JSW Steel Limited

Regd. Office: JSW Centre
Bandra Kurla Complex,
Bandra (East), Mumbai – 400 051
CIN : L27102MH1994PLC152925
Phone : +91 22 4286 1000
Fax : +91 22 4286 3000

No. JSW/S/CO/2024/337 Date: 14/05/2024

To,
The Deputy Director General of Forests (C),
Ministry of Environment, Forest and Climate Change,
Regional Office (Eastern Zone),
A/3, Chandersekharpur, Bhubaneswar – 751023

Sub: - Submission of Six-monthly EC compliance report for the **Jajang Iron Ore Mine of M/s JSW Steel Ltd for the period October 2023 to March 2024.**

Ref: - 1. Vesting Order dated 29th May 2020 issued by GoO, Steel and Mines Department.
2. Environment Clearance Letter dated 13.03.2015 and amendment dated 09.11.2015 issued by MOEF&CC, GOI.

Dear Sir,

We are submitting herewith six-monthly EC compliance report of Jajang Iron Ore Mine, M/s JSW Steel Ltd. for the period October 2023 to March 2024 as per EIA notification 2006.The same is also attached in Soft copy to your good office on e-mail to roez.bsr-mef@nic.in; for your ready reference.

We trust that the measures taken towards environmental safeguards comply with the stipulated conditions. We look forward to your guidance which shall certainly help us in our endeavor for improving upon our environmental management practices.

Seeking your co-operation as always.

Thanking you,

Yours Faithfully
For JSW Steel Ltd

MrutyunjayaMahapatra
(Authorized Signatory)

Encl: As above

Steel Limited

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Copy to:

1. Zonal Office Kolkata, Central Pollution Control Board, South end Conclave, Block 502, 5th and 6th Floors, 1582 Razidanga Main Road, Kolkata, West Bengal 700107.
2. The Member Secretary, State Pollution Control Board, A/118, Nilakantha Nagar, Bhubaneswar, Odisha-751012.
3. The Regional Officer, State Pollution Control Board, Baniapat, DD College Road, Keonjhar, Odisha-758001.

ENVIRONMENT CLEARANCE COMPLIANCE STATUS -JAJANG MINE

Six Monthly Compliance report of Environmental Clearance for Jajang Iron Ore Mine, JSW Steel Ltd. for the period from- October 2023 to March 2024.

Reference letter from MoEF&CC, New Delhi- J-11015/96/2012-IA. II(M), Dtd. 13.03.2015 and 09.11.2015.

Capacity- 16.5 MTPA of iron ore (12.8 MTPA ROM by fresh excavation + 3.7 MTPA by rehandling of low-grade old dump/ mineral stacks).

Sl. No	Environment Clearance Conditions	Self - Declaration	Compliance Remarks
A.	**Specific Conditions**		
1	The dump height should be maintained up to 60 meter and overall slope of the dump shall be up to 30°.	Being complied	The active dump height is around 50 meter and well within the limits as per the approved mine plan, ultimate angle of repose of 28 will be maintained once the dump stabilized.
2	The project proponent shall obtain Consent to Establish and Consent to Operate from the State Pollution Control Board, Odisha and effectively implement all the conditions stipulated therein.	Being Complied	CTE and CTO has been vested to JSW Steel Ltd. CTE vide letter no 5113/IND-II-CTE-6463 dated 26.03.2021. New CTO has been vested for 1 year with vide letter no 4820/IND-I-CON-247 dated 13.03.2024 have been obtained from SPCB. CTE & CTO has been attached as **ANNEXURE I.**
3	Environmental Clearance is subjected to obtaining clearance under the Wildlife (Protection) Act, 1972 from the competent authority, as may be applicable to this project.	Complied	No wild life sanctuary/Tiger Reserve/ National Park/ Elephant corridor within the core as well as within the buffer zone of the project. The report for the same has been attached as **ANNEXURE II.**
4	The project proponent shall obtain prior approval of the competent authorities for drawl of requisite quantity of surface water and ground water for the project before commencing the miningactivity.	Complied	There is no drawdown of surface water. We have submitted the renewal application for the groundwater NOC from CGWA. NOC Renewal application has been **ANNEXURE III.**
5	No mining activities are allowed in forest area for which the FC is not available.	Being Complied	The present mining operation is restricted within FC Transfer area over 447.811 ha (Including 44.70ha forest land already diverted). Vide letter No. FE-DIV-FLD-0007-2022- 5306/FE&CC, dated 14.03.2022. FC Transfer letter for diversion of 44.70 ha has been attached as **ANNNEXURE 1V.** Forest clearance applied over 46.757 Ha Forest land to the forest department with vide letter no. JSW/S/CO/2023/773 dated 28.11.2023. FC letter for diversion of 46.757 has been attached as **ANNEXURE V.**
6	The Condition 3(iii)b of the guidelines issued by the Forest Conservation Division in this I Ministry vide F.No.1 1-362/2012- FC dated 1st February, 2013 is		The present mining operation is restricted within FC Transfer area over 447.811 ha(Including 44.70 ha forest land already diverted) Vide letter no FE-DIV-FLD-0007-

