50	0.075	2.69	2.17	2.92	7.776
<i>Ehretia laevis</i>	3.5	50	0.085	2.09	2.17	3.29	7.555
<i>Helicters isora</i>	5	50	0.059	2.99	2.17	2.3	7.457
<i>Dodonaea viscosa</i>	5	50	0.058	2.99	2.17	2.24	7.403
<i>Ochna obtusata</i>	3.5	50	0.06	2.09	2.17	2.33	6.59
<i>Securinega leucopyrus</i>	3.5	50	0.035	2.09	2.17	1.34	5.605
<i>Hugonia mystax</i>	3	50	0.037	1.79	2.17	1.45	5.418
<i>Jatropha gossypifolia</i>	2	50	0.047	1.19	2.17	1.8	5.17

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<i>Canthium coromandelicum</i>	2.5	50	0.038	1.49	2.17	1.48	5.149
<i>Combretum ovalifolium</i>	2.5	50	0.036	1.49	2.17	1.39	5.059
<i>Benkara malabarica</i>	1.5	50	0.043	0.9	2.17	1.66	4.727
<i>Rivea hypocrateriformis</i>	1.5	50	0.029	0.9	2.17	1.13	4.204
<i>Naravelia zeylanica</i>	1.5	50	0.013	0.9	2.17	0.5	3.568
<i>Calotropis procera</i>	1	50	0.014	0.6	2.17	0.54	3.308
<i>Derris scandens</i>	1	50	0.013	0.6	2.17	0.52	3.292
<b>Total</b>	<b>167.5</b>	<b>2300</b>	<b>2.581</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>300</b>

**TABLE 3-26 IVI OF HERBACEOUS VEGETATION IN THE BUFFER AREA**

<b>Plant species</b>	<b>RA</b>	<b>RD</b>	<b>RF</b>	<b>IVI</b>
<i>Celosia argentia</i>	10.62	8.74	4.85	24.21
<i>Tephrosia purpurea</i>	8.85	7.77	4.41	21.03
<i>Leucas stricta</i>	6.07	4.85	9.88	20.8
<i>Parthenium hysterophorus</i>	8.74	4.85	4.85	18.44
<i>Apluda mutica</i>	1.52	7.77	8.85	18.13
<i>Evolvulus alsinoides</i>	6.07	9.85	1.47	17.39
<i>Euphorbia hirta</i>	1.11	5.65	9.85	16.61
<i>Tribulus terrestris</i>	6.07	3.88	5.88	15.83
<i>Boera havia diffusa</i>	6	7.74	1.47	15.21
<i>Commelina diffusa</i>	6.54	0.97	7.54	15.05
<i>Lepidagathis cristata</i>	6.07	2.91	4.41	13.39
<i>Enicostemma axillare</i>	4.55	4.85	2.94	12.35

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<i>Spermacoce articularis</i>	1.52	1.94	8.47	11.93
<i>Brachiaria reptans</i>	5.07	3.88	2.94	11.89
<i>Blepharis repens</i>	1.52	4.99	4.41	10.92
<i>Heteropogon contortus</i>	1.52	2.91	4.98	9.41
<i>Cymbopogon citratus</i>	4.52	1.94	2.94	9.4
<i>Andrographis paniculata</i>	6.07	0.97	1.47	8.51
<i>Hedyotis corymbosa</i>	1.52	4.08	1.47	7.07
<i>Cynodon dactylon</i>	1.11	2.91	2.94	6.97
<i>Solaum trilobatum</i>	1.94	2.68	1.02	5.64
<i>Sida acuta</i>	1.52	1.94	1.47	4.93
<i>Zornia gibbosa</i>	1.52	1.9	1.47	4.89
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>300</b>

### 3.12.6.1 Biodiversity indices

The value of biodiversity index increases both when the number of types increases and when evenness increases. For a given number of type of species, the value of a biodiversity index is maximized when all type of species is equally abundant. Biodiversity indices values are given. Biodiversity indices values are given in the Table 3.27.

**TABLE 3-27 BIODIVERSITY INDICES OF THE STUDY AREA**

Community	Buffer area	
	Shannon-Wiener Index (H)	Simpson Diversity Index (1/D)
Trees	3.56	0.96
Shrubs and lainas	3.28	0.95
Herbs	3.9	0.97

### 3.12.7 FAUNA

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians, and butterfly species, a baseline survey conducted in post-monsoon period of 2020. To prepare a detailed report on the status of faunal diversity within study area of 10 Km radius around proposed project. Both direct (sighting) and indirect (evidences) observations methods were used to survey the faunal species around the study area. Additionally, reference of relevant literatures (published/unpublished) and dialogues with local people were also varied out to consolidate the presence of faunal distribution (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993) in the study area.

A total of 104 species of fauna are reported from the study area including mammals (8 species), Amphibians (4 species), Reptiles (14 species), Amphibians (3 species), Birds (52 species) and Butterflies (27 species). A list of birds either spotted or reported from the study area is given in Table 3.28. None of the species listed in Schedule I of the Indian Wildlife (protection) Act was found in the study area.

**TABLE 3-28 CHECKLIST OF FAUNA RECORDED IN THE STUDY AREA**

S.No.	Scientific name	Common name	Status as per IPWA 1972
<b>Mammals</b>			
	<i>Funambulus palmarum</i>	Three-striped Palm squirrel	Schedule IV
2	<i>Herpestes edwardsi</i>	Common Mongoose	Schedule II
3	<i>Hystrix indica</i>	Indian Crested Porcupine	Schedule IV
4	<i>Lepus nigricollis</i>	Indian Hare	Schedule IV
5	<i>Mus musculus</i>	Common House Mouse	Schedule V
6	<i>Rattus rattus</i>	Common House Rat	Schedule V
7	<i>Semnopithecus entellus</i>	Common Langur	Schedule II
8	<i>Vulpes bengalensis</i>	Indian Fox	Schedule II
<b>Avifauna</b>			

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9	<i>Acridotheres tristis</i>	Common Myna	Schedule IV
10	<i>Alcedo atthis</i>	Small Blue Kingfisher	Schedule IV
11	<i>Amaurornis phoenicurus</i>	White-breasted Water hen	Schedule IV
12	<i>Anthus rufulus</i>	Paddyfield Pipit	Schedule IV
13	<i>Apus affinis</i>	House Swift	Not listed
14	<i>Ardeola grayii</i>	Indian Pond-Heron	Schedule IV
15	<i>Athene brama</i>	Spotted Owlet	Schedule IV
16	<i>Bubulcus ibis</i>	Cattle Egret	Schedule IV
17	<i>Casmerodius albus</i>	Large Egret	Schedule IV
18	<i>Centropus bengalensis</i>	Lesser Coucal	Schedule IV
19	<i>Centropus sinensis</i>	Greater Coucal	Schedule IV
20	<i>Ceryle rudis</i>	Lesser Pied Kingfisher	Schedule IV
21	<i>Charadrius dubius</i>	Common Sandpiper	Schedule IV
22	<i>Chloropsis aurifrons</i>	Golden Fronted Leafbird	Schedule IV
23	<i>Ciconia episcopus</i>	White-necked Stork	Schedule IV
24	<i>Clamator jacobinus</i>	Pied Crested Cuckoo	Schedule IV
25	<i>Columba livia</i>	Blue Rock Pigeon	Schedule IV
26	<i>Coracias benghalensis</i>	Indian Roller	Schedule IV
27	<i>Corvus splendens</i>	House Crow	Schedule V
28	<i>Cuculus canorus</i>	Common Cuckoo	Schedule IV
29	<i>Cuculus micropterus</i>	Indian Cuckoo	Schedule IV
30	<i>Dendrocitta vagabunda</i>	Indian Treepie	Schedule IV

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31	<i>Egretta Garzetta</i>	Little Egret	Schedule IV
32	<i>Francolinus pondicerianus</i>	Grey Francolin	Schedule IV
33	<i>Glaucidium radiatum</i>	Jungle Owlet	Schedule IV
34	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher	Schedule IV
35	<i>Hirundo daurica</i>	Red-rumped Swallow	Not listed
36	<i>Hirundo rustica</i>	Common Swallow	Not listed
37	<i>Lanius schach</i>	Rufous-backed Shrike	Not listed
38	<i>Lonchura malabarica</i>	Indian Silverbill	Schedule IV
39	<i>Megalaima haemacephala</i>	Coppersmith Barbet	Schedule IV
40	<i>Merops orientalis</i>	Green Bee-eater	Schedule IV
41	<i>Merops philippinus</i>	Blue-tailed Bee-eater	Not listed
42	<i>Microcarbo niger</i>	Little Cormorant	Schedule IV
43	<i>Motacilla maderaspatensis</i>	White-browed Wagtail	Schedule IV
44	<i>Nectarinia zeylonica</i>	Purple-rumped Sunbird	Schedule IV
45	<i>Passer domesticus</i>	House Sparrow	Schedule IV
46	<i>Perdica asiatica</i>	Jungle Bush-Quail	Schedule IV
47	<i>Prinia inornata</i>	Plain Prinia	Schedule IV
48	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	Schedule IV
49	<i>Psittacula krameri</i>	Rose-ringed Parakeet	Schedule IV
50	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Schedule IV
51	<i>Saxicoloides fulicata</i>	Indian Robin	Schedule IV
52	<i>Streptopelia chinensis</i>	Spotted Dove	Schedule IV

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53	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	Schedule IV
54	<i>Streptopelia senegalensis</i>	Little Brown Dove	Schedule IV
55	<i>Sturnus pagodarum</i>	Brahminy starling	Schedule IV
56	<i>Sturnus roseus</i>	Rosy Starling	Schedule IV
57	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	Schedule IV
58	<i>Turdoides striatus</i>	Jungle Babbler	Schedule IV
59	<i>Upupa epops</i>	Common Hoopoe	Not listed
60	<i>Vanellus indicus</i>	Red-wattled Lapwing	Schedule IV
<b>Reptiles</b>			
61	<i>Hemidactylus frenatus</i>	Asian House Gecko	Not listed
62	<i>Argyrogena fasciolata</i>	Banded Racer snake	Schedule II
63	<i>Xenochrophis piscator</i>	Checkered Keelback	Schedule II
64	<i>Boiga trigonata</i>	Common Cat Sanke	Schedule IV
65	<i>Hemidactylus flaviviridis</i>	Common House Gecko	Schedule IV
66	<i>Bungarus caeruleus</i>	Common Indian Krait	Not listed
67	<i>Oligodon arnensis</i>	Common Kukri	Not listed
68	<i>Mabuya macularia</i>	Common Skink	Not listed
69	<i>Coelognathus helena</i>	Common Trinket Snake	Not listed
70	<i>Chamaleon zeylanicus</i>	Indian Chameleon	Schedule II
71	<i>Ptyas mucosus</i>	Indian Rat Snake	Schedule II
72	<i>Calotes versicolor</i>	Oriental Garden Lizard	Not listed
73	<i>Oligodon taeniolatus</i>	Russel's Kukri snake	Schedule IV

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74	<i>Naja naja</i>	Spectacled Cobra	Schedule II
<b>Amphibians</b>			
75	<i>Bufo melanostictus</i>	Asian Common Toad	Schedule IV
76	<i>Polypedates maculatus</i>	Common Tree Frog	Schedule IV
77	<i>Euphlyctiscyanophlyctis</i>	Indian Skipper Frog	Schedule IV
<b>Butterflies</b>			<b>IUCN category</b>
78	<i>Junonia orithya</i>	Blue Pansy	Not assessed
79	<i>Tirumala limniace</i>	Blue Tiger	Not assessed
80	<i>Junonia iphita</i>	Chocolate Pansy	Not assessed
81	<i>Euthalia garuda</i>	Common Baron	Not assessed
82	<i>Jamides celeno</i>	Common Cerulean	Not assessed
83	<i>Catopsilia pomona</i>	Common Emigrant	Not assessed
84	<i>Eurema hecabe</i>	Common Grass Yellow	Least Concerned
85	<i>Euploea core</i>	Common Indian Crow	Not assessed
86	<i>Delias eucharis</i>	Common Jezebel	Not assessed
87	<i>Phalanta phalanta</i>	Common Leopard	Not assessed
88	<i>Papilio polytes</i>	Common Mormon	Not assessed
89	<i>Castalius rosimon</i>	Common Pierrot	Not assessed
90	<i>Neptis hylas</i>	Common Sailor	Not assessed
91	<i>Pachliopta hector</i>	Crimson Rose	Not assessed
92	<i>Hypolimnas misippus</i>	Danaid Egg fly	Not assessed
93	<i>Parantica algea</i>	Glassy Tiger	Not assessed
94	<i>Euchrysops cnejus</i>	Gram Blue	Not assessed

95	<i>Hypolimnas bolina</i>	Great Egg fly	Not assessed
96	<i>Junonia atlites</i>	Grey Pansy	Not assessed
97	<i>Spialia galba</i>	Indian Skipper	Not assessed
98	<i>Junonia lemonias</i>	Lemon Pansy	Not assessed
99	<i>Junonia almana</i>	Peacock Pansy	Least Concern
100	<i>Anaphaeis aurota</i>	Pioneer	Not assessed
101	<i>Danaus chrysippus</i>	Plain Tiger	Least Concern
102	<i>Abisara echerius</i>	Plum Judy	Not assessed
103	<i>Danaus genutia</i>	Striped Tiger	Not assessed
104	<i>Junonia hierta</i>	Yellow Pansy	Least Concern

### **3.12.8 AQUATIC ECOLOGY**

Aquatic life is an integral component of stream and rivers which are not only the best sources of food and animal protein for the human population but also provides base for ecosystem functioning. The impact of pollution on aquatic ecosystem manifests itself first on the biotic aquatic communities. The species composition of aquatic organisms in natural communities is directly influenced by ambient water quality. The responses of plants to pollutants, when measured quantitatively give an insight about the conditions of existing aquatic ecosystem.

### **3.12.9 METHODOLOGY**

#### **3.12.9.1 Phytoplankton**

Few horizontal hauls were made to collect plankton samples using plankton nets with a mesh size of 50µm and 120 µm. Samples were immediately transported to the laboratory and preserved using 40% formalin. After thoroughly shaking the concentrate sample, an aliquote sub-sample (1 ml), was transferred on to a microscopic slide examined. On an average, five such replicates were taken and the results computed for 1 ml of the concentrated sediment samples and identified using Edmondson (1959), Anand (1988).

### 3.12.9.2 Zooplankton

For the qualitative and quantitative analysis of zooplankton, an aliquote sub sample (2 ml) was taken from the concentrated sample, after thoroughly shaking and ensuring uniform distribution of the plankton, were qualitatively enumerated. Five such enumerations were made and averages calculated for 1 ml of each sample (Battish 1992).

### 3.12.9.3 Aquatic flora

The core area is in part of River Ramial and there are several small village tanks on all sides within the 10 Km buffer zone. Most tanks were either totally or partially dry during the period of survey. The present survey is confined to fresh water environment only. Apart from the River and the tanks, the aquatic environment is also represented by paddy fields and a few stagnant water ponds. In addition to these village tanks, drains, and paddy fields provide the aquatic habitat for a variety of very common aquatic plants and animals. All the aquatic plant species listed in Table 3.29 is found in the study area only.

**TABLE 3-29 AQUATIC FLORA OBSERVED IN THE STUDY AREA**

Scientific name	Family	Status
<i>Aponogeton natans</i>	Aponogetonaceae	Common
<i>Blyxa octandra</i>	Hydrocharitaceae	Sporadic
<i>Ceratophyllum demersum</i>	Ceratophyllaceae	Widespread
<i>Cyperus exaltatus</i>	Cyperaceae	Locally abundant
<i>Cyperus pangorei</i>	Cyperaceae	Scattered
<i>Eichhornia crassipes</i>	Pontederiaceae	Extensive and widespread
<i>Hydrilla verticillata</i>	Hydrocharitaceae	Widespread
<i>Ipomoea aquatic</i>	Convolvulaceae	Extensive and widespread
<i>Limnophila heterophylla</i>	Scrophulariaceae	Common
<i>Limnophila indica</i>	Scrophulariaceae	Common
<i>Nechamandra alternifolia</i>	Hydrocharitaceae	Sporadic
<i>Nelumbo nucifera</i>	Nelumbonaceae	Very common
<i>Nymphaea nauchali</i>	Nymphaeaceae	Widely scattedred
<i>Nymphaea stellate</i>	Nymphaeaceae	Widely scattedred
<i>Numphoides hydrophylla</i>	Nymphaeaceae	Scattered
<i>Nymphoides indica</i>	Nymphaeaceae	Scattered
<i>Ottelia alismoides</i>	Hydrocharitaceae	Widely scattedred

<i>Paspalidium geminatum</i>	Poaceae	Common
<i>Phragmites karka</i>	Poaceae	Dominant along boundaries
<i>Pistia stratiotes</i>	Araceae	Widespread
<i>Salvinia auriculata</i>	Salviniaceae	Widespread
<i>Salvinia cucullata</i>	Salviniaceae	Common
<i>Schoenoplectus articulatus</i>	Cyperaceae	Occasional
<i>Typha angustata</i>	Typhaceae	Extensive and widespread
<i>Utricularia flexuosa</i>	Lentibulariaceae	Sporadic
<i>Utricularia stellaris</i>	Lentibulariaceae	Sporadic
<i>Vallisneria spiralis</i>	Hydrocharitaceae	Widespread

### **3.12.9.4 Planktons**

Protecting the environment and making efficient use of natural resources are two of the most pressing demands in the present stage of social development. The task of preserving the purity of the atmosphere and water basins is of both national and global significance since there are no boundaries to the propagation of anthropogenic contaminants in the water. An essential pre requisite for the successful solution to these problems is to evaluate ecological impacts from the baseline information and undertake effective management plan. In order to get a clear picture and to assess the various parameters of water, three aquatic ecological sampling locations were identified for sampling. A qualitative study of these indicator groups provides the knowledge of aquatic flora and fauna to understand the community features such as taxonomic composition of species, and assemblages which vary with the physical and chemical attributes of the ecosystem.

#### **Phytoplankton**

Phytoplanktons are the major primary producers of organic matter in the aquatic ecosystem and especially oceans whose 90% productivity is from the planktons. Collectively, they directly or indirectly support the entire animal population. When the water column becomes shallow in spring, phytoplanktons are exposed to higher light intensity in the upper sunlight. Light is one of the major abiotic factors that favour the growth of phytoplankton. The massive build up of phytoplankton in spring directly contributes new organic carbon to support the Zooplankton, which, in turn, benefits larger aquatic animals including fish, crustaceans, molluscs, birds. Phytoplankton were concentrated by centrifugation and analysed microscopically in laboratory. The checklist of phytoplankton shown in Table 3.30.

**TABLE 3-30 PHYTOPLANKTON OBSERVED IN THE STUDY AREA**

S. No.	Group	Species
1	Bacillariophyceae	<i>Diatoma</i> sp.
		<i>Gomphonema</i> sp.
		<i>Navicula</i> sp.
		<i>Nitzschia</i> sp.
		<i>Ankistrodesmus</i> sp.
		<i>Chlorococcum</i> sp.
		<i>Chlorella</i> sp.
2	Chlorophyceae	<i>Closterium</i> sp.
		<i>Pandorina</i> sp.
		<i>Anabaena</i> sp.
		<i>Anacystis</i> sp.
		<i>Spirulina</i> sp.
3	Cyanophyceae	<i>Merismopedia</i> sp.
		<i>Phormidium</i> sp.
		<i>Euglena</i> sp.
4	Euglenophyceae	<i>Phacus</i> sp.

### Zooplankton

The significance of Zooplanktons is found in their role in transferring biological production from phytoplankton to larger organisms in the food web. A large number of phytoplankton species are grazed upon by the microscopic protozoans, tunicates, copepods and other cruastaceans. These in turn become food for the other animals further linking the food web. Therefore, variability in the production of planktons would affect the survival of young fish that depend on them. The result of the Zooplankton analysis is tabulated in Table 3.31.

**TABLE 3-31 ZOOPLANKTON SPECIES IN THE STUDY AREA**

S. No.	Group	Species
1	Copepoda	<i>Cyclops</i> sp.
		<i>Pseudocyclops</i> sp.
		<i>Nauplius larva</i>

2	Rotifera	<i>Asplanchna</i> sp.
		<i>Brachionus</i> sp.
		<i>Conochilus</i> sp
		<i>Keratella tropica</i>
		<i>Trichocera</i> sp.
3	Cladocera	<i>Daphnia</i> sp.
		<i>Diaphanosoma</i> sp.

### 3.12.10 FISHES

The primary study reveals that, potential fishing activities do not exist in the study area during summer season as water gets dry in stagnant water bodies and ponds during summer. The aquatic habitats consist of Nandir Jhor and Ramial River, Ditches and water logged areas were represented by fin-fish (fishes), shell-fish (mollusk) and prawns (crustaceans) of seasonal varieties. Some commercial fishing takes place in the Ramial River and collected stock is small and sold in the local market. *Mastacembelus armatus* and *Puntius ticto* has been recorded from Brahmini River in a fish catch of local fisherman. As per information collected from the Fishery Department, Commercial fish fauna found in the area is I) Catla (*Catla catla*) ii) Rohu (*Labeo rohita*) iii) Mrigal (*Cirrhinus mrigala*) and iv) Kalbasu (*Labeo kalbasu*). Total fishes listed in the Table 3.32.

**TABLE 3-32 CHECKLIST OF FISHES IN THE STUDY AREA**

<b>Family</b>	<b>Scientific name</b>	<b>Common name</b>
Cyprinidae	<i>Barilius barila</i>	Barred baril
Cyprinidae	<i>Cirrhinus mrigala</i>	Mrigal
Cyprinidae	<i>Catla catla</i>	Catla
Cyprinidae	<i>Danio devario</i>	Danio
Cyprinidae	<i>Labeo bata</i>	Bata Labeo
Cyprinidae	<i>Puntius sophore</i>	Spot Fin Barb
Cyprinidae	<i>Pethis ticto</i>	Fire fin barb
Cyprinidae	<i>Chela bacaila</i>	Chela Minnow

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Cobitidae	<i>Lepidocephalus guntea</i>	Guntea Loach
Siluridae	<i>Wallago attu</i>	Wallago cat fish
Pangasiidae	<i>Pangasius pangasius</i>	Pangas cat fish
Ambassidae	<i>Chanda nama</i>	Elongate grass Perchlet
Channidae	<i>Channa punctatus</i>	Spotted snakehead
Mastacembelidae	<i>Mastacembellus armatus</i>	Spiny Eel

### 3.13 SOCIO-ECONOMIC ENVIRONMENT

Environment is a whole complex of physical, social, economic, cultural and aesthetic dimensions which affects individual, communities and ultimately determines their forms, characters, relationships and survivals. As such it becomes imperative to integrate the components of socio-economic environment in impact assessment study related to environment conservation, protection and management. The social environment refers to demographic structure of the area incorporating population dynamics, infrastructure resource base and health status of the community, while economic environment refers to land utilization pattern, land values, employment generation, industrial development and sustainability of the project in financial term. The aesthetic environment refers to scenic value of the area, tourist attraction, forest, and wildlife, historic and cultural monuments. The study of these parameters helps in identification, prediction and evaluation of likely impacts on socioeconomics and parameters of human interest due to proposed project.

The data collection for evaluation of the impact of the proposed for proposal of Ramial river sand quarry, Baligorad over total lease area of 13.43acres/5.60 ha. At Baligorad Taluka Kamakhyanagar, district Dhenkanal on socioeconomic aspects in the study area has been done through a primary data and through the analysis of secondary data available for the study area.

To assess impact on socio-economic environment latest available data has been compiled to delineate the baseline socio- economic profile in study area. The database thus generated in this study includes:

- Demographic structure
- Infrastructure base
- Health status

- Economic attributes
- Cultural attributes
- Awareness and opinion of people about the proposed project

### **3.13.1 SAMPLING METHOD**

A judgmental and purposive sampling method was used for choosing respondents of various sections of the society i.e. Sarpanch, adult males and females, teachers, medical practitioners, businessmen, agriculture laborers, fishermen, unemployed group etc. Judgmental and purposive sampling method includes the right cases from the total population that helps to full fill the purpose of research needs. Observations are restricted to this group and conclusions from these observations are generalized to the total population. Judgment or purposive sampling is very precarious, because stronger assumption can be made about the population and sampling procedure than required while employing probability sampling.

#### **Data Collection Method**

In order to assess and evaluate the likely impacts arising out of any developmental projects on socio-economic environment, it is necessary to gauge the apprehensions of the people in the project area. For the process of data collection through primary and secondary sources certain methods are used among that are:

#### **Field Survey and Observations**

Field survey and observations are made at each sampling village and the quality of life of that region is estimated. Visits are made at hospitals, primary health centers and sub-centers to know the health status of the region. Various government organizations such as statistical department, department of census operations are visited to collect the population details of that region.

#### **Interview Method**

Structured interview method is used to collect data regarding the awareness and opinion from the sample selected of the various socio- economic sections of the community. Structured interviews involve the use of a set of predetermined questions that includes fixed and alternative questions. The questionnaire mainly highlights the parameters such

as income, employment and working conditions, housing, food, clothing, water supply, sanitation, health, energy, transportation and communication, education, environment and pollution to assess the quality of life of that particular region and general awareness and opinion of the respondents about the project.

The respondents were asked for their awareness/opinion about the project and also their opinion about the impacts of the project on job opportunities, education, healthcare, housing, transportation facility and economic status etc.

**The salient observations recorded during survey in the study area are:**

- All villages are having Anganwadi facilities. Most of the villages having Grampanchyat.
- Though, Primary Health center (PHC) is available in most of the villages, but only nurse is present, doctors are not available all the time.
- Most of the people are engaged in agricultural and livestock activities. Farming is the main occupation.
- Many respondents within the study area have mentioned that they are expecting better road infrastructure facilities and primarily job opportunities.
- A road approach is mainly both kaccha and pakka road.
- For travelling purpose government bus service and auto are sources available for villagers in this region.
- Tap water, Bore well, tank water, well are the main source of drinking water supply in the region.
- Sanitation facilities are good condition.
- Electricity is available in almost all the villages. Most of the villages having irrigation facility through electricity. Electricity use for all purpose in the study area.
- LPG gas and Wood is major fuel for cooking purpose; kerosene is also used in some villagers.
- Self Help Group (SHG) is actively strong in maximum villages.
- Most of the tourist places situated in Pune. Nearby villagers prefer to go in Pune for entertainment and enjoyment.

### **Public Awareness and Opinion**

- However, respondents have expressed favorable opinion about the project. This favorable opinion can also be attributed to proposed improvement in transportation and communication as well as the welfare activities in the study area
- Employment facilities for local youth may be increased

Majority of respondents are not aware about the proposed project activity

### **DEMOGRAPHIC STRUCTURE**

The demographic structure of the study area was derived primarily from data of Census record of Dhenkanal covering one districts and six taluka of Odisha state. The Demographic structures of each village in the study area as per Census 2011 are presented in **Table 3.33**.

**TABLE 3-33 DEMOGRAPHIC STRUCTURE OF POPULATION DETAILS**

S.No	Name	Area	Household	Total Population	Total Male	Total Female	Population SC	Male SC	Female SC	Population ST	Male ST	Female ST
	Dhenkanal											
	Parajang											
1.	Tulasipasi	182	103	344	190	154	169	98	71	0	0	0
	<b>Total</b>	<b>182</b>	<b>103</b>	<b>344</b>	<b>190</b>	<b>154</b>	<b>169</b>	<b>98</b>	<b>71</b>	<b>0</b>	<b>0</b>	<b>0</b>
	Kamakshyanagar											
2.	Kankana	788	356	1704	894	810	222	121	101	970	510	460
3.	Raibol	584	237	976	497	479	49	25	24	91	45	46
4.	Hadagari	475	104	477	232	245	0	0	0	451	219	232
5.	Rahani	392	355	1511	768	743	424	197	227	401	204	197
6.	Tandi Munda	340	137	804	299	505	29	14	15	712	254	458
7.	Rangamatia	109	23	110	59	51	0	0	0	110	59	51
8.	Jiridamali	216	585	2558	1358	1200	605	334	271	138	71	67
9.	Balabhadrapurpatna	12	51	217	131	86	89	54	35	0	0	0
10.	Malapura	488	434	1807	903	904	260	118	142	445	215	230
11.	Rajakulakateni	86	69	259	125	134	28	14	14	0	0	0
12.	Santarapur	324	97	496	259	237	13	5	8	442	231	211
13.	Khatakhura	414	376	1688	869	819	504	247	257	185	95	90
14.	Bhandaria oraf Brundabanpur	38	38	191	98	93	0	0	0	187	95	92

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15.	Tangrapada	355	142	665	350	315	34	20	14	310	161	149
16.	Karadapal	57	8	33	13	20	0	0	0	33	13	20
17.	Badamuktapasi	131	95	400	216	184	103	57	46	207	111	96
18.	Mathakaragola	639	809	3614	1868	1746	407	194	213	135	75	60
19.	Origaon	100	184	771	409	362	192	103	89	79	40	39
20.	Lokpali	15	133	571	306	265	127	71	56	0	0	0
21.	Arasahi	86	57	237	118	119	70	31	39	0	0	0
22.	Lokanathapur	423	129	641	332	309	18	9	9	200	110	90
23.	Siarimalia	5	182	817	417	400	34	16	18	22	10	12
24.	Arachua	145	110	505	250	255	272	136	136	13	5	8
25.	Badasuanlo	422	501	2154	1077	1077	500	231	269	168	80	88
26.	Dhobania	154	16	81	43	38	79	41	38	0	0	0
27.	Nuapani	179	96	363	194	169	10	5	5	73	37	36
28.	Baligorada	346	465	1962	1010	952	504	259	245	184	99	85
29.	Tentulisingha	117	142	585	302	283	246	131	115	166	85	81
30.	Kandarasingha	82	98	404	200	204	65	32	33	142	74	68
31.	Kakudia	142	92	365	200	165	65	35	30	8	4	4
32.	Saruali	959	508	2015	1036	979	259	134	125	421	221	200
33.	Sunajhari	279	59	256	135	121	70	37	33	186	98	88
34.	Bampu	223	72	356	189	167	0	0	0	356	189	167
35.	Mota	403	280	1270	664	606	241	122	119	269	131	138
36.	Pipala	297	180	788	383	405	182	89	93	122	56	66
37.	Kangeilo	264	383	1527	784	743	0	0	0	190	100	90

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38.	Korianpal	228	213	856	447	409	436	221	215	70	32	38
39.	Kanchhia	270	232	1059	522	537	434	221	213	199	95	104
40.	Jagannathpur	164	343	1338	681	657	527	258	269	2	1	1
41.	Malangadihi	12	11	72	35	37	0	0	0	0	0	0
42.	Badura	89	14	65	35	30	10	6	4	0	0	0
43.	Manitri	271	229	873	432	441	311	152	159	0	0	0
44.	Palikateni	151	120	554	232	322	31	10	21	342	120	222
45.	Khandabandha	103	46	167	83	84	167	83	84	0	0	0
46.	Suniamaru	189	26	110	60	50	58	28	30	0	0	0
47.	Danapasi	149	95	356	185	171	0	0	0	355	185	170
48.	Shyamasundarpur	208	27	115	60	55	24	15	9	3	3	0
49.	Sanabrahmapur	84	124	578	307	271	141	77	64	0	0	0
50.	Khajuridihi	54	38	138	74	64	138	74	64	0	0	0
51.	Arakhapal	89	243	1011	521	490	66	34	32	0	0	0
52.	Bedhapal	163	342	1699	914	785	272	137	135	0	0	0
53.	Jineilo	126	254	1085	572	513	49	26	23	0	0	0
54.	Mugapada	89	85	358	192	166	89	46	43	0	0	0
55.	Kendudhipa	126	151	562	302	260	211	109	102	0	0	0
56.	Jiral	553	1175	5435	2847	2588	615	324	291	25	12	13
57.	Santarapur	329	80	305	157	148	77	36	41	0	0	0
58.	Kairanali	71	132	561	299	262	155	79	76	0	0	0
59.	Saradeipur	32	52	234	116	118	0	0	0	0	0	0
60.	Dighi	453	342	1485	768	717	306	158	148	199	105	94

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61.	Goradia	570	355	1469	748	721	517	263	254	181	89	92
62.	Dimiria	182	302	1421	769	652	536	293	243	182	101	81
63.	Rankia	442	229	1091	538	553	111	59	52	213	104	109
	<b>Total</b>	<b>15286</b>	<b>12863</b>	<b>56175</b>	<b>28884</b>	<b>27291</b>	<b>10982</b>	<b>5591</b>	<b>5391</b>	<b>9187</b>	<b>4544</b>	<b>4643</b>
	Kankadahad											
64.	Sasapasi	828	341	1578	825	753	245	123	122	597	300	297
65.	Jamuchakada	98	73	332	183	149	0	0	0	287	157	130
66.	Koli Bania Kateni	210	28	134	73	61	13	7	6	0	0	0
67.	Makuakateni	291	265	1095	577	518	91	42	49	180	88	92
68.	Mahidharpur	52	1	2	1	1	0	0	0	0	0	0
69.	Kairatangar	363	156	719	359	360	57	23	34	535	270	265
70.	Baghua	464	85	383	185	198	0	0	0	383	185	198
71.	Tarajanga	165	161	619	325	294	123	64	59	1	1	0
72.	Bagha Basa	89	98	446	217	229	49	26	23	393	189	204
	<b>Total</b>	<b>2560</b>	<b>1208</b>	<b>5308</b>	<b>2745</b>	<b>2563</b>	<b>578</b>	<b>285</b>	<b>293</b>	<b>2376</b>	<b>1190</b>	<b>1186</b>
	Bhuban											
73.	Anala	348	360	1487	766	721	215	107	108	80	41	39
74.	Kanheipal	444	396	1875	955	920	221	105	116	747	375	372
75.	Bamuan	75	156	664	357	307	110	56	54	25	14	11
76.	Tipilei	382	258	1162	603	559	118	60	58	468	236	232
77.	Dayanabili	180	185	819	405	414	95	45	50	331	159	172
78.	Mathanuagan	110	186	834	433	401	421	216	205	0	0	0

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79.	Balipada	182	2	22	9	13	0	0	0	0	0	0
80.	Siaridoli	32	13	53	29	24	0	0	0	0	0	0
81.	Nrusinghapur oraf Krushnapur		116	513	269	244	183	95	88	0	0	0
82.	Jamunakote	470	707	3009	1484	1525	542	263	279	155	80	75
83.	Gheekhola	70	4	13	7	6	9	5	4	0	0	0
84.	Adipura	234	330	1605	790	815	396	188	208	4	2	2
85.	Gobindabidyadh ar Pur Patana	5	64	266	135	131	0	0	0	0	0	0
86.	Odhana	175	223	1009	525	484	89	45	44	0	0	0
	<b>Total</b>	<b>2707</b>	<b>3000</b>	<b>13331</b>	<b>6767</b>	<b>6564</b>	<b>2399</b>	<b>1185</b>	<b>1214</b>	<b>1810</b>	<b>907</b>	<b>903</b>
	Gandia											
87.	Kumbharunibati	58	21	82	39	43	0	0	0	0	0	0
	<b>Total</b>	<b>58</b>	<b>21</b>	<b>82</b>	<b>39</b>	<b>43</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	Tumusingha											
88.	Kantajharia	453	286	1252	633	619	280	144	136	179	85	94
89.	Bhairapur (R)	427	205	911	469	442	0	0	0	344	173	171
90.	Bhairapur (L)	423	587	2717	1420	1297	298	152	146	176	83	93
	<b>Total</b>	<b>1303</b>	<b>1078</b>	<b>4880</b>	<b>2522</b>	<b>2358</b>	<b>578</b>	<b>296</b>	<b>282</b>	<b>699</b>	<b>341</b>	<b>358</b>
	Grand Total	22096	18273	80120	41147	38973	14706	7455	7251	14072	698 2	7090

*Source: Primary Censes Abstract and Village Directory 2011 District Dhenkanal(Odisha)*

**TABLE 3-34 LITERACY POPULATION DETAILS**

SR.NO	Name	Total Population	Population Literacy	Male Literacy	Female Literacy	Population Illiteracy	Male Illiteracy	Female	Child Population	Boys	Girls
	Dhenkanal										
	Parajang										
1.	Tulasipasi	344	267	159	108	77	31	46	37	23	14
	<b>Total</b>	<b>344</b>	<b>267</b>	<b>159</b>	<b>108</b>	<b>77</b>	<b>31</b>	<b>46</b>	<b>37</b>	<b>23</b>	<b>14</b>
	Kamakshyanagar										
2.	Kankana	1704	1129	653	476	575	241	334	245	134	111
3.	Raibol	976	697	395	302	279	102	177	117	60	57
4.	Hadagari	477	288	161	127	189	71	118	51	27	24
5.	Rahani	1511	881	508	373	630	260	370	208	108	100
6.	Tandi Munda	804	627	244	383	177	55	122	99	36	63
7.	Rangamatia	110	54	37	17	56	22	34	17	8	9
8.	Jiridamali	2558	2036	1156	880	522	202	320	265	135	130
9.	Balabhadrapurpatna	217	178	113	65	39	18	21	18	15	3
10.	Malapura	1807	1300	715	585	507	188	319	200	95	105
11.	Rajakulakateni	259	217	111	106	42	14	28	23	9	14
12.	Santarapur	496	387	213	174	109	46	63	70	35	35
13.	Khatakhura	1688	1253	703	550	435	166	269	167	84	83
14.	Bhandaria oraf Brundabanpur	191	162	88	74	29	10	19	22	10	12
15.	Tangarapada	665	445	254	191	220	96	124	77	41	36
16.	Karadapal	33	14	6	8	19	7	12	6	2	4
17.	Badamuktapasi	400	195	120	75	205	96	109	57	38	19

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18.	Mathakaragola	3614	2867	1563	1304	747	305	442	384	199	185
19.	Origaon	771	559	309	250	212	100	112	82	52	30
20.	Lokpali	571	500	265	235	71	41	30	69	40	29
21.	Arasahi	237	190	103	87	47	15	32	26	10	16
22.	Lokanathapur	641	497	278	219	144	54	90	77	38	39
23.	Siarimalia	817	605	327	278	212	90	122	108	61	47
24.	Arachua	505	358	198	160	147	52	95	69	29	40
25.	Badasuanlo	2154	1443	794	649	711	283	428	228	127	101
26.	Dhobania	81	23	13	10	58	30	28	18	13	5
27.	Nuapani	363	292	171	121	71	23	48	28	16	12
28.	Baligorada	1962	1475	830	645	487	180	307	199	105	94
29.	Tentulisingha	585	444	255	189	141	47	94	73	41	32
30.	Kandarasingha	404	300	158	142	104	42	62	54	34	20
31.	Kakudia	365	280	163	117	85	37	48	30	22	8
32.	Saruali	2015	1331	735	596	684	301	383	249	139	110
33.	Sunajhari	256	179	103	76	77	32	45	56	25	31
34.	Bampu	356	283	158	125	73	31	42	53	26	27
35.	Mota	1270	1016	559	457	254	105	149	133	74	59
36.	Pipala	788	542	295	247	246	88	158	85	45	40
37.	Kangeilo	1527	1030	570	460	497	214	283	167	88	79
38.	Korianpal	856	487	296	191	369	151	218	105	52	53
39.	Kanchhia	1059	595	334	261	464	188	276	153	75	78
40.	Jagannathpur	1338	1037	566	471	301	115	186	150	83	67
41.	Malangadihi	72	66	32	34	6	3	3	4	3	1
42.	Badura	65	50	28	22	15	7	8	4	2	2
43.	Manitri	873	481	262	219	392	170	222	114	64	50

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44.	Palikateni	554	431	187	244	123	45	78	65	34	31
45.	Khandabandha	167	90	53	37	77	30	47	22	13	9
46.	Suniamaru	110	79	45	34	31	15	16	15	12	3
47.	Danapasi	356	215	142	73	141	43	98	33	16	17
48.	Shyamasundarpur	115	93	52	41	22	8	14	7	5	2
49.	Sanabrahmapur	578	318	186	132	260	121	139	69	43	26
50.	Khajuridihi	138	108	63	45	30	11	19	14	8	6
51.	Arakhapal	1011	807	442	365	204	79	125	92	54	38
52.	Bedhapal	1699	1384	777	607	315	137	178	173	104	69
53.	Jineilo	1085	835	462	373	250	110	140	102	56	46
54.	Mugapada	358	272	156	116	86	36	50	36	26	10
55.	Kendudhipa	562	292	184	108	270	118	152	50	30	20
56.	Jiral	5435	4227	2339	1888	1208	508	700	519	283	236
57.	Santarapur	305	261	138	123	44	19	25	34	17	17
58.	Kairanali	561	390	216	174	171	83	88	46	29	17
59.	Saradeipur	234	207	107	100	27	9	18	17	9	8
60.	Dighi	1485	989	565	424	496	203	293	174	97	77
61.	Goradia	1469	954	525	429	515	223	292	166	92	74
62.	Dimiria	1421	1116	652	464	305	117	188	140	83	57
63.	Rankia	1091	761	412	349	330	126	204	110	57	53
	<b>Total</b>	<b>56175</b>	<b>40622</b>	<b>22545</b>	<b>18077</b>	<b>15553</b>	<b>6339</b>	<b>9214</b>	<b>6244</b>	<b>3368</b>	<b>2876</b>
	Kankadahad										
64.	Sasapasi	1578	1133	650	483	445	175	270	185	89	96
65.	Jamuchakada	332	263	159	104	69	24	45	33	13	20
66.	Koli Bania Kateni	134	109	63	46	25	10	15	13	8	5
67.	Makuakateni	1095	838	480	358	257	97	160	112	66	46