	not being prescribed in view of Hon'ble Supreme Court Order dated 27.01.2014 and the EC is subjected to the final order of the Supreme Court in the matter.		2022-5306/FE&CC, dated 14.03.2022. FC Transfer letter for diversion of 44.70 ha has been attached as **ANNNEXURE 1V.** Forest clearance applied over 46.757 Ha Forest land to the forest department with vide letter no. JSW/S/CO/2023/773 dated 28.11.2023. FC letter for diversion of 46.757 has been attached as **ANNEXURE V.**
7	Traffic density on the route of mineral transportation shall be regularly monitored and report shall be submitted along with compliance report.	Complied	Iron ore lumps and iron ore fines extracted from the mine is being transported through railway/road/port to JSW & other Steel Plants. There are two nos of railway siding namely RMJC-JSW Railway Siding and part of BIL Siding existing within the ML area. Traffic density study has been regularly carried out and the report has been submitted in NEERI Compliance. NEERI Compliance report has been attached as **ANNEXURE XVI.**
8	As part of ambient air quality monitoring during operational phase of the project, the air samples shall also be analyzed for their mineralogical composition and records maintained.	Being Complied	Regular monitoring of ambient air quality parameters along with mineralogical composition being carried out and Monitoring Reports are attached as **ANNEXURE VI**. Vendor is a recognized NABET, MoEF&CC accredited laboratory.
9	Mineral handling plant shall be provided with adequate number of high efficiency dust extraction system. Loading and unloading areas including all the transfer points should also have efficient dust control arrangements. These should be properly maintained and operated.	Complied	Dust Suppression System (Dry fog system) being provided at all appropriate places of mineral handling plants (crusher & screening plant) and other areas. Same are being properly maintained and operated for proper dust control. The photos for the same has been attached as **ANNEXURE VII.**
10	Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to airpollution and having high levels of PM10 and PM2.5 such as haul road, loading and unloading point and transfer points. Fugitive dust emissions from all the sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard Monitoring of Ambient Air Quality tobe carried out based on the Notification 2009, as amended fromtime to time by the Central Pollution Control Board.	Complied	Regular water sprinkling through mobile water sprinkler tankers being carried out on haul roads and nearby mineral dispatch roads to avoid generation of dust during movement of vehicles. Fixed auto sprinklers arrangement has been made on both sides of major haul road. Regular maintenance of Haul roads is being carried out to avoid generation of dust during movement of vehicles. **ANNEXURE VIII.** Regular monitoring of ambient air quality parameters being carried out through and data is well within the limit prescribed. AAQ Monitoring reports are attached as **ANNEXURE VI.**
11	The project authority shall implement suitable conservation measures to augment ground water resources in the	Complied	Maximum rain water has already been channelized to Mine Pits and same is being utilized in dust suppression and other mining

	area in consultation with the Regional Director, Central GroundWater Board.		activities. Existing Retention wall, Garland drains,Check Dams and setting pits are being maintained. Detailed hydrology report has been prepared, recommendations of the study and consultation with CGWA, Additional rainwater harvesting measures/structures will be implemented for rainwater harvesting. Hydrological report has been attached as **ANNEXURE IX.**
12	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by establishing a network of existing wells and installing new piezo meters during the mining operation. The periodic monitoring [(at least four times in a year- pre-monsoon (April- May), monsoon (August), post-monsoon (November) and winter (January); once in each season)] shall be carried out in consultation with theState Ground Water Board/Central Ground Water Authority and the data thus collected may be sent regularly to the Ministry of Environment and Forests and its Regional Office Bhubaneswar, the Central GroundWater Authority and the Regional Director, Central Ground Water Board. If at any stage, it is observed that the groundwater table is getting depleted due to the mining activity; necessary corrective measures shall be carried out.	Being Complied	Regular monitoring of ground water level and quality being carried out and Monitoring reports of post-monsoon (November 23) and winter (January 24) are attached as **ANNEXURE VI.** Vendor is a recognized NABET, MOEF&CC accredited laboratory.
13	The project proponent shall regularly monitor the flow rate of the natural water streams Jalpa, Kakrapani Nallah and Baitarni river and the Sunanadi flowing adjacent to the mine lease and maintain the records.	Being Complied	Regular monitor of the flow rate of the natural water streams of Jalpa, Kakrapani Nallah, Baitarani River and Sunanadi has been carried out. Reports for the same attached as **ANNEXURE VI.**
14	The reclaimed and rehabilitated area shall be afforested. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining compliance status shall be submitted to the ministry of Environment & Forest and its Regional Office located at Bhubaneswar on six monthly basis.	Being Complied	Around 44.62 ha of land has been backfilledby ex-lessee (M/s Rungta Pvt Ltd). As per approved modified mine plan during the plan period an area of 22.56 Ha will be backfilled. Thus, the total backfilling area atthe end of plan period will be 67.18 ha. It has been planned to reclaim the mined-out area by Back-filling and plantation/re- grassing in the conceptual period and compliance status of the same will be submitted to RO, MOEF&CC on six monthly basis.
15	Dimension of the retaining wall at the toe of temporary over burden dumps and OB benches within the mine to check run-off and siltation shall be based on the rain fall data.	Being Complied	Existing Retention wall being maintained to prevent any direct flow of runoff to nearby water bodies as per requirement. So far, the retaining wall up to a length of 3323 m around the dump, backfilling area etc has been constructed by by erstwhile lessee (M/s Rungta Pvt Ltd) and necessary repair of retaining wall is being undertaken on regular basis. Retaining

			Wall around 400m has been constructed during 2023-24. As per approved modified mine plan, back filling site and OB dump area are proposed to be surrounded by retaining wall (1.0m Height) and garlanddrains (1.0m depth) to prevent any direct flow of runoff to nearby water bodies. Retaining wall photos has been attached as **ANNEXURE X**.
16	Plantation shall be raised in a specified area including a 7.5m wide green belt in the safety zone around the mining lease, backfilled and reclaimed area, around the higher benches of excavated void to be converted in to water body, roads etc.by planting the native species in consultation with the local DFO/Agriculture Department. The density of the trees should be around 2500 plants per Ha.	Being Complied	In FY 2022-23 a total of 14100 saplings were planted, and in current FY 2023-24 10000 saplings have been planted. Approximately 3.74 ha of plantation have been established within safety zones. Photos for the same attached as **ANNEXURE XI.**
17	Effective safeguard measures such as regular water sprinkling shall be carried out in critical areas prone to airpollution and having high levels of SPM and RPM such as haul road, loading and unloading point andtransfer points. It shall be ensured thatthe Ambient Air Quality parameters conform to the norms prescribed by the Central Pollution Control Board in this regard.	Complied	Drills equipped with dust extractors/ equipped with water injection system beingoperated in mine. Controlled blasting is in place. Dust Suppression System (Dry fog system) being provided at all appropriate places of mineral handling plants (crusher & screening. plant) and other areas. Same are being maintained for proper dust control. Regular water sprinkling through mobilewater sprinkler tankers being carried out on haul roads and nearby mineral dispatch roads (express highway) to avoidgeneration of dust during movement of vehicles. Dust suppressant chemicals arebeing used to control the dust emission on the haul roads, which also reduces the waterconsumption. **ANNEXURE VII.** Regular maintenance of Haul roads is being carried out to avoid generation of dust during movement of vehicles. Regularmonitoring of ambient air qualityparameters being carried out and data is wellwithin limits. AAQ Monitoring reports are attached as **ANNEXURE VI**.
18	Process water discharge and/or anywaste water shall be properly treated to meet the prescribed standards before reuse/discharge. The runoff from temporary OB dumps and other surface run off shall be analyzed for iron and in case its concentration is found higher than the permissible limit, the waste water should be treated before discharge/reuse.	Being Complied	No process water being discharged from the mine. Regular Monitoring of water quality parameters being carried out. Monitoring reports are attached as **ANNEXURE VI.** As there is no EC and CTO available for the beneficiation plant.