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68.	Mahidharpur	2	2	1	1	0	0	0	0	0	0
69.	Kairatangar	719	525	300	225	194	59	135	76	35	41
70.	Baghua	383	181	122	59	202	63	139	53	26	27
71.	Tarajanga	619	440	240	200	179	85	94	83	47	36
72.	Bagha Basa	446	249	154	95	197	63	134	49	18	31
	<b>Total</b>	<b>5308</b>	<b>3740</b>	<b>2169</b>	<b>1571</b>	<b>1568</b>	<b>576</b>	<b>992</b>	<b>604</b>	<b>302</b>	<b>302</b>
	Bhuban										
73.	Anala	1487	1112	627	485	375	139	236	156	83	73
74.	Kanheipal	1875	1352	776	576	523	179	344	192	95	97
75.	Bamuan	664	519	284	235	145	73	72	98	57	41
76.	Tipilei	1162	832	474	358	330	129	201	141	74	67
77.	Dayanabili	819	598	327	271	221	78	143	84	36	48
78.	Mathanuagan	834	561	321	240	273	112	161	78	41	37
79.	Balipada	22	19	9	10	3	0	3	3	0	3
80.	Siaridoli	53	38	22	16	15	7	8	6	3	3
81.	Nrasinghapur oraf Krushnapur	513	230	136	94	283	133	150	80	45	35
82.	Jamunakote	3009	2293	1212	1081	716	272	444	297	158	139
83.	Gheekhola	13	8	4	4	5	3	2	4	3	1
84.	Adipura	1605	1044	569	475	561	221	340	196	97	99
85.	Gobindabidyadhar Pur Patana	266	238	124	114	28	11	17	21	8	13
86.	Odhana	1009	594	340	254	415	185	230	125	74	51
	<b>Total</b>	<b>13331</b>	<b>9438</b>	<b>5225</b>	<b>4213</b>	<b>3893</b>	<b>1542</b>	<b>2351</b>	<b>1481</b>	<b>774</b>	<b>707</b>
	Gandia										
87.	Kumbharunibati	82	61	30	31	21	9	12	6	3	3

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	<b>Total</b>	<b>82</b>	<b>61</b>	<b>30</b>	<b>31</b>	<b>21</b>	<b>9</b>	<b>12</b>	<b>6</b>	<b>3</b>	<b>3</b>
	Tumusingha										
88.	Kantajharia	1252	849	487	362	403	146	257	127	59	68
89.	Bhairapur (R)	911	557	320	237	354	149	205	99	62	37
90.	Bhairapur (L)	2717	1962	1104	858	755	316	439	276	152	124
	<b>Total</b>	<b>4880</b>	<b>3368</b>	<b>1911</b>	<b>1457</b>	<b>1512</b>	<b>611</b>	<b>901</b>	<b>502</b>	<b>273</b>	<b>229</b>
	Grand Total	80120	57496	32039	25457	22624	9108	13516	8874	4743	4131

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**TABLE 3-18 EMPLOYMENT PATTERN**

SR.NO	Name	Total Population	Total Worker	Tptal Worker Male	Total Worker Female	Main Worker Population	Main Worker Male	Main Worker Female	Marginal Work population	Marginal Worker Male	Marginal Worker Female	Non Worker Population	Non Worker Male	Non Worker Female
	Dhenkanal													
	Parajang													
1.	Tulasipasi	344	166	121	45	20	15	5	146	106	40	178	69	109
	Total	344	166	121	45	20	15	5	146	106	40	178	69	109
	Kamakshyanagar													
2.	Kankana	1704	828	555	273	555	463	92	273	92	181	876	339	537
3.	Raibol	976	503	300	203	219	207	12	284	93	191	473	197	276
4.	Hadagari	477	276	149	127	231	134	97	45	15	30	201	83	118
5.	Rahani	1511	551	442	109	385	332	53	166	110	56	960	326	634
6.	Tandi Munda	804	254	165	89	161	134	27	93	31	62	550	134	416
7.	Rangamatia	110	48	23	25	23	17	6	25	6	19	62	36	26
8.	Jiridamali	2558	849	714	135	723	611	112	126	103	23	1709	644	1065
9.	Balabhadrapurpatna	217	71	63	8	44	38	6	27	25	2	146	68	78
10.	Malapura	1807	670	496	174	600	478	122	70	18	52	1137	407	730
11.	Rajakulakateni	259	45	43	2	32	31	1	13	12	1	214	82	132
12.	Santarapur	496	159	152	7	157	151	6	2	1	1	337	107	230
13.	Khatakhura	1688	688	518	170	498	395	103	190	123	67	1000	351	649
14.	Bhandaria oraf Brundabanpur	191	103	61	42	31	28	3	72	33	39	88	37	51
15.	Tangarapada	665	245	207	38	198	176	22	47	31	16	420	143	277
16.	Karadapal	33	11	9	2	6	6	0	5	3	2	22	4	18
17.	Badamuktapasi	400	129	111	18	71	68	3	58	43	15	271	105	166
18.	Mathakaragola	3614	1224	1027	197	775	707	68	449	320	129	2390	841	1549
19.	Origaon	771	397	266	131	155	148	7	242	118	124	374	143	231
20.	Lokpali	571	504	264	240	131	116	15	373	148	225	67	42	25
21.	Arasahi	237	189	101	88	55	39	16	134	62	72	48	17	31
22.	Lokanathapur	641	211	175	36	148	137	11	63	38	25	430	157	273
23.	Siarimalia	817	343	248	95	198	188	10	145	60	85	474	169	305
24.	Arachua	505	175	158	17	141	135	6	34	23	11	330	92	238

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25.	Badasuanlo	2154	713	594	119	463	417	46	250	177	73	1441	483	958
26.	Dhobania	81	45	23	22	44	23	21	1	0	1	36	20	16
27.	Nuapani	363	130	109	21	110	98	12	20	11	9	233	85	148
28.	Baligorada	1962	655	517	138	493	449	44	162	68	94	1307	493	814
29.	Tentulisingha	585	228	173	55	208	164	44	20	9	11	357	129	228
30.	Kandarasingha	404	119	110	9	98	97	1	21	13	8	285	90	195
31.	Kakudia	365	188	121	67	87	75	12	101	46	55	177	79	98
32.	Saruali	2015	680	571	109	572	551	21	108	20	88	1335	465	870
33.	Sunajhari	256	118	74	44	63	62	1	55	12	43	138	61	77
34.	Bampu	356	181	106	75	71	70	1	110	36	74	175	83	92
35.	Mota	1270	456	374	82	321	300	21	135	74	61	814	290	524
36.	Pipala	788	258	204	54	255	201	54	3	3	0	530	179	351
37.	Kangeilo	1527	557	477	80	378	358	20	179	119	60	970	307	663
38.	Korianpal	856	320	266	54	274	255	19	46	11	35	536	181	355
39.	Kanchhia	1059	514	291	223	106	92	14	408	199	209	545	231	314
40.	Jagannathpur	1338	410	369	41	86	71	15	324	298	26	928	312	616
41.	Malangadihi	72	14	14	0	3	3	0	11	11	0	58	21	37
42.	Badura	65	41	25	16	8	8	0	33	17	16	24	10	14
43.	Manitri	873	262	233	29	52	50	2	210	183	27	611	199	412
44.	Palikateni	554	140	132	8	12	7	5	128	125	3	414	100	314
45.	Khandabandha	167	85	51	34	29	27	2	56	24	32	82	32	50
46.	Suniamaru	110	41	30	11	18	15	3	23	15	8	69	30	39
47.	Danapasi	356	231	114	117	7	6	1	224	108	116	125	71	54
48.	Shyamasundarpur	115	41	34	7	14	13	1	27	21	6	74	26	48
49.	Sanabrahmapur	578	169	159	10	113	106	7	56	53	3	409	148	261
50.	Khajuridihi	138	42	41	1	39	38	1	3	3	0	96	33	63
51.	Arakhapal	1011	273	246	27	83	70	13	190	176	14	738	275	463
52.	Bedhapal	1699	507	489	18	483	470	13	24	19	5	1192	425	767
53.	Jineilo	1085	326	306	20	249	241	8	77	65	12	759	266	493
54.	Mugapada	358	117	101	16	87	82	5	30	19	11	241	91	150
55.	Kendudhipa	562	223	167	56	165	160	5	58	7	51	339	135	204
56.	Jiral	5435	1864	1576	288	1408	1317	91	456	259	197	3571	1271	2300
57.	Santarapur	305	127	89	38	2	1	1	125	88	37	178	68	110
58.	Kairanali	561	193	167	26	148	142	6	45	25	20	368	132	236

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59.	Saradeipur	234	58	56	2	54	53	1	4	3	1	176	60	116
60.	Dighi	1485	549	444	105	392	378	14	157	66	91	936	324	612
61.	Goradia	1469	569	394	175	380	321	59	189	73	116	900	354	546
62.	Dimiria	1421	443	422	21	242	235	7	201	187	14	978	347	631
63.	Rankia	1091	371	303	68	131	114	17	240	189	51	720	235	485
	Total	56175	20731	16219	4512	13285	11879	1406	7446	4340	3106	35444	12665	22779
	Kankadahad													
64.	Sasapasi	1578	765	439	326	721	405	316	44	34	10	813	386	427
65.	Jamuchakada	332	178	119	59	149	113	36	29	6	23	154	64	90
66.	Koli Bania Kateni	134	42	39	3	34	31	3	8	8	0	92	34	58
67.	Makuakatani	1095	486	364	122	291	276	15	195	88	107	609	213	396
68.	Mahidharpur	2	1	1	0	0	0	0	1	1	0	1	0	1
69.	Kairatangar	719	345	250	95	45	38	7	300	212	88	374	109	265
70.	Baghua	383	192	116	76	93	83	10	99	33	66	191	69	122
71.	Tarajanga	619	206	184	22	110	102	8	96	82	14	413	141	272
72.	Bagha Basa	446	238	141	97	15	13	2	223	128	95	208	76	132
	Total	5308	2453	1653	800	1458	1061	397	995	592	403	2855	1092	1763
	Bhuban													
73.	Anala	1487	489	446	43	402	388	14	87	58	29	998	320	678
74.	Kanheipal	1875	668	528	140	409	400	9	259	128	131	1207	427	780
75.	Bamuan	664	222	192	30	106	101	5	116	91	25	442	165	277
76.	Tipilei	1162	493	386	107	190	187	3	303	199	104	669	217	452
77.	Dayanabili	819	388	256	132	283	233	50	105	23	82	431	149	282
78.	Mathanuagan	834	296	245	51	126	118	8	170	127	43	538	188	350
79.	Balipada	22	10	7	3	10	7	3	0	0	0	12	2	10
80.	Siaridoli	53	12	12	0	12	12	0	0	0	0	41	17	24
81.	Nrusinghapur oraf Krushnapur	513	176	148	28	144	133	11	32	15	17	337	121	216
82.	Jamunakote	3009	1089	820	269	603	555	48	486	265	221	1920	664	1256
83.	Gheekhola	13	4	4	0	4	4	0	0	0	0	9	3	6
84.	Adipura	1605	584	441	143	475	360	115	109	81	28	1021	349	672
85.	Gobindabidyadhar Pur Patana	266	80	71	9	65	58	7	15	13	2	186	64	122
86.	Odhana	1009	260	244	16	169	160	9	91	84	7	749	281	468

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	<b>Total</b>	13331	4771	3800	971	2998	2716	282	1773	1084	689	8560	2967	5593
	Gandia													
87.	Kumbharunibati	82	27	27	0	25	25	0	2	2	0	55	12	43
	Total	82	27	27	0	25	25	0	2	2	0	55	12	43
	Tumusingha													
88.	Kantajharia	1252	394	339	55	353	325	28	41	14	27	858	294	564
89.	Bhairapur (R)	911	330	254	76	111	103	8	219	151	68	581	215	366
90.	Bhairapur (L)	2717	900	794	106	776	735	41	124	59	65	1817	626	1191
	<b>Total</b>	4880	1624	1387	237	1240	1163	77	384	224	160	3256	1135	2121
	<b>Grand Total</b>	<b>80120</b>	<b>29772</b>	<b>23207</b>	<b>6565</b>	<b>19026</b>	<b>16859</b>	<b>2167</b>	<b>10746</b>	<b>6348</b>	<b>4398</b>	<b>50348</b>	<b>17940</b>	<b>32408</b>

**The salient features of Socio-economic Profile are as follows:**

### **Demographic Structure**

The details regarding demographic structure are given below and statistical data is given in above **Tables**.

#### **1. Educational Structure**

- The literacy rate of the total population is worked out to 57496(71.76%). Male literacy 32039 (55.72%), and female literacy is 25457 (44.28%).
- The illiteracy rate of the total population is worked out to 22624(28.24%). Male illiteracy 9108(40.26%), and female illiteracy is 13516 (59.74%).

#### **2. Occupational Pattern**

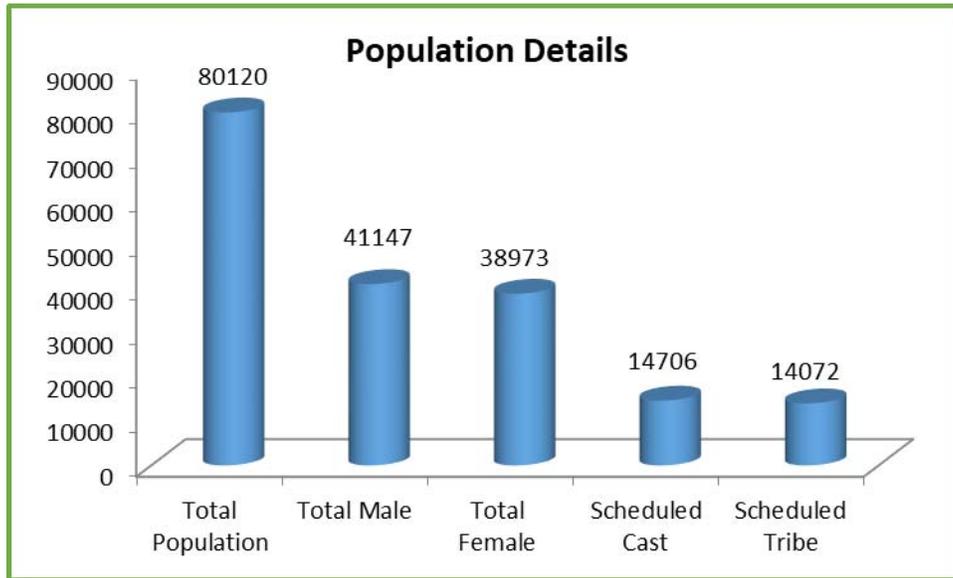
- The total population of Total Worker, main worker, marginal worker and non-worker category are 29772 (37.16%), 19026 (23.75%), 10746(13.41%) and 50348(62.84%) respectively.
- The majority patterns of the main other worker and agriculture worker 8386(44.08%) and is 5235 (27.51%). There are 4752(24.98%) and 653(3.43%) as cultivator worker and household worker.
- The total worker population is 29772 (37.16%). Male total worker 23207(77.95%), and female total worker is 6565(22.05%).
- The main worker population is 19026(23.75%). Male main worker 16859(88.61%), and female main worker is 2167 (11.39%).
- The marginal worker population is 10746 (13.41%). Male marginal worker 6348(59.07%), and female marginal worker is 4398 (40.93%).
- The total non-worker population is 50348 (62.84%). Male non-worker 17940(35.63%), and female non-worker is 32408(64.37%).
- The cultivator worker population is 4752 (24.98%). Male cultivator worker 4624(97.31%), and female cultivator worker is 128 (2.69%).
- The agriculture worker population is 5235 (27.51%). Male agriculture worker 4268(81.53%), and female agriculture worker is 967 (18.47%).
- The household worker population is 653(3.43%). Male household worker 527(80.70%), and female household worker is 126(19.30%).

- The main other worker population is 8386 (44.08%). Male main other worker 7440(88.72%), and female main other worker is 946(11.28%).
- During survey it was reported monthly family income are Rs.8000/- to Rs.50000/-

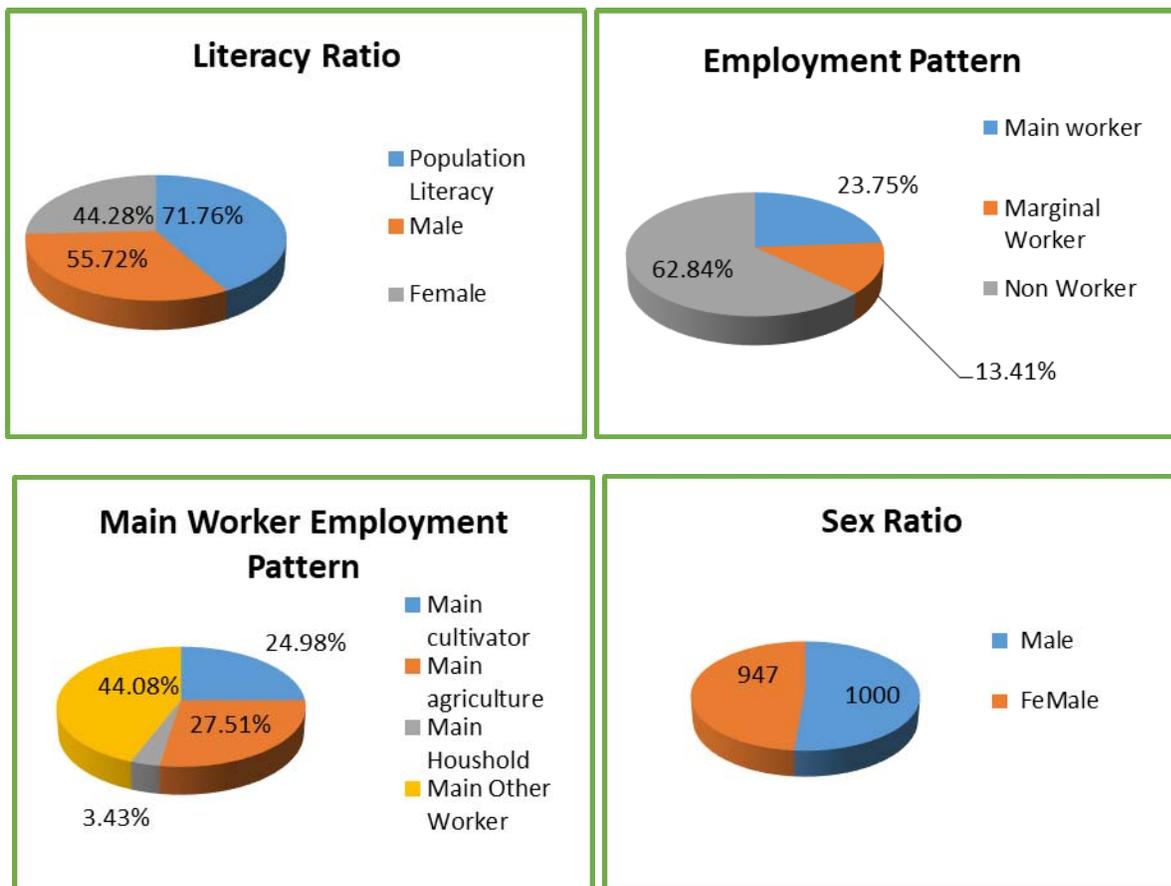
### **Economy and Industry Profile in Dhenkanal District**

- Dhenkanal town, east-central Odisha state, eastern India. The town is named for Dhenka, a medieval chieftain of the Savara people. It is a marketplace for Rice, Oilseeds and Timber and is a center of Handloom weaving. Dhenkanal was formerly the capital of the princely state of Dhenkanal, which was incorporated in 1949 into what became Odisha state in 1950. With a long, rich history of strong rulers that date back to the 15th and 16th centuries, Dhenkanal is filled with imposing palaces and forts, and intriguing archaeological remains of eras gone by. Much of the region is covered in dense foliage and gushing rivers, such as the Ramial and Mahanadi and is home to myriad species of Flora and Fauna. These areas are bound to excite travelers who have a penchant for wildlife and natural wonders. A number of temples also dot this scenic city, notching up its Tourism quotient quite high.
- Agriculture occupies a vital place in the economy of the district, as it provides direct and indirect employment to around 70 % of its total work force, as per the 2001 census. The total cultivable area of this District is 115000 hectares, covering 30.0 % of its total geographical area. The major crops of the Kharif season are paddy, maize, ragi, oilseeds, pulses, small millets and vegetables etc. Paddy, wheat, maize, field pea, sunflower, garlic, ginger, potato, onion, tobacco, sugarcane and coriander etc are the major Rabi crops. The last decade has witnessed a tremendous improvement in the industrial scenario of the District. Besides various kinds of handicraft works like Dhokra, Brass and bell metal, horn works, straw works and wood carving have been developed by the skilled workers and artisans of the district.
- M/s Scaw Industries (P) Ltd., M/s Tata Bhusan Steel & Strips,, M/s Rana Sponge Ltd. & BRG iron & Steel Ltd. Are some of the major plants within Dhenkanal district established during 2006-07 till 2005-06, seven chrome ore beneficiation plants (COBP) are operating within Dhenkanal. The quantity of low grade chrome ore utilized by these plants during 2005-06 varied between 96 MT to 532 MT.