19	The decanted water from the beneficiation plant and slime/tailing pond shall be re-circulated within the mine and there shall be zero discharge from the mine	Not applicable	As there is no EC and CTO available for the beneficiation plant.
20	Regular monitoring of the flow rate of the springs and perennial nallahs shall be carried out and records maintained.	Being Complied	Regular Monitoring of the flow rate of the springs and perennial nallahs carried out. Monitoring reports are attached as **ANNEXURE VI.**
21	Regular monitoring of water quality, upstream and downstream of river shall be carried out and record of monitoring data should be maintained and submitted to Ministry of Environment and Forests, its Regional Office, Bhubaneswar, CGWA, Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board.	Being Complied	Regular monitoring of water quality of up stream and downstream being carried out. Vendor is recognized NABET, MOEF&CC accredited laboratory. Monitoring reports are attached as **ANNEXURE VI.**
22	Suitable rainwater harvesting measures on long term basis shall be planned and implemented in consultation with Regional Director, Central Ground Water Board.	Complied	Maximum rain water has already been channelized to Mine Pits and same is being utilized in dust suppression and other mining activities. Existing Retention wall, Garland drains, Check Dams and setting pits are being maintained. Detailed hydrology report has been prepared, recommendations of the study and consultation with CGWA, additional rainwater harvesting measures/ structures will be implemented for rainwater harvesting. The photos for the same has been attached as **ANNEXURE IX.**
23	Vehicular emissions shall be kept under control and regularly monitored. Measures shall be taken for maintenance of vehicles used in mining operations and in transportation of mineral from mine face to the beneficiation plant. The vehicles shall be covered with a tarpaulin and shall not be overloaded.	Being Complied	Mineral carrying trucks are not allowed to go out of the lease area without tarpaulin cover and is being monitored by security personnel at the exit gate. Vehicular emissions being regularly monitored. Also, Security personnel are also do not allow the vehicles to enter into the mines without having valid PUC. PUC Report has been attached as **ANNEXURE**
24	Sewage treatment plant shall be installed for the colony. ETP shall also be provided for workshop and wastewater generated during mining operation.	Complied	Workshop along with ETP/Oil & Grease trap system being provided within lease area. STP of Capacity 30KLD has been installed. Meanwhile the Soak Pits are being used. The monitoring report for the same has been attached as **ANNEXURE VI.**
25	Digital processing of the entire lease area using remote sensing technique shall be carried out regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment and Forests and its Regional Office Bhubaneswar.	Complied	DGPS Surveyed Mining lease boundary superimposed on High Resolution Satellite image of Jajang Iron Ore Mine duly vetted by M/s ORSAC has been attached as **ANNEXURE XII.**
26	Pre-placement medical examination and periodical medical examination of the workers engaged in the project shall be	Complied	Initial medical examination & Periodical medical examination of the workers engaged in the the project is being varied periodically and records are maintained. A medical dispensary

	carried out and records maintained. For the purpose, schedule of health examination of the workers should be drawn and followed accordingly.		with full time Doctor has been appointed at mine area for the health check-up of the employees and alsothe locals.
27	The project proponent shall undertake all the commitments madeduring the public hearing and effectively address the concerns raised by the locals in the public hearing as well as during consideration of the project, while implementing the project.	Being Complied	Jajang Mining operation was started from 1st July 2020 and various communitydevelopment initiatives are under implementation for community upliftment. Need based assessment survey has beencompleted and action plan is under implementation for the compliance.
28	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered fauna spotted in the study area. Action planfor conservation of flora and fauna shall be prepared and implemented in consultation with the State Forest and Wildlife Department. Necessary allocation of funds for implementation of the conservation plan shall be made and the funds so allocated shall be included in the project cost. All the safeguard measures brought out in the Wildlife Conservation Pan so prepared specific to the project site shall be effectively implemented. A copy of action plan shall be submitted to the Ministry of Environment and Forests and its Regional Office, Bhubaneswar.	Complied	No wild life sanctuary/Tiger reserve/National park/ Elephant corridor within the core as well as within the buffer zone of the project. The Site Specific Wild life Conservation plan has been approved by PCCF vide letter number 1842/CWLW-FDWC-FD-0116-2021, Bhubaneshwar, dated 25/02/2022.
29	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forests 5 years inadvance of final mine closure for approval.	Being Complied	Final Mine Closure plan was approved by erstwhile lessee. After the expiry of the lease on 31.03.2020, the lease was put for auction. After getting the lease through auction mining plan along with progressive mine plan has been approved by IBM. FMCP along with corpus fund details will be submitted 5 years before the approval of final mine closure.

B. General Conditions

Sl. No.	Environment Clearance Conditions	Self - Declaration	Compliance Remarks
1	No change in Iron Ore Processing/ Beneficiation technology and scope of working should be made without prior approval of the ministry of Environment & Forests.	Complied	No change in Iron Ore Processing/ Beneficiation technology. There is no EC and CTO available for the beneficiation plant.
2	No change in the calendar plan including Processing/Beneficiation ofmineral iron ore and waste should be made	Being Complied	As per approved mine plan. There is no ECand CTO available for the beneficiationplant. No change in iron ore processing/Beneficiation technology and scope of working should be made without prior approval of the ministry of Environment & Forests.
3	At least four ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RSPM (Particulate matter with size less than 10 microns i.e., PM10) and NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets and frequency of monitoring should be undertaken in consultation with the State Pollution Control Board. The data so recorded should be regularly submitted to the Ministry including its regional office located at Bhubaneswar and the State Pollution Control Board / Central Pollution Control Board once in six months.	Complied	Regular Ambient air quality monitoring being carried out at four AAQ monitoring stations in core zone and four stations in buffer zone. AAQ monitoring reports are attached as **Annexure V1.**
4	Measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in operations of HEMM, etc. should be provided with ear plugs / muffs.	Being Complied	Noise barrier shall be provided with partially green net covering and partially with tin sheets. Workers engaged in Operations are provided with ear plugs/ muffs. Besides this, acoustic enclosures are provided for all machines operating within the mines. Controlled blasting is in place. Regular Noise Monitoring being carried out and Monitoring reports are attached as **ANNEXURE VI**.