**Graphs of Demographic structure**



**FIGURE 3-9 POPULATION DETAILS**



**FIGURE 3-10 LITERACY RATE**

### **3.13.2 INFRASTRUCTURE RESOURCES**

According to 2011 censuses record, the infrastructure resources in the study area with reference to education, medical facility, water supply, postal, transportation, communication and power supply are available however, which needs to be strengthened. The details of infrastructure resources have been abstracted from housing, household amenities and assets VD 2011 of Dhenkanal District (Orissa). The description of infrastructure resources attributes is:

#### **1. Education Facilities**

All villages in the study area have education facilities such as primary school with reasonably good facilities. Literacy rate found to be quite encouraging within the study area as the education level in the villages is comparatively good, i.e. more than 71.76% people are literate. Due to better transport from villages to taluka place and district place Dhenkanal. Students have opportunity to travel for better education. The survey reported that most of the villages have primary and secondary school facility (10th Standard), for further education student have to go about 5 to 40 km away. In the study area observed that most of student choose English medium for education. For higher & technical education people have to go to Taluka place and District place.

#### **2. Health Facilities**

Very few villages in the study area have medical facilities. While conducting surveys in this area, observed some villages have Health facilities like sub-center, Primary Health Center [PHC], and some villages have private clinic for better medical treatment, the people move to nearby town and district place Dhenkanal, where medical facilities are available.

No major diseases were reported by local people in the study area except routine cough, cold and fever etc. Local people mentioned about the lack of medical related equipments, infrastructure and poor coverage of the existing health services. The PHCs in the study area are lack of basic equipments and trained staffs and hence people are expecting better health infrastructure with adequate staff.

#### **3. Water and Sanitation facilities**

One of the most important factors responsible for the emergence of a settlement is availability of water. In surveyed all villages, it was found that people are using Tap water,

tank ,well tube, Reverse osmosis (RO) water for drinking purposes; however, pond water also used of other purpose.

During the field study and interaction with local people, it is observed that sanitation is good in nearby villages. Government has launched the scheme for sanitation and gives subsidy for toilet construction, but still they are not ready to build toilets at home. From the data we can say that there is good facility of the drinking water in all the study villages. Awareness level about sanitation is very low because they still prefer to go outside despite of they received government subsidy to construct toilets.

#### **4. Power Supply**

According to 2011 censuses record, electricity facility is available in the region. All villagers are using electricity for different proposes like domestic, agriculture and commercial.

#### **5. Communication and Transportation**

Transport plays a vital role between men, material and ideas in any region. It always supports for developing markets centres in rural area. Without an efficient transport market will not perform effectively. The mobility of goods and people from place to place is largely governed by efficient means of transport and communication. The availability of transport in region plays a key role in reducing an imbalanced development in study region. The road transport in study region plays dominant role in the origin and development of market centres. The study region has national and state highway, major district road, other district road and village roads.

### **3.13.3 LIVELIHOOD IN THE LOCAL VILLAGES**

During survey and interaction with local people it was revealed that majority of people are engaged in agricultural works, small business etc. as a source of livelihood. Paddy, wheat, maize, field pea, sunflower, garlic, ginger, potato, onion, tobacco, sugarcane and coriander etc are the major Rabi crops. Proposed study area does not involve any major place with religious, archaeological and historical importance.

## 4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### 4.1 GENERAL

Any human activity in any environment produces impact, modifying it to a status which is considered adverse or beneficial according to the damage or improvement it brings about in physical, biological and socio-economic status of baseline environment. Depending on the nature of activities and existing status, the impacts are assessed for their importance. On the basis of the impact analysis, the mitigating action and future monitoring requirement are focused in the Environmental Management Plan for countering or minimizing adverse impacts.

The following parameters are of significance in the EIA and are being discussed in detail:

- Land Environment
- Water Environment
- Air Environment
- Noise Environment
- Biological Environment
- Socio-Economic Environment

### 4.2 LAND ENVIRONMENT

**On River Bed:** The river mining does not involve any overburden/ waste. Thus, no waste dump sites are needed. Main aspects are excavation, loading and transportation activities.

**On Agriculture Field:** Since the dry sand mining will be carried out in the river bed, no impacts on surrounding agriculture lands is envisaged.

Anticipated Impacts	Mitigation measures
<ul style="list-style-type: none"> <li>▪ Obstruction in river flow / course.</li> <li>▪ Erosion of channel bed and banks.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Mining of minerals will be started from dip side towards rise at the centre and also laterally in 1.0-m slice. Unwanted material or spillage (if any) will not be stacked by the side of the excavation voids created. Excavation will be carried out in a manner so that water flow / course will</li> </ul>

<b>Anticipated Impacts</b>	<b>Mitigation measures</b>
<ul style="list-style-type: none"> <li>▪ Increase in channel slope</li> <li>▪ Change in channel morphology.</li> <li>▪ Impact on stream's physical characteristics such as channel geometry, bed elevation in stream roughness of the bed, flow velocity, discharge capacity, sediment transportation capacity etc.</li> <li>▪ Impact on ecological equilibrium of riverine regime.</li> </ul>	<ul style="list-style-type: none"> <li>not be obstructed.</li> <li>▪ Mining is to be done leaving safety barrier or offset on both sides and maximum barrier should be on concave side of river preferably the flow channel (excavation void created) should be kept straight so as to help avoid erosion as side cutting or collapsing.</li> <li>▪ Safety zone or buffer area will be created from the river banks to minimize the instability &amp; erosion and to increase the stability of structures. These safety zones will not be mined out.</li> <li>▪ Quantities will be strictly limited so that sand accumulation rates are sufficient to avoid extended impacts on channel morphology.</li> <li>▪ Mining will be carried out as per approved Mine Plan in scientific and systematic way.</li> <li>▪ Sand mining will be restricted down to 3.0m below river bed or 1.0m above the ground water table, whichever less. Therefore, the mining will not intersect the ground water table.</li> <li>▪ Loss of habitat is minimized because the river bed mining will be carried only in dry bed which will not disturb the riverine ecosystem.</li> <li>▪ The mine working will remain confined to river bed only and in no case mining will disturb any surface area outside the river bed which may affect topography or drainage.</li> <li>▪ The mining from river bed will not have impact on natural</li> </ul>

<b>Anticipated Impacts</b>	<b>Mitigation measures</b>
	drainage of surrounding areas as the excavated sand from river bed is filled with first heavy flow in river during monsoon season.

### **4.3 WATER ENVIRONMENT**

<b>Anticipated Impacts</b>	<b>Mitigation measures</b>
<ul style="list-style-type: none"> <li>▪ Flow pattern might be changed due to river bed mining.</li> <li>▪ Mining activities depth will be increased, which may result in increase of flow velocity.</li> </ul>	<ul style="list-style-type: none"> <li>▪ No diversion is proposed. There will not be any adverse impact on flow pattern, surface hydrology and ground water regime.</li> <li>▪ Mining activities will be restricted to 3.0m depth, which will not cause much change in flow pattern of the river.</li> <li>▪ An offset of 20m will be left from both sides of river, which will minimize the chances of bank failure.</li> </ul>
Change in surface water quality and ground water quality.	<ul style="list-style-type: none"> <li>▪ There will be no change in surface water quality as river is seasonal.</li> <li>▪ Ground water quality will not be affected due to mining activities as it is restricted to 3.0m depth and the water level is 9-15 m bgl below the surface of river bed.</li> <li>▪ A safety zone of 50m around the wells will be created and it will be left un-mined.</li> <li>▪ The mining will not be allowed below the water table.</li> <li>▪ Regular monitoring of water samples will be done as precautionary measures.</li> </ul>

Impact on ground water recharge potential as the thickness of the natural filter materials (sediments) is reduce causing less infiltration.	Mining will be done as per approved Mine Plan and applicable Rules & Regulation, so that there is no damage on ground water recharge potential due to sand mining.
Waste water discharge.	Portable Bio-tiolets will be used; hence no sewage / liquid effluent will be generated and contamination is also not expected due to percolation.

#### **4.4 AIR ENVIRONMENT**

##### **Air Quality Impact Prediction (AQIP)**

The major sources of air pollution from the mine are dust generation due to loading & transportation of minor mineral and wind erosion of exposed material. In this present study, United States Environmental Protection Agency (USEPA – 42 series) approved mathematical equations, have been used to predict emission rates for different operations in mining including the mineral transportation. Air dispersion modelling is the mathematical simulation of how air pollutants disperse in the ambient atmosphere.

##### **Mathematical model used in modeling for Sand Mining**

**Impact through Mathematical Modeling:** For Sand Mining Project As explained in the previous chapter, the ambient air quality monitoring results show that all the parameters such as PM10, SO2, NOx and CO are within the limits prescribed by CPCB for “Industrial and Mixed use” areas as well as areas meant for “Residential and Rural” areas. The major contribution of air pollution is by river bed mining, such as excavation, loading, transportation, hauling operation and handling of sand. This will lead to momentary rise in the particulate matter (PM10).

**Air Pollution Modeling:** The impact of the sand mining on the air quality has been predicated using Fugitive Dust model (FDM), which is a computerized air quality model specifically designed for computing concentration and deposition impacts from fugitive dust sources. The sources may be point, line or area sources. The model has not been

designed to compute the impacts of buoyant point sources; thus, it contains no plume rise algorithm. The model is generally based on the well-known Gaussian Plume formulation for computing concentrations, but the model has been specifically adapted to incorporate an improved gradient transfer deposition algorithm. Emissions for each source are apportioned by the user into a series of particle size classes. A gravitational setting velocity and a deposition velocity are calculated by FDM for each class. The emission factors considered for emission load estimation are given in **Table-4.1**

**TABLE 4-1 EMISSION FACTORS USED FOR MODELING**

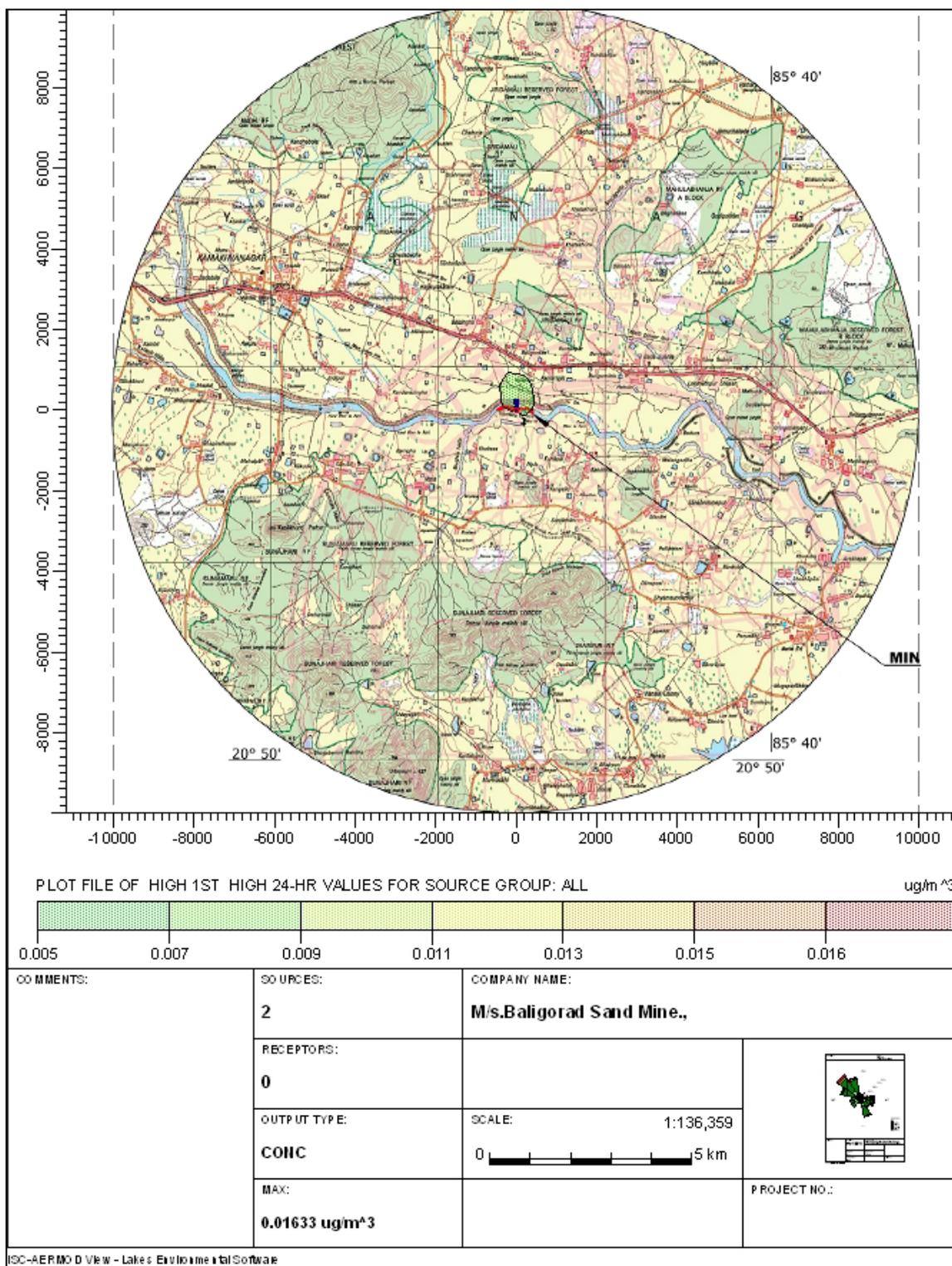
<b>Excavation of material</b>	
Quantity, m ³ /year	10902
Operations Hours Per Year	2640
Activity Rate, m ³ /Hr	4.13
Uncontrolled Emission Rate, g/s/m ²	0.00002
Controlled Emission Rate, g/s/m ²	0.00000002
<b>Transport of Material</b>	
Quantity, m ³ /year	10902
Operations Hours Per Year	2160
Capacity of Each Damper	10
Uncontrolled Emission Rate, g/s/m	3.4
Controlled Emission Rate, g/s/m ²	0.00034

The predicted ground level concentrations when added to Baseline scenario, the overall scenario levels of PM10, NOX and CO are well within the permissible limits as specified by NAAQ Standards. The predicted incremental GLC's are given below in detailed:

**RESULTANT CONCENTRATIONS DUE TO INCREMENTAL GLC'S**

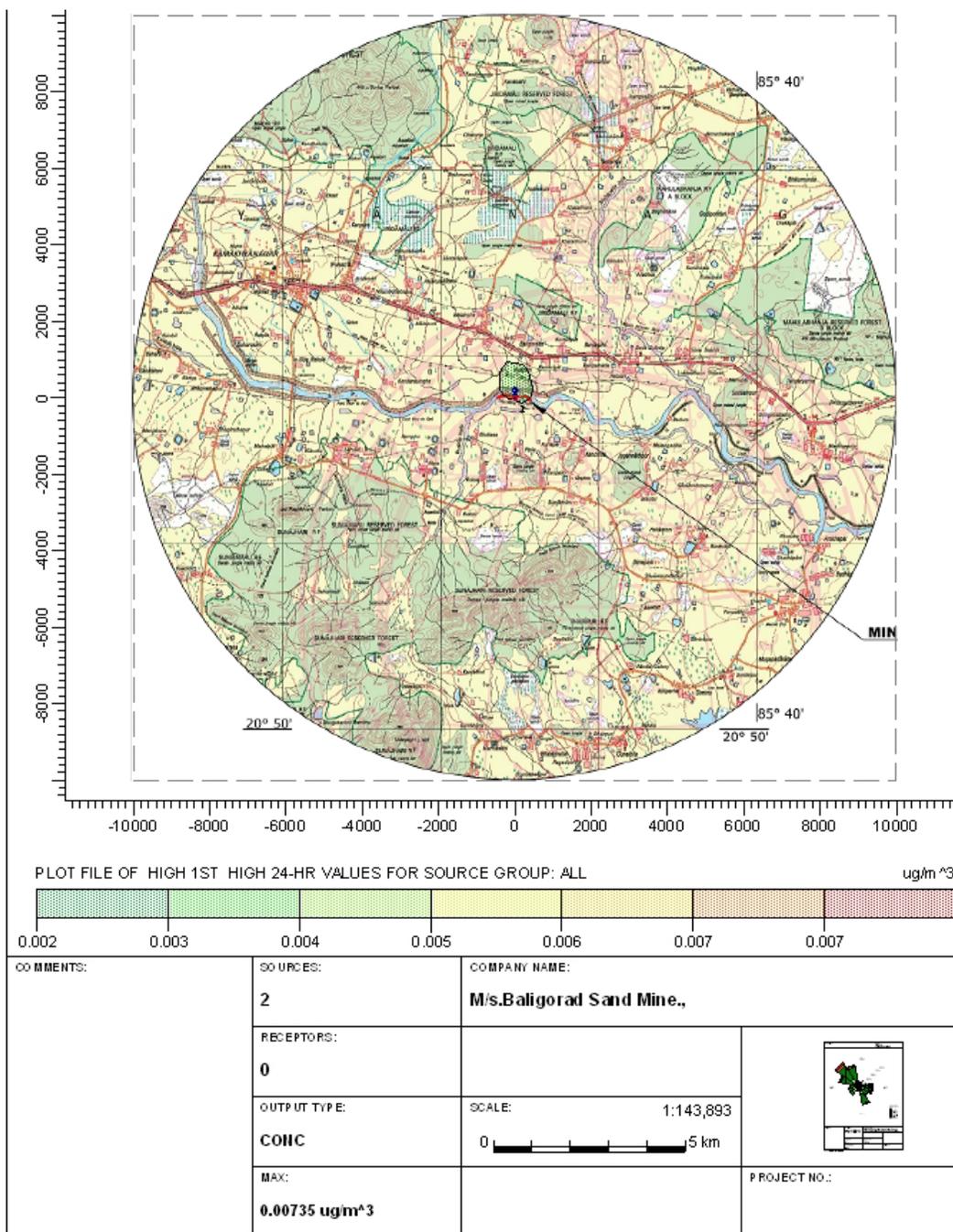
Pollutant	Baseline Concentration	Incremental Concentrations due to Proposed Project	Resultant Concentration	NAAQ Standards
PM10 (µg/m ³ )	63.0	0.01633	63.0163	100
PM2.5 (µg/m ³ )	28.8	0.0075	28.8075	60
NOx (µg/m ³ )	28.2	0.037	28.237	80
CO (mg/m ³ )	0.01	0.143	0.153	2.0

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**FIGURE 4-1 ISOPLETH FOR 1ST HIGH 24-HR AVERAGE INCREMENTAL CONCENTRATION OF PM10**

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ISC-AERMOD View - Lakes Environmental Software

**FIGURE 4-2 ISOPLETH FOR 1ST HIGH 24-HR AVERAGE INCREMENTAL CONCENTRATION OF PM2.5**

## **Results and Conclusions**

The ground level concentrations are computed for 24-hr average. The maximum ground level concentrations of Particulate matter from the different mining activities for study period were observed to be 63.02  $\mu\text{g}/\text{m}^3$ . The maximum GLC's were falling within the pit area/lease area for the given meteorological and topographical conditions.

From the above, it could be clearly seen that due effective implementation of various control measures as discussed in the proposed mine plan, there will not be any significant impact on the ambient air quality in the region as the resultant concentration of AAQ are much below the standard of 100  $\mu\text{g}/\text{m}^3$ .