5	There will be zero waste water discharge from the plant	Complied	As no EC and CTO available for the beneficiation plant.
6	Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.	Being complied	Personnel working in dusty areas are provided with nose mask, safety glass and earplug with proper safety training. Dust Suppression System (Dry fog system) being provided at all appropriate places of mineral handling plants (crusher & screening plant) and other areas. Same are being maintained for proper dust control. Preplacement medical examination on and periodical examination on of the workers engaged are being conducted & record maintained.
7	Occupational health surveillance program of the workers should be undertaken periodically to observe any contractions due to exposure to dust and take corrective measures, if needed.	Complied	Initial Medical Examination & Periodical Medical Examination of the workers engaged in the project are being carried periodically and records are maintained. A medical dispensary with full time doctor has been appointed at mine area for the health check-up of employees and also the locals.
8	A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.	Complied	A dedicated Environment Management Cell under the leadership of AVP Environment has been formed and reporting to Mine Senior Management i.e. Head of Operations(VP). The report for the same has been attached as **ANNEXURE XIV**.
9	The funds earmarked for environmental protectionmeasures should be kept in separate account and should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office located at Bhubaneswar.	Being Complied	We are in process for implementation of various measures undertaken for environment management plan since the operation started in July 2020. Details of environmental management measures expenditure (head wise breakup) as **ANNEXURE XV**.
10	The project authorities should inform to the Regional Office located at Bhubaneswar regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Noted	Will be complied.

11	The project proponent shall submit six monthly reports on the status of compliance of the stipulated environmental clearance conditions including results of monitored data (both in hardcopies as well as by e-mail) to the Ministry of Environment and Forests, its Regional Office Bhubaneswar, the respective Zonal Office of Central Pollution Control Board and the State Pollution Control Board. The proponent shall upload the status of compliance of the environmental clearance conditions, including results of monitored data on their website and shall update the same periodically. It shallsimultaneously be sent to the Regional Office of the Ministry ofEnvironment and Forests, Bhubaneswar, the respective Zonal Officer of Central Pollution Control Board and the State Pollution Control Board.	Being Complied	Last six-monthly compliance report along with monitoring data vide letter no JSW/S/CO/2023/755 dated 18.11.2023 was submitted to Regional Office, MOEF&CC, Bhubaneswar, Zonal Office, CPCB, Kolkata, MS and RO Offices SPCB, Odisha. EC Compliance report along with monitoring data being uploaded in companywebsite.
12	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad/ Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.	Noted	Noted
13	The State Pollution Control Board should display a copy of the clearance letter at the regional office, District Industry Centre and the Collector's office/ Tehsildar's Office for 30 days.	Noted	State Pollution Control Board/ Committee has displayed EC letter at its regional office,District Industry Centre and the Collector'soffice/ Tehsildar's Office.
14	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponentto the concerned State PollutionControl Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Office of the Ministry of Environment and Forests, Bhubaneswar by e-mail.	Noted	Last environmental statement for the financial year 2022-2023 with vide letter No JSW/S/CO/2023/590 dated on 20.09.2023 has been submitted to State PollutionControl Board, Odisha and ministry of environment and forest.

15	The project authorities should advertise at least in two local newspapers of the district or state in which the project is located and widely circulated one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy the clearance letter is available with the State Pollution Control Board and also at website of the ministry of environment and forests at and a copy of the same should be forwarded to the Regional Office of this Ministry located at Bhubaneswar.	Complied	It has been published in two local newspapers of the district.

ANNEXURE I

BY REGD. POST WITH AD

STATE POLLUTION CONTROL BOARD, ODISHA

[DEPARTMENT OF FOREST, ENVIRONMENT & CLIMATE CHANGE, GOVERNMENT OF ODISHA]
A/118, Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012
Phone-2561909, Fax: 2562822, 2560955 E-mail: paribesh1@ospcboard.org, Website: www.ospcboard.org

CONSENT ORDER

No. 4820 / IND-I-CON-247 Dt. 30.03.2024

CONSENT ORDER NO. 2942

Sub: Consent for discharge of sewage and trade effluent under section 25/26 of Water (PCP) Act, 1974 and for existing / new operation of the plant under section 21 of Air (PCP) Act, 1981.

Ref: Your online application No. 5230256, Dated 14-12-2023.

Consent to operate is hereby granted under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 and under section 21 of Air (Prevention & Control of Pollution) Act, 1981 and rules framed thereunder to

Name of the Industry: **JAJANG IRON & MANGANESE MINES OF M/S. JSW STEEL LTD.**

Name of the Applicant & Designation: **SHRI VINOD NOWAL, DY. MD**

Address: **AT: JAJANG, PO: JURUDI, DIST: KEONJHAR, PIN-758052, ODISHA**

This consent order is valid for the period from **01.04.2024 to 31.03.2025.**

Details of Products Manufactured

Sl. No	Product	Quantity
01.	Iron Ore(ROM)	12.8 MTPA

Details of Mineral Handing Plants /Units

01.	***Railway siding of handling capacity 7.2 MTPA of sized Iron ore & Iron ore fines***
02	***Stationary Crushing Plant of capacity 1x600 TPH & 1x150 TPH.***
03.	***Mobile Crushing Plant of capacity 15x100 TPH***
04.	***Stationary Screening Plant of capacity 1x250 TPH***
05.	***Mobile Screening Plant of capacity 12x300 TPH &7x150 TPH***

This consent order is valid for the specified outlets, discharge quantity and quality, specified chimney/stack, emission quantity and quality of emissions as specified below. This consent is granted subject to the general and special conditions stipulated therein.

A. Discharge permitted through the following outlet subject to the standard

Outlet No.	Description of outlet	Point of discharge	Quantity of discharge	Prescribed Standard				
				pH	TSS (mg/l)	BOD (mg/l)	Fecal Coliform (MPN/ 100ml)	Oil & Grease (mg/l)
01	Septic tank (Domestic effluent)	Soak pit	--	5.5-9.0	200	100	--	--
02	Mine drainage water/ surface runoff/other wastewater	On land / inland surface water body	--	5.5-9.0	100 (Rainy day) 50 (Non-Rainy day)	--	--	10

B. Fugitive Emission Standards

Particulate Matter	1200 $\mu g/m^3$
Note : Fugitive emission shall be monitored in the predominant downwind direction at a distance 25.0 $\pm$ 2.0 metres from the source of fugitive emission as per following :	
Area	**Monitoring Location**
Mine face / Benches	Drilling, excavation and loading applicable for operating benches above water table
Haul Roads/ Service Roads	Haul roads to ore processing plant, waste dumps and loading areas and service road.
Crushing plant	Run-off mine unloading at hopper, crushing areas, screens and transfer points.
Screening plant	Screens, conveying and transportation of ore discharge points.
Ore storage and loading	Intermediate stock bin / pile areas, ore stock bin / pile areas, wagon / truck loading areas.
Waste dump	Active waste / reject dumps

C. Disposal of solid waste permitted in the following manner

Sl. No.	Type of Solid waste	Quantity generated (TPD)	Quantity to be reused on site(TPD)	Quantity to be reused off site(TPD)	Quantity disposed off (TPD)	Description of disposal site.
01	Top soil/ over burden	As per approved mining plan	--	--	--	As per approved mining plan

D. GENERAL CONDITIONS FOR ALL UNITS

1. The consent is given by the Board in consideration of the particulars given in the application. Any change or alternation or deviation made in actual practice from the particulars furnished in the application will also be the ground for liable to review/variation/revocation of the consent order under section 27 of the Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 and to make such variations as deemed fit for the purpose of the Acts.
2. The occupier would immediately submit revised application for consent to operate to this Board in the event of any change in the quantity and quality of raw material / products / manufacturing process or quantity /quality of the effluent rate of emission / air pollution control equipment / system etc.
3. The applicant shall not change or alter either the quality or quantity or the rate of discharge or temperature or the route of discharge without the previous written permission of the Board.
4. The application shall comply with and carry out the directives/orders issued by the Board in this consent order without any negligence on his/her part. In case of non-compliance of any order/directives issued at any time and/or violation of the terms and conditions of this consent order, the applicant shall be liable for legal action as per the provisions of the Law.
5. The applicant shall make an application for grant of fresh consent at least 90 days before the date of expiry of this consent order.
6. The issuance of this consent does not convey any property right in either real or personal property or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central, State laws or regulation.
7. This consent does not authorize or approve the construction of any physical structure or facilities or the undertaking of any work in any natural water course.
8. The applicant shall display this consent granted to him in a prominent place for perusal of the public and inspecting officers of this Board.
9. An inspection book shall be opened and made available to Board's Officers during the visit to the factory.
10. The applicant shall furnish to the visiting officer of the Board any information regarding the construction, installation or operation of the plant or of effluent treatment system / air pollution control system / stack monitoring system any other particulars as may be pertinent to preventing and controlling pollution of Water / Air.
11. The applicant shall display suitable caution board at the place where the effluent is entering into any water-body or any other place to be indicated by the Board, indicating therein that the area into which the effluents are being discharged is not fit for the domestic use/bathing.
12. Storm water shall not be allowed to mix with the trade and/or domestic effluent on the upstream of the terminal manholes where the flow measuring devices will be installed.
13. The applicant shall maintain good house-keeping both within the factory and the premises. All pipes, valves, sewers and drains shall be leak-proof. Floor washing shall be admitted into the effluent collection system only and shall not be allowed to find their way in storm drains or open areas.
14. The applicant shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems install or used by him to achieve with the term(s) and conditions of the consent.
15. Care should be taken to keep the anaerobic lagoons, if any, biologically active and not utilized as mere stagnation ponds. The anaerobic lagoons should be fed with the required nutrients for effective digestion. Lagoons should be constructed impervious.
16. The utilization of treated effluent on factory's own land, if any, should be completed and there should be no possibility of the effluent gaining access into any drainage channel or other water courses either directly or by overflow.
17. The effluent disposal on land, if any, should be done without creating any nuisance to the surroundings or inundation of the lands at any time.
18. If at any time the disposal of treated effluent on land becomes incomplete or unsatisfactory or create any problem or becomes a matter of dispute, the occupier must adopt alternate satisfactory treatment and disposal measures.
19. The sludge from treatment units shall be dried in sludge drying beds and the drained liquid shall be taken to equalization tank.
20. The effluent treatment units and disposal measures shall become operative at the time of commencement of production.
21. The applicant shall provide port holes for sampling the emissions and access platform for carrying out stack sampling and provide electrical outlet points and other arrangements for chimneys/stacks and other sources of emissions so as to collect samples of emission by the Board or the applicant at any time in accordance with the provision of the Acts or Rules made therein.