## **Mitigation Measures**

- Water sprinkling will be done on the haul roads twice in a day.
- Plantation will be carried out on approach roads.
- Planning transportation routes of mined material so as to reach the nearest paved roads by shortest route. (minimize transportation over unpaved road);
- Dust mask provided to the workers engaged at dust generation points like excavations loading and unloading points.
- Speed limit will be enforced to reduce airborne fugitive dust from vehicular traffic.
- Deploying PUC certified vehicles to reduce their noise emission.
- Spillage from the trucks will be prevented by covering tarpaulin over the trucks.

## **4.5 NOISE ENVIRONMENT**

Since the mining operations are non-mechanised, there will not be any noise and vibrations related impacts. However, only noise generating activities are the truck movement carrying sand from mining lease area. The noise sources shall not generate sound levels above 90dB(A).

From the above we find that if the noise source of dBA, each at 400m from a receptor, converges at the receptor, their components would be 30 dBA respectively. With the resultant value being less than the ambient noise levels, there is no likelihood of excess addition of noise, from the mine operation, on the surrounding background noise level. As derived above and due to the fact that there is no human settlement within 600m, no

impact of noise on habitation is likely. The same is brought out by the noise measurements carried out which indicate that the noise levels in the vicinity are within limits.

<b>Impacts</b>	<b>Mitigations</b>
<ul style="list-style-type: none"> <li>▪ Noise Impact due to mining activities.</li> <li>▪ Noise impact due to vehicular movement.</li> <li>▪ Auditory impact</li> </ul>	<ul style="list-style-type: none"> <li>▪ The noise levels from all these sources are periodical and restricted to particular operation.</li> <li>▪ The noise measurement data indicated that present noise levels in the study area is within the permissible limits of National Ambient Noise Quality Standards.</li> <li>▪ Periodical monitoring of noise will be done.</li> <li>▪ No other equipments except the transportation vehicles will be allowed.</li> <li>▪ Noise generated by these equipments will be intermittent and does not cause much adverse impact.</li> <li>▪ Proper maintenance of all equipments/ machines will be carried out which help in reducing noise during operations.</li> <li>▪ Plantation will be taken up along the approach roads and vicinity of river bank. The plantation minimizes propagation of noise and also arrests dust.</li> <li>▪ Ear muffs will be provided while working on mining equipments.</li> <li>▪ Regular health check-ups will be conducted for any such health implications.</li> </ul>

#### **4.6 BIOLOGICAL ENVIRONMENT**

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation</b>
Temporary Road	Short-term disturbance in habitats of wildlife populations from noise	<ul style="list-style-type: none"> <li>▪ Do not cut trees that are larger in diameter than local regulations permit, or in the absence of</li> </ul>

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Aspect	Impact	Mitigation
	(impacts usually local and short-term)	<p>regulations, greater than 90-cm</p> <ul style="list-style-type: none"> <li>▪ Minimize clearing of vegetation. Leave in place smaller vegetation, topsoil, root, stock, seeds and endangered or protected species and species used by local</li> <li>▪ Communities for commercial or subsistence use.</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>▪ Erosion and changes in surface hydrology.</li> <li>▪ Vegetation cleared, disturbing local habitats.</li> </ul>	<ul style="list-style-type: none"> <li>▪ “Minimize the footprint”, use existing infrastructure to the extent possible to avoid or reduce clearing.</li> <li>▪ In clearing vegetation, use hand-cutting techniques to the extent possible, thereby avoiding the use of heavy machinery.</li> </ul>
Drainage	<ul style="list-style-type: none"> <li>▪ Erosion and changes in surface hydrology, causing short and possible long-term changes in local habitats.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Take topography, natural drainage and site runoff patterns into account.</li> <li>▪ Ensure adequate drainage away from streams, river and other waterways.</li> </ul>
Top soil loss	<ul style="list-style-type: none"> <li>▪ Impedes ability of habitats to revegetate, causing possible long-term damage to affected area.</li> <li>▪ Siltation of waterways, with negative impacts on surrounding environments.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Take topography, natural drainage and also site runoff patterns into accounts.</li> <li>▪ Ensure adequate drainage.</li> <li>▪ Stabilize all slopes, revegetating with native species to reduce/avoid erosion.</li> <li>▪ Break-up compacted surfaces and replace topsoil, brush, seed source, leaf litter, etc.</li> </ul>

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation</b>
Traffic	<ul style="list-style-type: none"> <li>▪ Short-term disturbance of habitats from traffic; short term disturbance of wildlife populations from noise.</li> <li>▪ Compaction of soils and changes in surface hydrology.</li> <li>▪ Killing of local wildlife.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Keep traffic to the absolute minimum requirements.</li> <li>▪ Impose and enforce speed limits and provide driving guidelines for vehicle operators.</li> <li>▪ Treat (water) road surfaces to manage dust.</li> <li>▪ Allow only authorized employee access to site(s) transportation.</li> </ul>

#### **4.7 SOCIO-ECONOMIC ENVIRONMENT**

<b>Aspect</b>	<b>Impact</b>	<b>Mitigation measure</b>
Habitation	No loss of habitation	<ul style="list-style-type: none"> <li>▪ All necessary measures are being taken, so that there is no disturbance to the normal life of persons.</li> </ul>
Employment Generation	<ul style="list-style-type: none"> <li>▪ Direct employment to 11 persons.</li> <li>▪ Improved income expenditure.</li> <li>▪ Improved micro investments – savings patterns.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Local people will be employed.</li> <li>▪ Training will be provided to non-workers and unskilled workers.</li> <li>▪ Awareness programme to motivate people for savings and investment.</li> </ul>
Health Implications	<ul style="list-style-type: none"> <li>▪ No health-related problems were reported during the primary survey.</li> <li>▪ No significant health implications to the workers due to mining activities.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Regular health camps will be organized for the local people.</li> <li>▪ Adequate numbers of medical facilities are situated in the area.</li> </ul>

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<b>Aspect</b>	<b>Impact</b>	<b>Mitigation measure</b>
Health impacts on mental, physical, and social well-being.	<ul style="list-style-type: none"> <li>The proposed project will not adversely impact the mental, physical and social well-being. It will improve the well-being of the people and the area.</li> </ul>	<ul style="list-style-type: none"> <li>Expectations in fair pay, employee care, social responsibility commitments etc. will be timely met. Grievance redressal mechanism is made to handle complaints from the study area.</li> </ul>
Loss / gain of self esteem	<ul style="list-style-type: none"> <li>A rise in the self-esteem due to increase rate of economic growth in the region. Higher degree of self-satisfaction and contentment.</li> </ul>	<ul style="list-style-type: none"> <li>Immigration in search of employment will be controlled.</li> </ul>
Loss/ gain of culture and religion	<ul style="list-style-type: none"> <li>The proposed project will follow universal respect for, and observance and protection of, human rights and fundamental freedoms for all.</li> </ul>	<ul style="list-style-type: none"> <li>The proposed project will promote neither selective, nor relative, but universal respect through contribution in various festivities, equal observance and protection among employees and societies at large in all CSR activities.</li> </ul>
<b>Corporate Environment Responsibility</b>		
The proposed project is a river bed sand mine and is providing to their employees all basic facilities.	<ul style="list-style-type: none"> <li>The mine will promote girl child education, women empowerment, scholarship to encourage the student and give donation to built toilet for sanitation.</li> <li>Community development will be designed and programmed by engaging with the panchayats and local authorities.</li> </ul>	<ul style="list-style-type: none"> <li>The mine will give boost to local population. Monetary gains, education, health, sanitation, water conservation, plantation and improvement in general environment will lead to positive growth.</li> </ul>

## **5 ANALYSIS OF ALTERNATIVES**

### **5.1 ALTERNATE TECHNOLOGY**

Manual opencast method is being involved in this mining. No alternative technology will be envisaged for this proposed enhancement project.

### **5.2 PROPOSED METHOD OF MINING**

The mining operations will be carried open excavation with manual method only.

#### **A. Over Burden Removal**

No overburden is anticipated.

#### **B. Loading**

The ordinary Sand will be loaded by manually by labours.

#### **C. Hauling**

Ordinary Sand is transported through tractors with trailers.

#### **D. Stock Yard**

There will be no generation of the sub grade material in the area and the entire sand will be dispatched for domestic uses.

### **5.3 ALTERNATE SITE**

The mineral deposits are site specific in nature; hence question of seeking alternate site does not arise.

### **5.4 CONNECTIVITY**

The lease area is located at a distance of 1.49 km from village Baligorad and at a distance of 5 kms from Kamakhyanagar, 45 kms from the District Headquarters Dhenkanal and 99 kms from the State Capital Bhubaneswar. Dhenkanal Railway station is the nearest railway station located at a distance of 25.6 kms from the lease area. Nearest Road Bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.

## **6 ENVIRONMENTAL MONITORING PROGRAMME**

### **6.1 INTRODUCTION**

Regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operation. The knowledge of baseline conditions, the monitoring program will serve as an indicator for any deterioration in environmental conditions due to operation of the project, to enable taking up suitable mitigatory steps in time to safeguard the environment. Monitoring is an important as that of control of pollution since the efficiency of control measures can only be determined by monitoring.

An impact assessment study is carried over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environmental quality.

### **6.2 ENVIRONMENTAL MONITORING AND REPORTING PROCEDURE**

Monitoring will conform those commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amount and concentrations of discharges. The objectives of the monitoring are: -

- a. Very effectiveness of planning decisions;
- b. Measure effectiveness of operational procedures;
- c. Conform statutory and corporate compliance; and
- d. Identify unexpected changes.

### **6.3 ENVIRONMENTAL MONITORING CELL**

A centralized Environmental Monitoring Cell will be established for monitoring of important and crucial environmental parameters which are of immense importance to assess the status of environment during mine operation. With the knowledge of initial parameters, deviations in environmental conditions due to operation of the mine will be assessed and suitable mitigation steps will be taken to safeguard the environment. The routine monitoring program will be implemented under the project monitoring as per CPCB & MoEF & CC guidelines.

The core responsibilities of the Environmental Monitoring Cell will be:-

- a. The organization and interpretation of the environmental monitoring data to establish a record of change associated with the implementation of a project or the operation of an organization.
- b. The process of verification that all or selected parameters measured by Environmental Monitoring Program are in compliance with regulatory requirements, internal policies and standards, and established environmental quality performance limits.
- c. The assessment of the effectiveness of the environmental management system, practices and procedures.
- d. The environmental monitoring and audit work will be carried out by qualified personnel.
- e. A summary of non-compliance of the environmental quality performance limits.
- f. To implement and monitor the control and protective measures based on the EMP.
- g. To coordinate the environment related activities to the top management within as well as with outside concerned agencies.
- h. To provide of health check up of workers and the people living in nearby villages.
- i. To develop greenbelt in the nearby villages, schools, Govt. offices and transportation routes.

#### **6.4 ENVIRONMENTAL MONITORING SCHEDULE**

Environmental monitoring schedules will be prepared covering various phases of project advancement, such as Mining and regular operational phase.

<b>S.no.</b>	<b>Potential Impact</b>	<b>Parameters for Monitoring</b>	<b>Frequency of Monitoring</b>	<b>Location</b>
<b>1.</b>	Air Emission	PM10, PM2.5, SO2, NO2, CO & Free Silica	As per CPCB / MoEF & CC requirement i.e. 24 hourly monitoring for one month in each season except monsoon season.	One location in the core mining area and four in buffer area.
<b>2.</b>	Noise	Spot Noise level recording Leq	Periodic / As per CPCB norms i.e. quarterly	One location in the core mining area and four in buffer area.

		(day),Leq (night), Leq (dn)		
3.	Water Quality	As per drinking water standards	Four times in a Year	One location in the core mining area and four in buffer area.
4.	Health	Total health parameters	Initial Medical Examination (IME) and Periodic Medical Examination – Once in a five year as per Mines Rules, 1955.	All employees

### **6.5 MONITORING SCHEDULE DURING OPERATIONAL PHASE**

During operational phase, dust will be the main pollutant which arises from different mining activities. The major attributes which merit regular monitoring based on the environmental setting and nature of project activities are listed below:

- ✓ Source emission and ambient air quality;
- ✓ Ground water levels and ground water quality;
- ✓ Water and waste water quality;
- ✓ Soil quality;
- ✓ Noise levels (equipment and machinery noise levels, occupational exposures and ambient noise levels); and
- ✓ Ecological preservation and a forestation

### **6.6 MONITORING METHODS**

#### **6.6.1 MONITORING OF AMBIENT AIR QUALITY WORKSPACE MONITORING**

The concentration of air borne pollutants in the workspace / work zone environment will be monitored periodically. If concentrations higher than threshold limit values will be observed, the source of fugitive emissions will be identified and necessary measures will be taken as detailed in EMP.

## **Ambient Air Quality Monitoring**

The ground level concentrations of PM₁₀, PM_{2.5}, SO₂, NO₂ and CO in the ambient air will be monitored at regular intervals. Any abnormal rise will be investigated to identify the causes and appropriate actions will be initiated. Greenbelt will be developed for minimizing dust propagation.

### **6.6.2 MONITORING OF WATER QUALITY**

#### **Monitoring of Ground Water**

The monitoring of groundwater is the most important tool to find out the depletion/increase in level of water table. Water table will be monitored at regular interval to check the behavior pattern of the water table. It is suggested to collect water samples and analyze. Records of analysis will be maintained.

#### **Monitoring of Surface Water**

Samples will be collected from well-mixed section of the river (main stream) and will be analyzed.

### **6.6.3 MONITORING OF NOISE LEVELS**

Noise levels in the work zone environment shall be monitored. The frequency will be once in three months in the work zone. Similarly, ambient noise levels near habitations will also be monitored once in three months. Audiometric tests will be conducted periodically for the employees working close to the high noise sources.

## **6.7 REPORTING SCHEDULES OF THE REPORTING DATA**

It is proposed that voluntary reporting of environmental performance with reference to the EMP will be undertaken.

The Environmental Monitoring Cell will co-ordinate all monitoring programs at site and data thus generated will be regularly furnished to the State regulatory agencies. The frequency of reporting will be on six monthly bases to the office of State Pollution Control Board and to the Regional Office of MoEF&CC. The Environmental Audit reports will be prepared for the entire year of operations and will be regularly submitted to regulatory authorities as per EC conditions.

## **6.8 CONCLUSION**

Post Environmental monitoring is an essential step in the EIA process if the predicted impacts, the efficiency of mitigation measures and the shortcomings of prediction methods, measures and even regulations are to be verified and EIA practice improved. Environmental indicators could contribute to designing and evaluating monitoring programs, thus improving establishment of the cause effect relationship and the reporting and communication of environmental data.

The Environmental Monitoring Cell will co-ordinate all monitoring programs at site and data thus generated will be furnished as per statutory requirements. The frequency of reporting will be on half yearly basis to the Odisha State Pollution Control Board and to Regional Office of MoEF&CC. The Environmental audit reports will be prepared for the entire year of operations and will be regularly submitted to regulatory authorities.

## **7 ADDITIONAL STUDIES**

### **7.1 INTRODUCTION**

The proposed project is for the mining (removal of sand), from the river bed of Ramial river by opencast Manual method of mining. Risk assessment & social impact assessment due to project has to be addressed, which are as follows:

### **7.2 RISK ANALYSIS**

Risk analysis is the systematic study of uncertainties and risks encountered in various areas. Risk analysis is to identify the risks involved in mining operations at various phases. Potential locations and activities around the proposed site are identified and probable risks are estimated on a person, business and Govt. establishment.

### **7.3 RISK PRIORITIZATION BASED ON HAZARDS IN SAND MINING**

Sand mining is done by open cast manual method. Mining is done only within the Ramial River stretch located near revenue village Baligorad of Kamakhyanagar Tahasil, Dhenkanal district. The lease area is 5.435ha. There is no land degradation due to mining activities as mining is done only on river bed surface. There will be no over Burden or waste generation as the sand is exposed in the river bed. There will be neither any stacking of soil nor creation of OB dumps. So, no dumping area as well as stock piling area is required. Therefore, there is no chance of failure of dumps and no slope failure due to Over Burden dump and stock piling.

However, there are various factors, which can create unsafe working conditions/ hazards in mining of sand (minor minerals) from river bed. The following types of hazards are identified during the sand mining operations:-

1. Accident during sand/mineral loading, unloading, transportation and dumping/piling
2. Accident due to vehicular movement
3. Inundation/ Flooding
4. Quick Sand Condition

### **7.4 MITIGATION MEASURES**

#### **Measures to prevent accidents during loading**

The following activities will be done to minimize the risk are:-

- ✓ The truck would be brought to a lower level so that the loading operation suits to the ergonomic condition of the workers.
- ✓ The workers will be provided with gloves and safety shoes during loading.
- ✓ Opening of the side covers (pattas) should be done carefully and with warning to prevent injury to the loaders.
- ✓ Operations during daylight only.

### **Measures to prevent accidents during vehicular movement & transportation**

The following activities will be done to minimize the risk are:-

- ✓ The truck will be covered with tarpaulin and maintained to prevent any spillage.
- ✓ To avoid danger while reversing the trackless vehicles especially at the embankment and tipping points, all areas for reversing of Lorries should be made man free as far as possible.
- ✓ The vehicles must be maintained in good repairs and checked thoroughly at least once in a week.
- ✓ All transportation within the main working will be carried out directly under the supervision and control of the management.
- ✓ Overloading should not be permitted and the maximum permissible speed limit should be ensured.
- ✓ The truck drivers should have proper driving license.
- ✓ A statutory provision of the fences, constant education, training etc. will go a long way in reducing the incidents of such accidents.

### **Measures to prevent incidents during Inundation/ Flooding**

The following activities will be done to minimize the risk are:-

- ✓ During monsoon months and heavy rains the mining operations are ceased.
- ✓ There should be mechanism/ warning system of heavy rains and discharges from the Up-stream dams.

- ✓ Inundation of flooding is expected and beneficial for these mines as during this time only the mineral reserve gets replenished.

#### **7.4.1 PRECAUTIONARY MEASURE FOR SUDDEN RELEASE OF WATER FROM UPSTREAM DAM**

The following activities will be done to minimize the risk are:-

- ✓ The mining should be done only during the dry season and under strict supervision.
- ✓ Mining activities should be avoided during monsoon season.
- ✓ No go zones should be clearly marked and made aware to the mine workers.
- ✓ Deep water areas must be identified.

#### **7.4.2 MEASURES TO PREVENT SUDDEN INCREASE IN WATER LEVEL**

The following activities will be done to minimize the risk are:-

- ✓ The mining activities will be restricted to 1m depth from river bed surface.
- ✓ Mining activities will be avoided during monsoon season.
- ✓ Mining will be done as per the approved Mining Plan and it will also be conformed to avoid the ponding effect.

### **7.5 DISASTER MANAGEMENT PLAN**

This should deal with action plan for high risk accidents like landslides, subsidence, flood, Inundation in mines, fire, seismic activities, tailing dam failures etc. and emergency plan proposed for quick evacuation, ameliorative measures to be taken etc. The capability of lessee to meet such eventualities and the assistance to be required from the local authorities should be described.

- ✓ The shallow depth of activities in river bed mining will not involve any high risk accident due to side falls/collapse.
- ✓ The complete mining operation will be carried out under the Management and control of experienced and qualified Mines Manager having Certificate of Competency to manage the mines granted by DGMS.
- ✓ All the provisions of Mines Act 1952, MMR 1961 and Mines Rules 1955 and other laws applicable to mine will strictly be complied with.

- ✓ During heavy rainfall the mining activities will be closed.
- ✓ All persons in supervisory capacity will be provided with proper communication facilities.
- ✓ Proper coordination with Irrigation Department will be maintained so that at the time of releasing water, if any, from the dam suitable warning/information is given in advance.

## **7.6 OCCUPATIONAL HEALTH HAZARDS**

Dry- pit mining by open cast method involves dust generation by excavation, loading and transportation of mineral. At site, during excavation and loading activity, dust is main pollutant which affects the health of workers whereas environmental and climatic conditions also generate the health problems.

Addressing the occupational health hazard means gaining an understanding of the source (its location and magnitude or concentration), identifying an exposure pathway (e.g. a means to get it in contact with someone), and determination of likely a receptor (someone receiving the stuff that is migrating).

Occupational hazard due to sand mining mainly comes under the physical hazards. Possible physical hazards are as below mention: -

### **7.6.1 PHYSICAL HAZARDS DUE TO MINING OPERATIONS**

Following health related hazards were identified due to riverbed sand mining operations to the workers:-

- ✓ **Light:** - The workers may be exposed to the risk of poor illumination or excessive brightness. The effects are eye strain, headache, eye pain and lachrymation, congestion around the cornea and eye fatigue.
- ✓ **Heat and Humidity:** - The most common physical hazard is heat. The direct effects of heat exposure are burns, heat exhaustion, heat stroke and heat cramps; the indirect effects are decreased efficiency, increased fatigue and enhanced accident rates. Heat and humidity are encountered in hot and humid condition when temperatures and air temperatures increase in summer time up to 49°C or above in the river bed mining area.

- ✓ **Eye Irritation:** - During the high windy days in summer the sand could be the problems for eyes like itching and watering of eyes.
- ✓ **Respiratory Problems:** - Large amounts of dust in air can be a health hazard, exacerbating respiratory disorders such as asthma and irritating the lungs and bronchial passages.
- ✓ **Noise Induced Hearing Loss:** - Transportation vehicles are the main source of noise pollution at the mine site.

## 7.7 MANAGEMENT OF HEALTH HAZARDS

Particulars	Control Measures
Heat & Light	<ul style="list-style-type: none"> <li><input type="checkbox"/> The mine site will have adequate drinking water supply so that workers do not get dehydration.</li> <li><input type="checkbox"/> Lightweight and loose-fitting clothes having light colors will be preferred to wear.</li> <li><input type="checkbox"/> Rigorous exercise and more physical activities will be avoided in hot weather.</li> </ul>
Noise	<ul style="list-style-type: none"> <li><input type="checkbox"/> Noise exposure measurements will be taken to determine the need for noise control strategies.</li> <li><input type="checkbox"/> The personal protective equipment will be provided for each mine workers.</li> <li><input type="checkbox"/> Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.</li> <li><input type="checkbox"/> At noisy working activity, exposure time will be minimized.</li> </ul>
Respiratory	<ul style="list-style-type: none"> <li><input type="checkbox"/> PPE like face mask etc. will be provided during mining activity.</li> <li><input type="checkbox"/> Periodic medical examinations will be provided for all workers.</li> <li><input type="checkbox"/> Awareness program will be organized for workers.</li> </ul>

## 7.8 SOCIO-ECONOMIC IMPACT ASSESSMENT

### 7.8.1 INTRODUCTION

Socio-Economic Impact Assessment (SEIA) refers to systematic analysis of various social and economic characteristics of human being living in a given geographical area. The geographical area is often called Study Area or Impact Area. SEIAA is carried out

simultaneously with Environment Impact Assessment (EIA). The objectives of the SEIAA are as follows:

- ✓ To identify and assess socio-economic activities, which are significantly influenced by mining activities.
- ✓ To examine the perceptions of local communities' how mining activities can impact the socio- economic life of the people
- ✓ To suggest interventions that can assist in mitigating the negative impacts of mining

#### **7.8.1.1 SCOPE OF THE PROPOSED STUDY**

1. Collection of baseline data of the study area
2. To comprehend socio-economic status of people living in the study area
3. To assess likely impact of the project on social and economic life of the people in the study area
4. To measure the impact of the project on Quality of life of the people living in the study area
5. To ensure sustainability of positive impacts
6. To recommend mitigation measures on adverse impacts.

#### **7.9 STUDY AREA**

The study area, also known as Impact Area has been defined as sum total of core and buffer area with a radius of 10km from the periphery of the project site. The study area includes all the land marks both natural and manmade, falling therein.

The Sand Mining area is located in the Ramial River. The lease area is devoid of any vegetation. It is a government land exclusively allotted for open cast sand mining. Land adjoining to lease area is private agricultural land growing various crops.

##### **7.9.1 IMPACT ON POPULATION COMPOSITION**

In general, no impact is envisaged on the population composition of the study area as there will be no in-migration or out-migration of villagers. Since all the workers will be recruited locally in-migration of people in search of job in the proposed mining project is not expected. Similarly, chances of out migration of people due to environmental degradation resulting from mining activities are remote as sand is not so lethal even if it is handled

loosely. Hence, there will be no negative impact on the population composition of the study area. If on the other hand, the project proponent is compelled to recruit few highly skilled workers from outside the study area the impact on population composition will be insignificant.

### **7.9.2 IMPACT ON EMPLOYMENT**

For removal of Sand from the river bed the project proponent intends to recruit the local people. The total number of people to be recruited will depend upon quantity of minerals to be extracted over a period of time. In the initial period the number of such people will be less but gradually it will go up when the extraction of minerals will pick up. It is definitely a positive impact of the proposed mining project.

It has been proposed that the mining will be carried out by open cast semi mechanised method and also by manual means. The labours are mainly required for excavating of sand. It has been calculated that a total of 13 nos. manpower will be required for the purpose. Hence, there will be an overall improvement of socio-economic status of the people in the surrounding areas.

It is expected that total number of workers in the study area will increase, when the project will be in operation. Though, the percentage increase in employment generation is negligible but it is definitely a positive impact of the proposed mining project.

### **7.9.3 SCOPE FOR DEVELOPMENT AND MAINTENANCE OF ROADS IN THE AREA**

Movement of trucks, dumpers and other vehicles to and fro the quarry site is expected to increase substantially, when the mine will start operation. The existing approach roads connecting the quarry with the national and state highways are narrow and uneven. There will be mud slides and traffic bottle necks if the road is not widened and their surface conditions are not improved to support heavy truck dumper traffic. Hence, there is a scope for development and maintenance of roads in the area. This is a positive impact of the project.

### **7.9.4 FLOOD CONTROL & PROTECTION TO LIFE AND PROPERTY**

The study area is exposed to annual flood resulting to destruction of life and property. Due to proposed mining the river channel will become deep enough to hold the excess water

that flows into the river during the rainy season. This will stop overflowing of the river submerging the fertile land on both sides of the river bank. In this way the proposed riverbed mining will save the standing crops and thousands of people and their property from the vagaries of annual floods. This is a positive impact of the project.

#### **7.9.5 IMPROVEMENT IN QUALITY OF LIFE OF THE LOCAL PEOPLE**

The mining project proposes to provide gainful employment to 11 people. This will add to their household income, and bring a positive change in their consumption pattern. The quality of life will improve to those households who will be benefitted by getting employment in the above mining project. This is a positive impact of the project.

#### **7.9.6 IMPACT ON STATE INCOME**

The upcoming mining project will make positive impact on state's economy as state's revenue will increase due to higher collection of royalty, dead rent, taxes and fees. This has been worked out by multiplying the sale price of mineral by rate of royalty (in percentage) and total quantity of mineral produced/ dispatched. It is a positive and direct impact of the project on State's Gross Domestic product (SGDP).

#### **7.9.7 IMPACT ON LAW & ORDER**

As local people will be deployed to run the quarry, no law & order problem is envisaged. It is expected that the workers will attend to their duties from their residences and return to their homes after the day's work is over. There would have ethnic issues and subsequent law & order problem if the workers were migrants and lived in shanties close to the mining area. However, to meet any untoward incident a police post may be set up close to the project area.

#### **7.9.8 CHECK ON ILLEGAL MINING**

Illegal sand extraction in the riverbed has far reaching impacts on the society as it creates disturbances in the social well-being of the people. There are instances of indiscriminate violation of 'Illegal Mining Rules' framed by various state governments. This has resulted to increase in the instances of conflicts in the area. Majority of the people who are engaged in illegal sand mining activities are outsiders with criminal backgrounds. They force the local people in different ways to sell their lands for extraction of sand and those who oppose

them are physically attacked. Conflict between the criminal groups for the monopoly of sand mining is a usual scene in many areas across the country and in many cases it is fatal. In such cases the common people are helpless as they are often threatened by the mafias. Further, illegal mining brings windfall gain to the sand mafias resulting to conspicuous expenditures especially on drinking, which again causes law and order problem in the mining area and its surrounding areas. Thus, illegal mining not only bring loss to the Government revenue but also create law and order problems in the mining area. The proposed mining project has legal backing since the lease has been granted by the Government and the miner will start operating the mine after the receipt of environment clearance and other permissions from the Government. Such projects with legal backing are expected to put a check on illegal mining and siphoning of government revenue.

#### **7.9.9 IMPACT ON HEALTH**

Mining is always a health hazard and extraction of Sand is no exception to that. The major health problem originates from mining of sand is the generation of dust and other pollutants. It exposes communities to airborne particulate matter that damages lungs of infants, children, elderly persons and those with existing health problems. This must be checked when mine starts operating, otherwise it will lead to permanent respiratory diseases.

**TABLE 7-1 SOCIAL & ECONOMIC IMPACTS OF SAND MINING PROJECT**

Sr. No.	Characteristics	Impact Type				
		Positive Impact		Negative Impact		No Impact
		Direct	In-direct	Direct	In-direct	
1	Population Composition	-	-	-	-	Yes
2	Formal Employment Generation	Yes	-	-	-	-
3	Informal Employment Generation	Yes	-	-	-	-
4	Increased Supply of sand for end users	Yes	-	-	-	-

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Mine, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**

5	Scope for promotion of sand based industries in the study area.	-	Yes	-	-	-
6	Scope for development and maintenance of roads in the area	-	Yes	-	-	-
7	Impact on Agriculture	-	-	-	-	Yes
8	Flood Control & protection to life and property	Yes	-	-	-	-
9	Improvement in Quality of life of the local people	-	Yes	-	-	-
10	Increase in State Income	Yes	-	-	-	-
11	Impact on Law & Order	-	-	-	-	Yes
12	Check on illegal Mining	Yes	-	-	-	-
13	Impact on Health	-	-	Yes	-	-

It may be seen from the above table that the up-coming mining project at Baligorad will yield positive impact in most cases, negative impact on two cases and no impact on one case.

### **7.10 SUGGESTIONS**

Under community health programmes, the mine operators will be encouraged to invest in the building of healthcare infrastructure like hospitals, clinics, health education resources, emergency response personnel and equipment, doctors, nurses and hygienists. Given below are few steps to be taken by the mine operator to meet any health hazard during the course of mining practices.

#### **7.10.1 SAFE WORK ENVIRONMENT**

The project proponent ensures health and safety of all the employees at work. He intends to provide and maintain a safe work environment and ensures that the machinery and

equipment in use will be safe for employees. He further ensures that work arrangements will be non-hazardous to employees.

**7.10.2 PROVISION OF FIRST AID:**

There will be provision for First Aid and the first aiders will be well trained in handling patients working in mines.

**7.10.3 REGULAR HEALTH EXAMINATION:**

Periodical medical examination as per Mines Rule 1955 will be undertaken for all the mine workers. Regular health examination will be compulsory for all workers engaged in extraction of minerals. The regular health examination will cover treatment of serious back injury; existing asthma or respiratory diseases, existing skin diseases, lung function test (pre and post ventolin), Audiograms, Chest X- ray, for detection of Silicosis as per mines Act. etc.

**7.10.4 NO WORK FOR TEMPORAL DISABILITIES:**

The workers having temporary disability will stop doing the job till he/she recovers from disabilities.

**7.10.5 HEALTH EDUCATION:**

Adequate health education and information related to the job will be provided to the workers. Baseline health information will be recorded for future references.

**7.10.6 TIE UP WITH THE NEAREST HOSPITAL FOR MEDICAL HELP**

To meet the medical needs of the mine workers tie-ups with nearest hospitals will be made. Efforts will be made to reserve few beds in the above hospitals for the workers of the upcoming mining project. This will ensure timely medical aid to the affected persons.

**7.10.7 SUPPLY OF MASK, GLOVES ETC.**

The workers in the sand mine are subject to respiratory diseases. It will be made compulsory for all workers to wear masks and gloves, while working in the mine to protect from Dust, Airpollution.

#### **7.10.8 ADMINISTRATION OF ANTI-VENOM INJECTIONS**

Provision of Anti-venom therapy will be made available for administration to the workers in case of snake, spider and insect bites, while working in the mine.

#### **7.10.9 SPECIAL TELEPHONE NUMBER**

A special telephone number will be made available to the workers in case of emergency so that they can dial the same for medical assistances. Further, efforts will be made to provide vehicles to the patients in short duration for shifting to the health institutions.

#### **7.10.10 SPECIAL GROUP INSURANCE SCHEME**

All the mine workers will be covered under a Group Insurance Scheme of LIC or any other Insurance company to achieve economic objectives and social obligations.

### **7.11 CORPORATE ENVIRONMENTAL RESPONSIBILITY**

Corporate Environmetnal Responsibility (CER) refers to responsibility of a company to ensure positive impact on environment, consumers, employees, communities, stakeholders and all other members of public sphere. CER is seen more as a responsibility towards society / Environment rather than a business promotion activity. It is the need of the day for expansion of occupational welfare. The project proponent of the upcoming sand mining project in village Baligorad, has already identified the activities, which are proposed to be undertaken for the benefits of the local community. This will not only improve the socio-economic status of the people but also enhance the reputation of the project proponent among the general public. The project proponent proposes to spend about Rs. 1.0 Lakhs. The list of activities proposed to be taken up by the project proponent list indicated below.

- ✓ Health camps for local community
- ✓ Financial assistance to schools for construction and maintenance of toilets separately for males and females.
- ✓ Repair of village roads
- ✓ Construction of Vats for dumping of garbage
- ✓ Repair of wells, tube wells and hand pumps

## **7.12 CONCLUSION**

During the course of the study some factors were identified that may influence the socio-economic life of the people in the study area. Except one all of them are positive impacts, which are expected to increase the quality of life of the local people. Beside the above the mining will bring revenue to the government.

The implementation of the quarry will generate both direct and indirect employment for the local jobseekers. Besides the above it will bring a check on illegal mining in the district. Since the quarries have been allotted by the Government on lease basis, mining operation will be legally valid It is expected that intending entrepreneurs will venture to set up micro and small-scale units in the near future making the area a mixed society, dependent on industry, trade and business. At present agriculture is the main occupation of the people. With the implementation of the proposed mining project the occupational pattern of the people in the area will change making more people engaged in industrial and business activities rather in agriculture. Thus, there will be a gradual shifting of population from agriculture to mining and industry. It thus proves that “Sand Mining activities have significant socio-economic impacts on livelihoods of local communities. However, care has to be taken to discourage illegal mining that results to social tension, conflicts and alcoholism that may pose a threat to the well being of the people living in the neighborhoods of the mining area.

## **8 PROJECT BENEFITS**

### **8.1 GENERAL**

The demand of Sand has been rising in the state as a result of rising in construction activities and development of the proposed project aims to fulfill the supply of Sand. Hence, the fine quality of mineral will be used further for development. The sediment in the form of river bed material deposited is of critical importance in civil and other infrastructural activities. The proposed project lies on the river bed of Yamuna. The quality of Sand is fine and appropriate for the mega infrastructural activities. The demand for Sand is ever growing with the growth of the infrastructure sector in our country. The mineral is used mainly in the construction activities like buildings, bridges etc. The requirement for the mineral is always high in the nearby cities and towns. Therefore, there is always a good demand of the mineral in the domestic market. The local region demand is increasing; hence newer areas for Sand reserves are approached.

This will also generate much needed employment to the local people. Economy of the area will get a boost and there will be overall growth of the region in terms of education, health, training, transport, automobile, industry. The standard of living accordingly will also get an upliftment on the positive side.

### **8.2 EMPLOYEMENT**

#### **8.2.1 DIRECT EMPLOYMENT**

During the operational phase, about 11 people will be employed directly. Considering that some of the skilled personnel to be employed for the project will be from outside the area and unskilled/ semiskilled personnel will be from within the study area, the project will add to the well being of the area. In addition to the workforce the indirect employment will also be generated for local persons. It will help in bringing prosperity to the area.

#### **8.2.2 INDIRECT EMPLOYMENT**

The project will also provide some indirect employment to the people of nearby area of mine site. Some people will get engaged in some shops like tea shop, vehicle repair center etc. It will also provide some need-based opportunity to the local public. The project will provide following indirect employment to the local people: -

- ✓ The SAND available will provide agency employment in the value chain analysis, for place utility and retail.
- ✓ Transportation and warehousing in the region required to transfer the mineral will eventually be needed and therefore trucks and jobs in logistical activities will come up.
- ✓ There will be development of externalities for the mine workers petty shops (tea, repair stations for trucks etc.) as supporting services.
- ✓ As there would be vocational training camps and Technical Training of mining to the regional people, hence there will be potential manpower available for the proposed and surrounding mines of the Tehsil.
- ✓ This would create Indigenous Technologies for sustainable development.

### **8.3 IMPROVEMENTS IN PHYSICAL AND SOCIAL INFRASTRUCTURE**

The proposed project will enhance the socio-economic activities in the adjoining areas. This will result in following benefits:

- ✓ Improvements in physical infrastructure.
- ✓ Improvements in social Infrastructure.
- ✓ Increase in employment potential.
- ✓ Contribution to the exchequer.
- ✓ Prevention of illegal mining which will help in sustaining the river and its aesthetic value.
- ✓ Post-mining enhancement of green cover.

### **8.4 IMPROVEMENTS IN SOCIAL INFRASTRUCTURE**

There will be some obvious changes in various environmental parameters due to mining activity. Increase socio-economic activities, creation of new employment opportunities, infra-structural development, better educational and health facilities.

Following are the benefits in specific area of social domain:-

**Socio-Economic:** - There will be positive impact in socio-economic area due to increased economic activities, creation of new employment opportunities, infrastructural development and better educational and health facilities.

**Health Care Facilities:-** Company will undertake awareness program and community activities like health, camps, family welfare camps, AIDS awareness program etc.

**Employment Potential:-** There is a possibility of creation of direct and indirect employment opportunities due to working of this mine.

#### **8.4.1 THE MINE WILL CONTRIBUTE TO THE EXCHEQUER OF STATE AND CENTRAL GOVERNMENT AS PER NORMS.**

The lease area is in the river bed and devoid of any vegetation. Mining activities will not cause any harm to riparian vegetation cover as the working will not extend beyond the offset left against the banks. Plantation will be carried out as social forestry programme in villages, school and the areas allocated by the Panchayat / State authorities.

Plantation has been proposed on both sides of the roads as greenbelt to provide cover against dust dissemination. A massive plantation will be done nearby the mine area to mitigate the ill-effects of mining and to improve environment of its surrounding area

Plantation work will be carried out at the safety zone of the lease area. 50 number of saplings proposed during plan period will be planted. Plantation shall be done with suitable local species like teak, mango, Jammu, Jhaun, neem etc. per year and also along the approach road during the plan period.

#### **8.5 HEALTH**

Periodic medical checkups as per Mines Act / Rules and other social development and promotional activities will be undertaken. All this will assist to lift the general health status of the residents of the area around mines.

#### **8.6 OTHER BENEFITS**

The other tangible benefits include metrics and improvements demonstrating process and system cost savings, compliant inspections and customer audits, faster product approvals and manufacturing throughput, less rejected material, reduced nonconformance issues, and more efficient continuous improvement and project implementation. Intangible benefits include improved staff morale, quick, more accurate and transparent decision making, increased staff accountability and an enhanced culture of quality throughout the organization.

## 9 ENVIRONMENTAL COST & BENEFIT ANALYSIS

Not applicable as this chapter is needed if recommended at the scoping stage

## 10 ENVIRONMENTAL MANAGEMENT PLAN

### 10.1 INTRODUCTION

A project specific Environmental Management Plan has been formulated subsequent to an EIA study as per the requisite Terms of Reference to ensure that the appropriate environmental management practices are followed in compliance with the environmental legislation.

It has been evaluated that the study area has not been affected adversely with the proposed activity and likely to get new economical fillip, not only for the study area but also for the region as a whole.

Environmental Management for the mining activity is discussed for environmental impact pertains to the operational phase. Even though is reversible in nature all the impacts will be visible only during operational phase. The EMP will therefore be initiated during operational phase.

### 10.2 CRITICAL ACTIVITIES FOR EMP IMPLEMENTATION

1. Training and Environmental Awareness;
2. Documentation and record keeping;
3. Reporting Procedures;
4. Stakeholder/ Project Proponent engagement;
5. Auditing;
6. Responding to Non-compliance.