22. The applicant shall provide all facilities and render required assistance to the Board staff for collection of samples / stack monitoring / inspection.
23. The applicant shall not change or alter either the quality or quantity or rate of emission or install, replace or alter the air pollution control equipment or change the raw material or manufacturing process resulting in any change in quality and/or quantity of emissions, without the previous written permission of the Board.
24. No control equipments or chimney shall be altered or replaced or as the case may be erected or re-erected except with the previous approval of the Board.
25. The liquid effluent arising out of the operation of the air pollution control equipment shall be treated in the manner so as to meet the standards prescribed by the Board in accordance with the provisions of Water (Prevention and Control of Pollution) Act, 1974 (as amended).
26. The stack monitoring system employed by the applicant shall be opened for inspection to this Board at any time.
27. There shall not be any fugitive or episodal discharge from the premises.
28. In case of such episodal discharge/emissions the occupier shall take immediate action to bring down the emission within the limits prescribed by the Board and stop the operation of the plant if required. Report of such accidental discharge /emission shall be brought to the notice of the Board within 24 hours of occurrence.
29. The applicant shall keep the premises and air pollution control equipments clean and make all hoods, pipes, valves, stacks/chimneys leak proof. The air pollution control equipments, location, inspection chambers, sampling port holes shall be made easily accessible at all times.
30. Any upset condition in any of the plant/plants of the factory which is likely to result in increased effluent discharge/emission of air pollutants and / or result in violation of the standards mentioned shall be reported to the Headquarters and Regional Office of the Board by E-mail within 2 hours of its occurrence.
31. The occupier has to ensure that minimum three varieties of trees are planted at the density of not less than 1000 trees per acre. The trees may be planted along boundaries of the premises. This plantation is stipulated over and above the bulk plantation of trees in that area.
32. The solid waste such as sweeping, wastage packages, empty containers residues, sludge including that from air pollution control equipments collected within the premises of the shall be disposed off scientifically to the satisfaction of the Board.
33. All solid wastes arising in the premises shall be properly classified and disposed off to the satisfaction of the Board by :
    i) Land fill in case of inert material, care being taken to ensure that the material does not give rise to leachate which may percolate into ground water or carried away with storm run-off.
    ii) Controlled incineration, wherever possible in case of combustible organic material.
    iii) Composting, in case of bio-degradable material.
34. Any toxic material shall be detoxicated if possible, otherwise be sealed in steel drums and buried in protected areas after obtaining approval of this Board in writing. The detoxication or sealing and burying shall be carried out in the presence of Board's authorized persons only. Letter of authorization shall be obtained for handling and disposal of hazardous wastes.
35. If due to any technological improvement or otherwise this Board is of opinion that all or any of the conditions referred to above requires variation (including the change of any control equipment either in whole or in part) this Board shall after giving the applicant an opportunity of being heard, vary all or any of such condition and thereupon the applicant shall be bound to comply with the conditions so varied.
36. The applicant, his/heirs/legal representatives or assignees shall have no claim whatsoever to the condition or renewal of this consent after the expiry period of this consent.
37. The Board reserves the right to review, impose additional conditions or condition, revoke change or alter the terms and conditions of this consent.
38. Notwithstanding anything contained in this conditional letter of consent, the Board hereby reserves to it the right and power under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review any and/or all the conditions imposed herein above and to make such variations as deemed fit for the purpose of the Act by the Board.
39. The conditions imposed as above shall continue to be in force until revoked under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 and section 21 A of Air (Prevention & Control of Pollution) Act, 1981.
40. The occupier shall comply to the conditions stipulated in CTE order issued by Odisha State Pollution Control Board and conditions stipulated in Environmental Clearances issued by MoEF&CC, Govt. of India.
41. The occupier shall abide by E(P) Act, 1986 and Rules framed there-under.
42. In case the consent fee is revised upward during this period, the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the amount within the period stipulated by the Board the consent order will be revoked without prior notice.

GENERAL CONDITIONS FOR UNITS WITH INVESTMENT OF MORE THAN Rs.50 CRORES, AND 17 CATEGORIES OF HIGHLY POLLUTING INDUSTRIES (RED A).

1. The applicant shall analyse the emissions every month for the parameters indicated in TABLE. B & C as mentioned in this order and shall furnish the report thereof to the Board by the 10th of the succeeding month.

2. The applicant shall provide and maintain at his own cost three ambient air quality monitoring stations for monitoring Suspended Particulate Matter, Sulphor Dioxide, Oxides of Nitrogen, Hydro-Carbon, Carbon-Monoxide and monitor the same once in a day/week/fortnight/month. The data collected shall be maintained in a register and a monthly extract be furnished to the Board.

3. The applicant shall provide and maintain at his own cost a meteorological station to collect the data on wind velocity, direction, temperature, humidity, rainfall, etc. and the daily reading shall be recorded and the extract sent to the Board once in a month.

4. The applicant shall forward the following information to the Member Secretary, State Pollution Control Board, Odisha, Bhubaneswar regularly.
   a. Report of analysis of stack monitoring, ambient air quality monitoring meteorological data as required every month.
   b. Progress on planting of trees quarterly.

5. The applicant shall install mechanical composite sampling equipment and continuous flow measuring / recording devices on the effluent drains of trade as well as domestic effluent. A record of daily discharge shall be maintained.

6. The following information shall be forwarded to the Member Secretary on or before 10th of every month.

   a. Performance / progress of the treatment plant.
   b. Monthly statement of daily discharge of domestic and/or trade effluent.

7. -Non-compliance with effluent limitations

   a) If for any reason the applicant does not comply with or is unable to comply with any effluent limitations specified in this consent, the applicant shall immediately notify the consent issuing authority by telephone and provide the consent issuing authority with the following information in writing within 5 days of such notification.

      i) Causes of non-compliance

      ii) A description of the non-compliance discharge including its impact on the receiving waters.

      iii) Anticipated time of continuance of non-compliance if expected to continue or if such condition has been corrected the duration or period of non-compliance.

      iv) Steps taken by the applicant to reduce and eliminate the non-complying discharge and

      v) Steps to be taken by the applicant too prevent the condition of non-compliance.

   b) The applicant shall take all reasonable steps to minimize any adverse impact to natural waters resulting from non-compliance with any effluent limitation specified in this consent including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.

   c) Nothing in this consent shall be construed to relieve the applicant from civil or criminal penalties for non-compliance whether or not such non-compliance is due to factors beyond his control, such as break-down, electric failure, accident or natural disaster.

8. The applicant shall at his own cost get the effluent samples collected both before and after treatment and get them analysed at an approval laboratory every month for the parameters indicated in Part-D and shall submit in duplicate the report thereof to the Board.

9. The addition of various treatment chemicals should be done only with mechanical dozers and proper equipment for regulation of correct dosages determined daily and for proper uniform feeding. Crude practices such as dumping of chemicals in drains or sumps or trickling of acids or alkalies arbitrarily and utilizing poles for stirring etc. should not be resorted to.

10. In the disposal of treated effluent on land for irrigation, the industry shall keep in view of the need for;

    a) Rotation of crops

    b) Change of point of application of effluent on land

    c) A portion of land kept fallow.

11. The adoption of these would avoid soil becoming sick or slate, the industry may ensure this in consultation with the Agriculture Department.

12. It is the sole responsibility of the industry to ensure that there are no complaints at any time from the royats in the surrounding areas as a result of discharge of sewage or trade effluent if any.

13. Proper housekeeping shall be maintained by a dedicated team.

14. The industry must constitute a team of responsible and technically qualified personnel who will ensure continuous operation of all pollution control devices round the clock (including night hours) and should be in a position to explain the status of operation of the pollution control measures to the inspecting officers of the Board at any point of time. The name of these persons with their contact telephone numbers shall be intimated to the concerned. Regional Officer and Head Office of the Board and in case of any change in the team it shall be intimated to the Board immediately.

E. (1) SPECIAL CONDITIONS:(for the mine and railway siding):

1. This consent order is subject to compliance of orders of the Hon'ble Supreme Court of India In the matter of W. P. (Civil) 114/2014.
2. This consent order is subject to permission from Steel and Mines Department, Government of Odisha for continuing of mining operation.
3. Mining operation is subject to availability of all other statutory clearances.
4. The mine shall confine its activity within the previous lease area of 666.15 ha as EC & CTE are not yet obtained for the new lease deed executed over increased area of 669.078 ha. A declaration to this effect shall be submitted to the Board within 07 days.
5. Drills shall either be operated with dust extractors or equipped with water injection system to minimize dust generation in the work environment.
6. Controlled blasting shall be practiced to minimize generation of dust and fly rocks.
7. Regular water sprinkling shall be carried out in critical areas prone to air pollution such as around crushing and screening plant. Water sprinkling shall also be carried out on haul roads at frequent interval so that it should always remain in wet condition. Haulage roads shall be devoid of ruts and potholes and shall be maintained properly to avoid generation of dust during movement of vehicles.
8. Dust suppression measures preferably dry fog system shall be provided at all appropriate places of mineral handling plants (crusher & screening plant). Loading and unloading areas including all the transfer points shall also have efficient dust suppression arrangements (dry fog system). These shall be properly maintained and operated.
9. Fixed auto sprinklers shall be provided on both sides of major haul road and approach road of the mine and inside railway siding. Frequency of water sprinkling through mobile water tankers shall be increased till installation of fixed sprinklers.
10. Wheel washing facility for the ore transport vehicles shall be provided at the exit point of the mine. The wheel washing facility shall be integrated with complete recirculation system.
11. The vehicles carrying ore for transportation from the mine shall be covered with tarpaulin (both bottom & top).
12. Regular water sprinkling on mineral transportation roads passing through the habitation area as well as other strategic point on the National Highway shall be done jointly by the mining lessees in consultation with the Regional Officer.
13. Regular water sprinkling shall be done on approach roads, stockpiles, railway siding area and transportation road (Banspani to Bamebari) to suppress fugitive dust during plying of vehicles.

14. Four Ambient Air Quality Monitoring Stations shall be established in core zone and buffer zone for monitoring of ambient air quality and location of the stations shall be decided in consultation with the Regional Officer, State Pollution Control Board based on the metrological data, topographical features and environmentally and ecologically sensitive targets.
15. The monitoring of ambient air quality shall be carried out twice in a week (24 hourly) at a particular site and the consolidated data shall be submitted to the State Pollution Control Board, once in a year.
16. The ambient air quality shall remain within prescribed national ambient air quality standards.
17. Four Continuous Ambient Air Quality Monitoring Stations (CAAQMS), with data transfer facility to SPCB server shall be established in core and buffer zone. The locations of these stations shall be decided in consultation with the Regional Officer, State Pollution Control Board, based on metrological data, topographical features and environmentally and ecologically sensitive targets.
18. The CAAQMS shall be properly maintained and calibrated from time to time to ensure that spurious data are not transmitted to the SPCB server.
19. Fugitive Dust Emission Monitoring shall be carried out at the places as stated in Part-B of this order. The monitoring of fugitive dust shall be carried out twice in a week (24 hourly) at a particular site and consolidated data shall be submitted to the State Pollution Control Board, once in a year.
20. The topsoil generated shall be stored at earmarked site (s) only and stabilized with plantation or shall be used for land reclamation and plantation.
21. The over burden generated during the course of mining shall be stacked at earmarked dump site (s) and stabilized with plantation or used for reclamation of excavated land followed by plantation.
22. The project proponent shall ensure that no natural watercourse and / or water resources are obstructed due to any mining operations.
23. Check dams and check weirs shall be constructed at appropriate places of the mine lease area to prevent direct flow of runoff to nearby water bodies. The surface run off water from the existing runoff management system shall meet the prescribed standards as stated in Sl. 2 of Part-A of this order.
24. Retention wall shall be constructed at the toe of topsoil dump and OB dump. Garland drain shall be constructed around topsoil dumps, over burden dumps, mineral stack yards and railway siding area terminating at settling pit to prevent direct disposal of runoff to nearby water bodies.
25. Garland drain and sedimentation pit shall be de-silted after monsoon or as and when required. The runoff discharge quality from runoff management system shall meet the standards prescribed as stated in Sl. 2 of Part-A of this order.

26. Domestic effluents shall be treated in a sewage treatment plant (STP) and or shall be discharged to soak pit via septic tank constructed as BIS specification. The treated wastewater quality of STP shall remain within the following standards and shall be used for plantation:

pH	-	6.5 -9.0
TSS	-	<100 mg/l
BOD	-	30 mg/l
Fecal Coliform	-	<1000 MPN/100 ml.

27. ETP comprising of oil and grease trap with sedimentation pit shall be provided for treatment of workshop effluent and treated effluent shall remain within the following prescribed standards and shall be re-used for washing of vehicles:

pH	-	6.5 -8.5
TSS	-	50 mg/l
Oil & Grease	-	10 mg/l
COD	-	150 mg/l

28. Regular monitoring of water quality of upstream and downstream of surface water bodies existed if any within 5 Km shall be carried out once in every month and record shall be maintained and submitted to the State Pollution Control Board once in every year. Monitoring shall be carried out through MoEF& CC accredited laboratory.
29. Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells. The monitoring should be done four times a year in pre-monsoon (April/May), monsoon (August), post-monsoon (November) and winter (January) seasons. Data thus collected should be submitted to the Board quarterly.
30. The mine shall take necessary action for compliance with the air and water quality standards as stipulated in Part-A and Part-B of this order.
31. Adequate measures shall be taken for control of noise levels in the work environment of mine area so that noise levels at the boundary line of mining lease area shall not exceed 75 dB(A) during day time (6.00 AM to 9.00 PM) and 70 dB(A) during night time (9.00 PM to 6 AM).
32. Adequate noise barriers shall be provided surrounding the crushing and screening plants to control noise pollution and avoid impact on wildlife due to operation of crushing and screening plants during night hours.
33. Online noise monitoring system shall be installed to monitor noise level during night hours.
34. Protective barriers shall be provided for the lights to prevent illumination towards the forest area during night hours.