### 10.3 ENVIRONMENTAL MANAGEMENT PLAN

S.No.	Particular	Management Plan
1.	Land Environment	<ul style="list-style-type: none"><li>➤ 50m offset will be left against the banks to protect from side collapse.</li><li>➤ Soil quality will be monitored from strategic locations and analysis will be done once in every two years.</li><li>➤ To prevent erosion, moving the road or footpath will be</li></ul>

		<p>kept away from the river's edge.</p> <ul style="list-style-type: none"> <li>➤ Care will be taken to ensure that ponding is not formed in the river bed.</li> </ul>
2.	Water Environment	<p>Based on baseline data, corrective measures will be taken.</p> <ul style="list-style-type: none"> <li>➤ Measurement of water level fluctuations to assess impact of mining activity on the water table depletion in close proximity of dug wells and bore wells.</li> <li>➤ Rainwater harvesting (percolation tank) has been proposed for augmenting ground water resources and for arresting/reversing the declining trends of ground water levels.</li> <li>➤ Regular monitoring and analysis of water samples at strategic locations will be carried out to monitor the water quality of the area.</li> </ul>
3.	Air Environment	<p><b><u>Unpaved Roads</u></b></p> <ul style="list-style-type: none"> <li>➤ Water sprinkling will be done for dust suppression.</li> <li>➤ Leveling of roads will be done to maintain the uniform speed of the trucks/tippers.</li> </ul> <p><b><u>Paved Roads</u></b></p> <ul style="list-style-type: none"> <li>➤ The roads will be maintained.</li> <li>➤ Regular cleaning will be done to reduce the chances of road dust to become airborne.</li> <li>➤ Water sprinkling will be done on a fixed stretch of paved road passing through the villages.</li> <li>➤ Adequate transportation routes will be decided to transport the mineral and will be maintained properly.</li> <li>➤ Speed breakers will be constructed to restrict the speed of transporting vehicles. However, limiting of vehicular speed will be adopted.</li> </ul> <p><b><u>Transportation</u></b></p> <ul style="list-style-type: none"> <li>✓ The vehicles will be maintained to control the air</li> </ul>

		<p>emissions.</p> <ul style="list-style-type: none"> <li>✓ The speed of the vehicles will be maintained uniform.</li> <li>✓ PUC certified vehicles will be used.</li> <li>✓ The loaded vehicles will be covered with tarpaulin.</li> <li>✓ Over loading will be avoided.</li> </ul>
4.	Noise Environment	<p>Regular inspection and maintenance of vehicles and equipment will be performed to ensure efficiency and worn parts will be replaced.</p> <ul style="list-style-type: none"> <li>➤ Limited numbers of equipments will be used on-site.</li> <li>➤ The vehicles will be maintained in good condition and overloading will be avoided.</li> <li>➤ Speed limits will be enforced in relation to road conditions and on-route communities.</li> <li>➤ Road surfaces will be maintained in good condition to reduce tyre noise and to assure continuous traffic flow to avoid prolonged idling.</li> <li>➤ Noise monitoring will be conducted on a regular basis to determine compliance with noise criteria.</li> <li>➤ Personal protective devices i.e., earmuffs and earplugs will be provided to workers, working in high noise areas.</li> <li>➤ Periodical medical checkup will be organized for all workers to check any noise related health problems.</li> </ul>
5.	Occupational Health and Safety	<p><b>Heat &amp; Light</b></p> <ul style="list-style-type: none"> <li>➤ The mine site will have adequate drinking water supply so that workers do not get dehydrated.</li> <li>➤ Lightweight and loose-fitting clothes having light colors will be preferred to wear.</li> <li>➤ Rigorous exercise and more physical activities will be avoided in hot weather.</li> </ul>

		<p><b>Noise</b></p> <ul style="list-style-type: none"> <li>➤ Noise exposure measurements will be taken to determine the need for noise control strategies.</li> <li>➤ The personal protective equipment will be provided for mine workers.</li> <li>➤ Supervisor will be instructed for reporting any problems with hearing protectors or noise control equipment.</li> <li>➤ At noisy working activity, exposure time will be minimized.</li> <li>➤ Machineries will be labeled with noise levels.</li> </ul> <p><b>Dust Control</b></p> <p>Dust generating sources will be identified and proper control measure will be adopted.</p> <ul style="list-style-type: none"> <li>➤ Face mask will be provided during mining activity.</li> <li>➤ Periodic medical examinations will be provided for all workers.</li> <li>➤ Awareness program will be organized for workers.</li> </ul>
6.	Biological Environment	<ul style="list-style-type: none"> <li>➤ Mining activities will not cause any harm to riparian vegetation cover as the working will not extend beyond the offset left against the banks.</li> <li>➤ The lease area is devoid of any vegetation. Hence, It is proposed to develop social forestry in the approach villages at public places like School, PHC's, Panchayat Bhawan with due permission from Panchayat and in consultation with Forest Department/ local authorities.</li> <li>➤ The green belt development will be carried out by Project Proponent and maintenance will be done by the villagers/NGO's with their active participations.</li> </ul>

7.	Socio-Economic Aspect	<ul style="list-style-type: none"> <li>➤ Direct employment to the local people which help to sustain their livelihood.</li> <li>➤ During the operational phase by the implementation of certain CER activities indirect employment will also generate.</li> <li>➤ Improved livelihood.</li> <li>➤ Training will be provided to the local persons</li> <li>➤ Awareness programme will be organized.</li> </ul>
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#### **10.4 ENVIRONMENTAL MANAGEMENT PLAN**

The Project Proponent is quite conscious of its responsibility for maintaining clean and a healthy environment. The management is also keen to modify and make more efficient measures towards suppression of pollution sources. Adequate fund for Pollution Control Measures is provided as a part of overall project financing to ensure the availability of proper treatment facilities. This cost will be spending phase wise along with the growth of project.

The estimated cost of the project is Rs. 40.0Lakhs. A budget of Rs 2.50 Lakhs as capital cost and Rs.6.0 lakhs as recurring cost is allocated for environment protection measures. The details are given below:

**TABLE 10-1 EMP COST DETAILS**

<b>S. No</b>	<b>Particulars</b>	<b>Capital Cost (INR)</b>	<b>Recurring Cost (INR)</b>
1	Air pollution Control: Dust Suppression/ Water Sprinking	1,00,000	1,00,000/-
	Road Maintanace	50,000	2,00,000/-
	Greenbelt	1,00,000	50,000/-
2	Personal Protective Equipment	-	50,000/-
3	Environmental monitoring	-	1,00,000/-
4	Social Welfare Measures	-	1,00,000
<b>Total</b>		<b>2,50,000/-</b>	<b>6,00,000/-</b>

## **10.5 CONCLUSION**

Various aspects of mining activities were considered and related impacts were evaluated. Considering all the possible ways to mitigate the environmental concerns Environmental Management Plan was prepared and fund has been allocated for the same. The EMP is dynamic, flexible and subjected to periodic review. For project where the major environmental impacts are associated, EMP will be under regular review.

Senior Management responsible for the project will conduct a review of EMP and its implementation to ensure that the EMP remains effective and appropriate. Thus, the proper steps will be taken to accomplish all the goals mentioned in the EMP and the project will bring the positive impact in the study area.

## **11 SUMMARY & CONCLUSION**

### **11.1 BACKGROUND OF THE PROJECT**

Ramial River Sand Quarry, Baligorad is a sand mining project over an area of 13.43acres/ 5.435Ha. Located in village - Baligorad, Tahasil - Kamakhyanagar in District - Dhenkanal of Odisha. The mining lease granted by Tahasildar, Kamakhyanagar, Dhenkanal will be auctioned and leased out to the successful bidder after obtaining statutory clearances by Tahasildar Kamakhyanagar, District- Dhenkanal. The mining lease will be granted on for long term basis for 5 years and the lease period will start from the date of registration of executed lease deed and letter details attached as **Annexure-I**. The Mining Plan has been approved with vide No. 855 on dated 30.06.2020 by the approving authority, Office of the Joint Director, Geology, Zonal Survey, Dhenkanal and attached as an **Annexure-II**. It is relevant to mention here that approval of Mining Plan has been conferred under section 2 of Rule 28 (4) of OMMC, 2016 as per clause 5. As per EIA notification 2006 and subsequent amendments, the project is coming under B1 Category and the lease area is more than 5.0 Ha.

The Ramial River Sand quarry, Baligorad is on Khata no-361, Plot no-3768/5973 of Kisan Nadi at village Baligorad in Kamakhyanagar Tahasil in Dhenkanal District of Odisha. The mining lease area is listed as an identified sand minor mineral in the DSR page no. 25, Serial No-21 of the Dhenkanal district. The sand quarry lies on river bed Ramial.

Ramial River Sand Quarry, Baligorad, is a minor mineral project for exploitation of river sand. The average production is proposed to be 10902 cum/year and 54510 cum is the total production during the plan period. This sand would be mainly used for civil works in major projects and infrastructures development so as to meet the market potential.

As per the Environmental Impact Assessment (EIA) Notification dated 14th September 2006 and its subsequent amendments, the proposed Ramial River Sand Quarry project falls under 'Category B1', since the project is more than 5.0 Ha.

## **11.2 PURPOSE OF THE REPORT**

The purpose of the report is to identify environmental aspects, impacts and mitigation measures arising out from the proposed project and to prepare EIA report as per the Terms of Reference (ToR) finalized by State Level Expert Appraisal Committee of Odisha vide The ToR application submitted to SEIAA, Odisha on 25.01.2021 with proposal No. SIA/OR/MIN/60167/2021. SEIAA meeting was held on 10.02.2021. ToR was issued with F.No. 663/SEIAA dated: 26.02.2021. ToR letter is enclosed as **Annexure -III** for the preparation of EIA/EMP report.

Tahasildar, Dhenkanal as part of the compliance from SEIAA has appointed Environmental Consultants who are accredited by National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI), New Delhi.

The total extent of area is 5.435Ha for which Environmental Clearance is required with proposed 10902 cubic meters /year and total production capacity 54510 M³ for five years. The total project cost is Rs. 40 Lakh.

## **11.3 LOCATION OF THE PROJECT**

The area under discussion is featured in Survey of India Topo Sheet No-73H/9 and is bounded between the Latitude -20° 54' 21.93" N to 20° 54' 30.49" N, Longitude-85° 35' 49.94" E to 85° 36' 30.71" E. The lease area is located at a distance of 1.49 km from village Baligorad and at a distance of 5 kms from Kamakhyanagar, 45 kms from the District Headquarters Dhenkanal and 99 kms from the State Capital Bhubaneswar. Dhenkanal Railway station is the nearest railway station located at a distance of 25.6 kms from the lease area. Nearest Road Bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village – Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.

**Table 11-1 Project Summary & Salient Features of project**

<b>S.No.</b>	<b>Particulars</b>	<b>Details</b>
1.	Land use at the Project Site	Mining will be carried out at the site for ordinary sand as construction material (Aggregate)
2.	Nearest Highway	Nearest Road bridge is at a distance of 0.19 km from the mining lease area. Kaccha road connecting to the lease area and with the village - Baligorad is at distance of 1.49 km. SH -20 is the nearest major district road is at distance of 40.70 km. NH-200 is the nearest National Highway which is at a distance of 1.06 km.
3.	Nearest Railway station	Dhenkanal Railway station located at a distance of 25.6 kms from the lease area in SW direction.
4.	Nearest Village	Baligorad is 1.49 km from the proposed area in N direction
5.	Nearest Major Settlement	Baligorad is 1.49 km from the proposed area in N direction
6.	Nearest Major Town	Kamakhyanagar is 5 km from the proposed area in NW direction.
7.	Communication Network	Amenities like Telephone, Post and Telegraph Office, Police Station, Primary Health Center etc., are available at Kamakhyanagar.
8.	Education	Primary School Education is available at nearby village. Higher Education are available at Kamakhyanagar.
9.	Medical Facility	RMP Doctor is available at Renthapat, Nursing Homes and Hospitals are located at Kamakhyanagar.

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Quarry, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**

<b>10.</b>	Availability of Water	The ground water level is about 4m to 14m below sand level.
<b>11.</b>	Availability of Electricity	Electricity is available in all human settlements
<b>12.</b>	Hills/Valleys	Nil
<b>13.</b>	Ecologically Sensitive Zone (Wild Life Sanctuaries)	Nil
<b>14.</b>	Reserved Forests	<ul style="list-style-type: none"> <li>• Jiridamali RF – 1.96 km, N</li> <li>• Jiridamali RF – 4.5 km NW</li> <li>• Mahulabhanja RF A Block – 4.1 km NNE</li> <li>• Mahulabhanja RF B Block -6.3 km ENE</li> <li>• Sunajhari RF -3.13 km ,S</li> <li>• Bhairipur RF -4.8 km SSE</li> <li>• Suniamaru RF – 3.03 km ,S</li> <li>• Madhi RF – 7.7 km NNW</li> </ul>
<b>15.</b>	Water Bodies	<ul style="list-style-type: none"> <li>• Ramial River – Mine lease area</li> <li>• Budhia Nala – 0.76 km SW</li> <li>• Mahapatia Jora – 2.9 km NE</li> <li>• Betali Nadi – 9.1 km WNW</li> </ul>
<b>16.</b>	Defence Installation/ Historical Monuments/ Archaeological/ Ports	Charbatia Air Base, Cuttack is the nearest defense installations from the mining lease located at a distance of 50.0 kms.
<b>17.</b>	Historical Places	Nil
<b>18.</b>	Areas occupied by sensitive man-made land uses (Hospitals, schools, places worship,	The mining lease is at a distance from areas occupied by sensitive man-made land uses – There is a temple, Govt. Hospital, Educational

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Quarry, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**

	community facilities)	institutions- Govt. High School, Govt. College, Communication facilities- 5 kms in NW direction.
<b>19.</b>	Nearest River	Ramial River
<b>20.</b>	Areas susceptible to natural hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions) similar effects	The area is not sensitive to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions. Zone-II (Least Active)

#### **11.4 SIZE OR MAGNITUDE OF OPERATION**

In this mining lease area only 5.435hectare area is available for mining as per Terms of Reference approved by SEIAA; Odisha for the Proposed production capacity around 54510 M³ for five years. It is an open cast mine and it is proposed to do mining by manual method.

#### **Existing land use pattern:**

<b>Type of land use</b>	<b>Area (Ha.)</b>
Water channel area	Nil
Left over area adjacent to water channel	Nil
Quarry Safety zone area	2.765
Potential Mineable surface area within the plan period	2.67
<b>Total</b>	<b>5.435</b>

#### **Life of the Mine**

Life of the Quarry = 5 YEARS

#### **11.5 MINING & METHOD OF MINING**

The mining operations will be carried open excavation with manual method only.

### **11.5.1 PRODUCTION FOR THE THREE YEARS PLAN PERIOD**

It is proposed to produce the ordinary sand and from the Southern boundary of sand reach area during the plan period.

<b>Year</b>	<b>Production in m³</b>
1 st	10902
2 nd	10902
3 rd	10902
4 th	10902
5 th	10902
<b>Total</b>	<b>54510</b>

### **11.5.2 EXTENT OF MECHANIZATION**

Manual Method will be used in sand open excavation without affecting the ground water table.

### **11.6 WATER REQUIREMENT**

Water requirement for the project will be 2.5 KLD. Water required in the project will be for drinking purpose and dust suppression, which will be sourced from water tanker.

### **11.7 POWER REQUIREMENT AND SOURCE**

Power Requirement will not be required for operations as the mining will be worked out during day time only. Minimal power required for office shall be taken from the general electric supply of the area.

### **11.8 MAN POWER REQUIREMENT**

Employment Generation from the project is 11 nos. of people. OMS has been assumed to be 4.9cum. Indirect employment through creation of shops/ stalls, hired vehicles, etc. also can be generated to full fill the day-to-day requirements of the mining personals.

### **11.9 SITE SERVICES**

All the site services and other facilities including regular & periodic health checkup, Eye camp, Adult & Female education & training programmes shall be provided outside nearer to the lease.

### **11.10 PROJECT COST**

Project cost of the project is 40 Lakh.

### **11.11 SUMMARY OF ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION**

The summary of anticipated adverse environmental impacts and mitigation measures are given in Chapter -4.

### **11.12 CONCLUSIONS**

The proposed dry sand mining project will have marginal impacts on the local environment with proper mitigation measures with the effective implementation of the environment management measures as suggested in the EIA/EMP report and as recommended by MoEF&CC/ SEIAA, CPCB and State Pollution Control Board, the negative impacts will be minimized to a great extent. However, development of this project has beneficial impact/effects in terms growth in regional economy, transform the region's economy from predominantly mega infrastructure development and construction activities, increase Government earnings and revenues and accelerate the pace of development in the region.

The proposed project will provide employment to number of personnel. This project will also generate indirect employment to a considerable number of families, who will render their services for the employees of the project.

The project will also encourage ancillary industries in the region, which will not only increase the employment potential but also the economic base of the region will be further strengthened. Thus, in view of considerable benefits from the project, the proposed project is advantageous to the region as well as to the nation.

## 12 DISCLOSURE OF CONSULTANT

Declaration by Experts contributing to the Draft EIA of Baligorad Sand Mining of Ramial River over an area of 5.435Hectares in Khata No: 361 Plot No.3768/5973, Kisam : Nadi, Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District, Odisha.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above Draft EIA.

EIA coordinator: Name:

P. Hari Prasad

Signature:



Period of involvement: September - 2019 - Till date

**Contact information:** M/s Rightsource Industrial Solutions Pvt. Ltd. Plot No: 203,

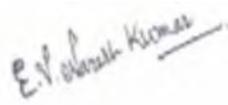
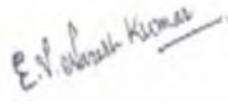
H.No:5-36/203, Prashanthi Nagar, IDA, Kukatpally, Hyderabad –500072.

Ph: 040-23070602, 23075699.info@rightsource.co.in, peddihari@gmail.com

### Functional Area Experts:

S. No.	Functional areas	Name of the expert/s	Involvement (period and task**)	Signature
1	AP	Yarlagadda V. Prasad	Task: Selecting ambient air monitoring sites based on IMD data, Review of the meteorological data, Process emissions and AAQ data, suggesting air pollution control measures.	
2	WP	P. Chiranjeevi Rao	Task: Identification of water monitoring sites, estimating water requirement, Suggesting Recycling of water, waste water treatment methods & disposal schemes.	
3	SHW*	P.S.N. Murthy	Task: Inventorization of Hazardous waste, Solid wastes, etc., suggesting treatment options viz., landfill, incineration, recycling, and stabilization.	

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Quarry, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**

4	SE	Setti VR Bhaskara Rao	Task: Generating primary SE data, livestock inventory and impacts, conducted focused group discussions, taken public opinion on the project. Identified villages wise amenities and needs	
5	EB	Dr. K. Bayapureddy	Task: Collected secondary data from forest/ agricultural/ fisheries department, generation of primary flora and fauna data from study area & core area, ground truthing for ecological assessment, development of status report, suggested species for greenbelt development.	
6	SC	Dr. K. Bayapureddy	Sampling, analysis and characterization of soil for duggesting suitable soil conservation measures.	
7	HG	E. V. Naresh Kumar	Task: Measurement of ground water levels from the existing wells present in and around project site, observation of surface water bodies, establishing groundwater flow direction and its gradient and evaluation of rainfall data and suggesting suitable depth for secured land fill base, and identification of development of monitoring wells.	
8	GEO	E. V. Naresh Kumar	Task: Observations made towards the Identification of country rock, development of porosity, thickness and extent of weathered formations, area seismicity and evaluation of soil permeability for suggesting suitable civil structures.	
9	AQ	K. Rohini	Task: Meteorological & Air Pollution dispersion studies, suggesting environmental management plan for air pollution control measures	
10	NV	Yarlagadda V. Prasad	Task: Monitoring of noise / vibration levels using instrument, processing and analysis of Data for suggesting suitable noise mitigating measures	
11	LU	Dr. Y. Rama Mohan	Task: Collection of GPS readings from the project site and prepared layout, preparation of TOPO map through SOI 1:50,000 scale TOPO sheet. Collections of ground through data from the field. Preparation of LU map through Satellite imagery, SOI, Google map & Ground through data.	
12	RH	P.S.N. Murthy	Task: Identification of Hazards and Hazardous substances from process & warehouse, storage tanks .Risks and consequence analysis using software and lethality damages, DMP and EPP for onsite & offsite were provided	

**Draft Environmental Impact Assessment Report for Proposed Ramial River Sand Quarry, Baligorad, over an area of 13.43acres/ 5.435Ha. at Village-Baligorad, Tahasil-Kamakhyanagar, District-Dhenkanal, Odisha State**

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**Declaration by the Head of the accredited consultant organization/ authorized person**

I, Yarlagadda V. Prasad, hereby, confirm that the above-mentioned experts prepared the Draft EIA of Baligorad Sand Mining of Ramial River over an area of 5.435Hectares in Khata No.:361, Plot No.3768/5973, Kisam : Nadi, Baligorad Village, Kamakhyanagar Tahasil, Dhenkanal District, Odisha State. I also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this statement.

Signature:



Name: Yarlagadda V. Prasad Designation:

Managing Director

Name of the EIA consultant organization: **M/s Rightsource Industrial Solutions Pvt. Ltd.**

NABET Certificate No. & Issue Date: NABET Accreditation No: NABET/EIA/1821/SA 0128, October,29,2021.

OFFICE OF THE JOINT DIRECTOR, GEOLOGY

ZONAL SURVEY, DHENKANAL, ODISHA

No. 855 /DZ/ DI. 30-06-2020

To

The Tahasildar,  
Kamakhyanagar.

Sub: Approval of mining plan of ramial river sand quarry ballgovada over 13.43 acres in Kamakhyanagar taluasi of Dhenkanal District.

Sir,

In giving a reference to the final copy of the mining plan submitted by the RQP, it is informed that the mining plan is hereby approved as per clause 5 of Rule 28 of OMMC, Rule -2016 in respect of the above mentioned sairat subject to the conditions mentioned below:

8. The mining plan is approved without prejudice to any other law applicable to the quarry from time to time, whether made by Central Government, State Government or any other authority.
9. The mining plan is approved without prejudice to any order or direction from the court of competent jurisdiction.
10. The approval of the mining plan is based on the information provided by the RQP and if anything is found to be concealed in the contents, the approval shall be deemed to have been withdrawn with immediate effect.
11. This mining plan has been based on the present resource of minor mineral available within the lease area.
12. The boundary pillars of the quarry area shall be maintained in good order throughout the subsistence of the lease.
13. The concerned Tahasildar shall monitor the commitments made by the lessee in the mining plan.
14. The boundary pillars of the quarry area shall be maintained in good order throughout the subsistence of the lease.

Yours faithfully,

(M. R. Pandat)  
Joint Director, Geology,  
Zonal Survey, Dhenkanal.  
(Authorised officer)

Memo No. _____ /DZ, Dt. _____

Copy to Sri Bipln Behari Khandual, RQP, M/s Geo Consultants Pvt. Ltd, 853, Gobind Prasad (Medical Lane), in front of Reliance fresh (Radhika Complex) Bhubaneswar 751006 along with one copy of the approved mining plan.

(M. R. Panda)  
Joint Director, Geology,  
Zonal Survey, Dhenkanal.  
(Authorised officer)

**State Environment Impact Assessment Authority, (SEIAA),  
Odisha**

Qr. No. 5RF-2/1, Unit - IX, Bhubaneswar - 751022, Tel: 0674-2540669

No. 663/SEIAA

Dt. 26.02.2021

SEIAA File No. SIA/OR/MIN/60167/2021

To

The Tahasildar, Kamakhyanagar  
Dist - Dhenkhal

Sub: Proposal for EC for Ramial River Sand, Baligorad is a sand mining project over an area of 13.43 acres/ 5.435 Ha. located in village - Baligorad, Tahasil-Kamakhyanagar in District - Dhenkanal of Tahasildar Kamakhyanagar -Issuance of Terms of Reference (ToR) reg.

Ref: 1) Your online application dated 25.01.2021 for issue of ToR vide Proposal No: SIA/OR/ MIN /60167/2021

2. SEIAA meeting held on 10.02.2021.

Sir,

This has reference to the online proposal submitted in the Ministry of Environment, Forest and Climate Change (SEIAA, Odisha) to prescribe the Terms of Reference (TOR) for undertaking detailed EIA study for the purpose of obtaining Environmental Clearance in accordance with the provisions of the EIA Notification, 2006. For this purpose, the proponent had submitted online information in the prescribed format. (Form-1) along with Pre-feasibility Report and Approved Mining Plan.

In this regard, under the provisions of the EIA Notification 2006 as amended, the Standard ToR (enclosed as Annexure-I) along with specific ToR as mentioned below for the purpose of preparing environment impact assessment report and environment management plan for obtaining prior environment clearance with public hearing is prescribed.

**Specific ToRs**

1. Whether it is an existing mine? If yes, submit the copy of Environmental Clearance and compliance to EC conditions from the Regional Office, SPCB. The year which last operated.  
1(a) The project proponent has to carry out by engaging appropriate consultant, a study of the annual replenishment rate of sand by collecting pre monsoon &

DAI

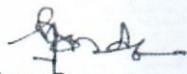
post monsoon data from the field to know the quantum or volume of sand deposited /replenished & extracted in the mining lease area. The detailed comparison of both pre monsoon and post monsoon elevation data shall be included in the study report. The replenishment rate of sand may be studied as per the procedure laid down in the Enforcement and Monitoring Guidelines for Sand Mining, 2020 (www.moef.gov.in) issued by the MoEF&CC, Govt. of India. The finding of the study shall be submitted to SEIAA along with the final EIA / EMP report to assess the rate of replenishment of mined out sand.

2. Area of the 'no mining zone' specially demarcated within the list out area for safety of the river bank / any bridge or such other structure nearby; and the dimensions and geo-co-ordinates of this zone w.r.t lease boundary.
3. Any approach road existing or will be constructed inside the safety zone?
4. Mitigation measures to be taken to ensure not to disturb free flow of river.
5. Distance of the river bank / embankment from the lease boundary. It is a river bank or embankment?
6. Any ramp existing or will be constructed on the river bank / embankment for movement of vehicles to reach the nearest road.
7. Distance of the village road / city road / district road / public road for the river bank. Is this road single road / double road?
8. No. of village (s) and name of village (s) or the city (s) or urban place (s) or semi urban place (s) through which the sand carrying vehicles will ply and the distance of it from the river bank or embankment whether there is any forest land in the intervening area through which the sand carrying trucks will ply.
9. Whether schools / colleges / hospitals / health centers / bus stops / religious places existing nearby and if so, the distances of it from the bank or the road through which the vehicle will ply or existing alongside the road?
10. Any plantation done in the safety zone or embankment in case of an existing mines and if so, the area of plantation, number of species.? If not, the plan for it to arrest bank erosion.
11. Any stone packing in the river bank / embankment existing in case of existing mines and if not, the plan for it.
12. Whether, any alternative mine exists or explored or can be explored if this mine is otherwise found unsuitable? Please furnish details.

DM

13. (i) Whether permission taken or will be taken from Water Resource Authority or the concerned Authority of the roads to be used for plying of vehicles loaded with sand or empty vehicles for the same after the river bank.  
(ii) Responsibility of perennial perpetual maintenance of these roads and the mechanism for the same.
14. No and type of vehicles to be used daily and the frequency for the purpose of transportation and the time and duration of such transportation. Whether permission taken or will be taken for the appropriate authority for the purpose.
15. Intersection point of the haulage roads with the main SH / NH / public road and the traffic density study at appropriate locations by domain expert with remedial measures for decongestion and road safety.
16. (i) Any bridge (road / rail) existing and the distance of it from the lease boundary.  
(ii) Any culvert or small bridge will be used by the plying vehicles carrying the sand minerals.
17. Any High Transmission Electric line existing and if yes, the distance of the same from the boundary of the lease.

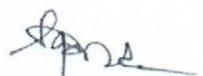
Yours faithfully,

  
Member Secretary

Memo No. 66A/SEIAA  
Copy forwarded to

Dated 26.08.2021

1. The ADM & Collector, Dhenkanal for information and necessary action.
2. The Deputy Secretary, of MM&S Branch of Revenue and DM Department, Govt. of Odisha Bhubaneswar for information.

  
Member Secretary

## **STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

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Terms of Reference (TOR) for preparation of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for "Mining of Minerals" as per the EIA Notification, 2006 has been devised to improve the quality of the reports and facilitate decision-making transparent and easy. TOR will help the project proponents to prepare report with relevant project specific data and easily interpretable information. TOR for mining of minerals is expected to cover all environmental related features.

Mining of minerals plays a positive role in the process of country's economic development. In addition to the contribution towards economic growth, mining can also be a major source of degradation of physical as well as social environment, unless it is properly managed. Environmental impacts can arise during all activities of the mining process. Minimizing the damage due to mining operations depends on sound environmental practices in a framework of balanced environmental legislation. The potential adverse effects of mining activities include air pollution, surface and groundwater pollution, noise and vibration, damage to local ecology, natural topography and drainage, depletion of water resources etc. All these environmental components are required to be considered while selecting a proper methodology of mining, mitigation measures to reduce pollution load, conservation of natural resources etc.

The projects of mining of minerals as stated in the schedule require prior environment clearance under the EIA notification, 2006. Category 'A' Projects are handled in the MoEF&CC and Category 'B' projects are being handled by the respective State Environment Impact Assessment Authorities (SEIAAs) notified by MoEF&CC and following the procedure prescribed under the EIA Notification, 2006. As per this Notification, as amended, the projects of mining of minor minerals with mining lease area equal to or greater than 50 hectare are to be handled at the level of the MoEF&CC for grant of EC. Such projects with mining lease area less than 50 hectare are to be handled by the respective State Environment Impact Assessment Authority (SEIAA).

### **1(a):STANDARD TERMS OF REFERENCE FOR CONDUCTING ENVIRONMENT IMPACT ASSESSMENT STUDY FOR NON-COAL MINING PROJECTS AND INFORMATION TO BE INCLUDED IN EIA/EMP REPORT**

- 1) Year-wise production details since 1994 should be given, clearly stating the highest production achieved in any one year prior to 1994. It may also be categorically informed whether there had been any increase in production after the EIA Notification 1994 came into force, w.r.t. the highest production achieved prior to 1994.
- 2) A copy of the document in support of the fact that the Proponent is the rightful lessee of the mine should be given.
- 3) All documents including approved mine plan, EIA and Public Hearing should be compatible with one another in terms of the mine lease area, production levels, waste generation and its management, mining technology etc. and should be in the name of the lessee.
- 4) All corner coordinates of the mine lease area, superimposed on a High Resolution Imagery/ toposheet, topographic sheet, geomorphology and geology of the areashould be provided. Such an Imagery of

## **STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

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the proposed area should clearly show the land use and other ecological features of the study area (core and buffer zone).

- 5) Information should be provided in Survey of India Toposheet in 1:50,000 scale indicating geological map of the area, geomorphology of land forms of the area, existing minerals and mining history of the area, important water bodies, streams and rivers and soil characteristics.
- 6) Details about the land proposed for mining activities should be given with information as to whether mining conforms to the land use policy of the State; land diversion for mining should have approval from State land use board or the concerned authority.
- 7) It should be clearly stated whether the proponent Company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be spelt out in the EIA Report with description of the prescribed operating process/procedures to bring into focus any infringement/deviation/violation of the environmental or forest norms/ conditions? The hierarchical system or administrative order of the Company to deal with the environmental issues and for ensuring compliance with the EC conditions may also be given. The system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large, may also be detailed in the EIA Report.
- 8) Issues relating to Mine Safety, including subsidence study in case of underground mining and slope study in case of open cast mining, blasting study etc. should be detailed. The proposed safeguard measures in each case should also be provided.
- 9) The study area will comprise of 10 km zone around the mine lease from lease periphery and the data contained in the EIA such as waste generation etc. should be for the life of the mine / lease period.
- 10) Land use of the study area delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features should be indicated. Land use plan of the mine lease area should be prepared to encompass preoperational, operational and post operational phases and submitted. Impact, if any, of change of land use should be given.
- 11) Details of the land for any Over Burden Dumps outside the mine lease, such as extent of land area, distance from mine lease, its land use, R&R issues, if any, should be given.
- 12) A Certificate from the Competent Authority in the State Forest Department should be provided, confirming the involvement of forest land, if any, in the project area. In the event of any contrary claim by the Project Proponent regarding the status of forests, the site may be inspected by the State Forest Department along with the Regional Office of the Ministry to ascertain the status of forests, based on which, the Certificate in this regard as mentioned above be issued. In all such cases, it would be desirable for representative of the State Forest Department to assist the Expert Appraisal Committees.
- 13) Status of forestry clearance for the broken up area and virgin forestland involved in the Project including deposition of net present value (NPV) and compensatory afforestation (CA) should be indicated. A copy of the forestry clearance should also be furnished.

**STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR  
PROJECTS/ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

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- 14) Implementation status of recognition of forest rights under the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 should be indicated.
- 15) The vegetation in the RF / PF areas in the study area, with necessary details, should be given.
- 16) A study shall be got done to ascertain the impact of the Mining Project on wildlife of the study area and details furnished. Impact of the project on the wildlife in the surrounding and any other protected area and accordingly, detailed mitigative measures required, should be worked out with cost implications and submitted.
- 17) Location of National Parks, Sanctuaries, Biosphere Reserves, Wildlife Corridors, Ramsar site Tiger/ Elephant Reserves/(existing as well as proposed), if any, within 10 km of the mine lease should be clearly indicated, supported by a location map duly authenticated by Chief Wildlife Warden. Necessary clearance, as may be applicable to such projects due to proximity of the ecologically sensitive areas as mentioned above, should be obtained from the Standing Committee of National Board of Wildlife and copy furnished.
- 18) A detailed biological study of the study area [core zone and buffer zone (10 km radius of the periphery of the mine lease)] shall be carried out. Details of flora and fauna, endangered, endemic and RET Species duly authenticated, separately for core and buffer zone should be furnished based on such primary field survey, clearly indicating the Schedule of the fauna present. In case of any scheduled-I fauna found in the study area, the necessary plan alongwith budgetary provisions for their conservation should be prepared in consultation with State Forest and Wildlife Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.
- 19) Proximity to Areas declared as 'Critically Polluted' or the Project areas likely to come under the 'Aravali Range', (attracting court restrictions for mining operations), should also be indicated and where so required, clearance certifications from the prescribed Authorities, such as the SPCB or State Mining Dept. Should be secured and furnished to the effect that the proposed mining activities could be considered.
- 20) Similarly, for coastal Projects, A CRZ map duly authenticated by one of the authorized agencies demarcating LTL, HTL, CRZ area, location of the mine lease w.r.t CRZ, coastal features such as mangroves, if any, should be furnished. (Note: The Mining Projects falling under CRZ would also need to obtain approval of the concerned Coastal Zone Management Authority).
- 21) R&R Plan/compensation details for the Project Affected People (PAP) should be furnished. While preparing the R&R Plan, the relevant State/National Rehabilitation & Resettlement Policy should be kept in view. In respect of SCs /STs and other weaker sections of the society in the study area, a need based sample survey, family-wise, should be undertaken to assess their requirements, and action programmes prepared and submitted accordingly, integrating the sectoral programmes of line departments of the State Government. It may be clearly brought out whether the village(s) located in the mine lease area will be shifted or not. The issues relating to shifting of village(s) including their R&R and socio-economic aspects should be discussed in the Report.

## **STANDARD TERMS OF REFERENCE (TOR) FOR EIA/EMP REPORT FOR PROJECTS/ ACTIVITIES REQUIRING ENVIRONMENT CLEARANCE**

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- 22) One season (non-monsoon) [i.e. March-May (Summer Season); October-December (post monsoon season) ; December-February (winter season)] primary baseline data on ambient air quality as per CPCB Notification of 2009, water quality, noise level, soil and flora and fauna shall be collected and the AAQ and other data so compiled presented date-wise in the EIA and EMP Report. Site-specific meteorological data should also be collected. The location of the monitoring stations should be such as to represent whole of the study area and justified keeping in view the pre-dominant downwind direction and location of sensitive receptors. There should be at least one monitoring station within 500 m of the mine lease in the pre-dominant downwind direction. The mineralogical composition of PM10, particularly for free silica, should be given.
- 23) Air quality modeling should be carried out for prediction of impact of the project on the air quality of the area. It should also take into account the impact of movement of vehicles for transportation of mineral. The details of the model used and input parameters used for modeling should be provided. The air quality contours may be shown on a location map clearly indicating the location of the site, location of sensitive receptors, if any, and the habitation. The wind roses showing pre-dominant wind direction may also be indicated on the map.
- 24) The water requirement for the Project, its availability and source should be furnished. A detailed water balance should also be provided. Fresh water requirement for the Project should be indicated.
- 25) Necessary clearance from the Competent Authority for drawl of requisite quantity of water for the Project should be provided.
- 26) Description of water conservation measures proposed to be adopted in the Project should be given. Details of rainwater harvesting proposed in the Project, if any, should be provided.
- 27) Impact of the Project on the water quality, both surface and groundwater, should be assessed and necessary safeguard measures, if any required, should be provided.
- 28) Based on actual monitored data, it may clearly be shown whether working will intersect groundwater. Necessary data and documentation in this regard may be provided. In case the working will intersect groundwater table, a detailed Hydro Geological Study should be undertaken and Report furnished. The Report inter-alia, shall include details of the aquifers present and impact of mining activities on these aquifers. Necessary permission from Central Ground Water Authority for working below ground water and for pumping of ground water should also be obtained and copy furnished.
- 29) Details of any stream, seasonal or otherwise, passing through the lease area and modification / diversion proposed, if any, and the impact of the same on the hydrology should be brought out.
- 30) Information on site elevation, working depth, groundwater table etc. Should be provided both in AMSL and bgl. A schematic diagram may also be provided for the same.
- 31) A time bound Progressive Greenbelt Development Plan shall be prepared in a tabular form (indicating the linear and quantitative coverage, plant species and time frame) and submitted, keeping in mind, the same will have to be executed up front on commencement of the Project. Phase-wise plan of plantation and compensatory afforestation should be charted clearly indicating the area to be covered

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under plantation and the species to be planted. The details of plantation already done should be given. The plant species selected for green belt should have greater ecological value and should be of good utility value to the local population with emphasis on local and native species and the species which are tolerant to pollution.

- 32) Impact on local transport infrastructure due to the Project should be indicated. Projected increase in truck traffic as a result of the Project in the present road network (including those outside the Project area) should be worked out, indicating whether it is capable of handling the incremental load. Arrangement for improving the infrastructure, if contemplated (including action to be taken by other agencies such as State Government) should be covered. Project Proponent shall conduct Impact of Transportation study as per Indian Road Congress Guidelines.
- 33) Details of the onsite shelter and facilities to be provided to the mine workers should be included in the EIA Report.
- 34) Conceptual post mining land use and Reclamation and Restoration of mined out areas (with plans and with adequate number of sections) should be given in the EIA report.
- 35) Occupational Health impacts of the Project should be anticipated and the proposed preventive measures spelt out in detail. Details of pre-placement medical examination and periodical medical examination schedules should be incorporated in the EMP. The project specific occupational health mitigation measures with required facilities proposed in the mining area may be detailed.
- 36) Public health implications of the Project and related activities for the population in the impact zone should be systematically evaluated and the proposed remedial measures should be detailed along with budgetary allocations.
- 37) Measures of socio economic significance and influence to the local community proposed to be provided by the Project Proponent should be indicated. As far as possible, quantitative dimensions may be given with time frames for implementation.
- 38) Detailed environmental management plan (EMP) to mitigate the environmental impacts which, should inter-alia include the impacts of change of land use, loss of agricultural and grazing land, if any, occupational health impacts besides other impacts specific to the proposed Project.
- 39) Public Hearing points raised and commitment of the Project Proponent on the same along with time bound Action Plan with budgetary provisions to implement the same should be provided and also incorporated in the final EIA/EMP Report of the Project.
- 40) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
- 41) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
- 42) A Disaster management Plan shall be prepared and included in the EIA/EMP Report.

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- 43) Benefits of the Project if the Project is implemented should be spelt out. The benefits of the Project shall clearly indicate environmental, social, economic, employment potential, etc.
- 44) Besides the above, the below mentioned general points are also to be followed:-
- a) All documents to be properly referenced with index and continuous page numbering.
  - b) Where data are presented in the Report especially in Tables, the period in which the data were collected and the sources should be indicated.
  - c) Project Proponent shall enclose all the analysis/testing reports of water, air, soil, noise etc. using the MoEF&CC/NABL accredited laboratories. All the original analysis/testing reports should be available during appraisal of the Project.
  - d) Where the documents provided are in a language other than English, an English translation should be provided.
  - e) The Questionnaire for environmental appraisal of mining projects as devised earlier by the Ministry shall also be filled and submitted.
  - f) While preparing the EIA report, the instructions for the Proponents and instructions for the Consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II(I) dated 4th August, 2009, which are available on the website of this Ministry, should be followed.
  - g) Changes, if any made in the basic scope and project parameters (as submitted in Form-I and the PFR for securing the TOR) should be brought to the attention of MoEF&CC with reasons for such changes and permission should be sought, as the TOR may also have to be altered. Post Public Hearing changes in structure and content of the draft EIA/EMP (other than modifications arising out of the P.H. process) will entail conducting the PH again with the revised documentation.
  - h) As per the circular no. J-11011/618/2010-IA.II(I) dated 30.5.2012, certified report of the status of compliance of the conditions stipulated in the environment clearance for the existing operations of the project, should be obtained from the Regional Office of Ministry of Environment, Forest and Climate Change, as may be applicable.
  - i) The EIA report should also include (i) surface plan of the area indicating contours of main topographic features, drainage and mining area, (ii) geological maps and sections and (iii) sections of the mine pit and external dumps, if any, clearly showing the land features of the adjoining area.

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