35. The following deficiencies in pollution control measures were observed during inspection of your mine on 19.12.2023, 2.12.2023 and 15.02.2024:

i) Although Dry fog system is provided at crushing and screening plant, but the same is not operational. DFS installed at fixed crusher & screening plant (1x300TPH) in C block is required to be functional.

ii) Iron ore fines dump and sub-grade dumps are not provided with proper retaining wall/toe wall Garland drain.

iii) Water sprinkling on Haul roads, Crusher & Screening was not sufficient enough for dust suppression.

iv) One mechanized wheel washing facility with complete recirculation system has been provided at the exit gate of the mine, but the same is found to be grossly inadequate during peak transportation capacity of the mine.

v) Intermittent water sprinkling by tankers was observed on mineral transportation road, which was not sufficient enough for dust suppression.

vi) Proper surface runoff management is not provided in the mine.

vii) Garland drain with settling pit provided at west side of railway siding is not of adequate capacity. No garland drain and settling pond in the eastern side of the railway siding.

viii) Noise barriers around crushing and screening plant are not yet provided.

An action plan for rectification of the above deficiencies shall be submitted by 15.04.2024 at the Regional Office as well at Head Office of SPCB, Odisha.

36. Ambient air quality monitoring data, noise monitoring data and water / wastewater quality monitoring data shall be electronically displayed at the entry point of the mine or at a suitable location of the mine.

37. The height of the stack connected to DG sets of capacity more than 800 KVA shall conform to the following:

i) $14Q^{0.3}$, Q = Total SO_2 emission from the plant in kg/hr.
ii) Minimum 6m. above the building where generator set is installed.
iii) 30 m.

38. The height of the stack connected to DG set of capacity less than and upto 800 KVA shall conform to the following:

i) $H = h+0.2\sqrt{KVA}$
ii) h= Height of the building where it is installed in meter
iii) KVA = Capacity of DG set
iv) H = Height of the stack in meter above ground level.

39. All DG sets installed before 1.7.2004 shall be scrapped. DG sets complying with either State-I or Stage-II emission norms shall reduce Particulate Matter Emission

by 70% by installing RECD without affecting any other emission parameters as per the CPCB guidelines and Board's letter vide No.17927, dated 14.11.2023, in this regard.

40. Plantation of trees shall be undertaken in the colony/ township, over top soil dumps, OB dumps, along the side of haul road and in other areas of the mines not being utilized for mining activities. The mine shall take up avenue plantation and plantation in nearby village areas in consultation with DFO/Horticulture Department. The plantation details shall be submitted to the Board before end of April every year.

41. A copy of the annual return (annual return submitted to IBM, Govt. of India/ Directorate of Mines, Govt. of Odisha) shall be submitted to this Board every year.

42. The environmental statement report shall be submitted to the Board in prescribed format every year.

E. (2) SPECIAL CONDITIONS: (for railway siding)

1. All entry points, internal roads and loading/unloading areas must be adequately compacted for movement of heavy vehicles by using low permeability material and be cleaned regularly to minimize potential of dust generation and off-site impact.
2. A boundary wall of at least 3 meter height shall be constructed along the periphery of the railway siding to prevent the dust particles from being air borne and/or getting carried away with surface runoff to nearby water bodies.
3. The height of material stack within storage areas must be kept below the height of the boundary wall at all times to prevent the material from being air borne.
4. All mineral storage areas containing fines or dusty materials must be either;
   (a) Covered with tarpaulins when not in use or
   (b) Fitted with Water Sprinkling/Dry fog systems.
5. Green belt of adequate width (at least one row of trees) shall be developed along the boundary of railway siding.
6. At the material storage areas, atomized stationery mist spray of water or conditioning of material with water shall be practiced to prevent dust getting air borne during loading/unloading.
7. Appropriate transfer chutes shall be provided at material discharge points at material storage areas, loading points etc. to minimize the discharge height and spread of air borne dust.
8. Garland drain shall be provided along the boundary wall at the appropriate places depending upon the slope of the area, inside the railway siding. Provision shall be made for collection of wash water from the garland drain and the water, so collected shall be treated in a sedimentation tank for further use inside the premises for green belt or water sprinkling etc.

9. After operation of railway siding, the mine shall submit an annual return to concerned Regional Office in the prescribed format as per Annexure-I by 31st May every year incorporating the quantities and types of materials handled during the preceding financial year (i.e.1st April to 31st March).

30/03/23

MEMBER SECRETARY
STATE POLLUTION CONTROL BOARD, ODISHA

TO,

SHRI VINOD NOWAL, DY. MD,
JAJANG IRON & MANGANESE MINES
OF M/S. JSW STEEL LTD
AT/PO: JAJANG, PS: BAMEBARI
DIST- KEONJHAR, PIN-758052

Memo No._____/Dt._____/

Copy forwarded to :

i) Regional Officer, State Pollution Control Board, **Keonjhar.**
ii) District Collector, **Keonjhar**
iii) Director of Mines, Govt. of Odisha, Bhubaneswar
iv) Director, Environment-cum-Special Secretary, F, E & CC Dept., Govt. of Odisha, Bhubaneswar.
v) D.F.O., **Keonjhar**
vi) Deputy Director of Mines, **Joda**
vii) Chief Env. Scientist, Central Lab. SPCB, Bhubaneswar
viii) Addl. Chief Env. Engineer, (Hazardous Waste Management Cell)
ix) Consent Register

CHIEF ENV. ENGINEER (M)
STATE POLLUTION CONTROL BOARD, ODISHA

GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS

GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART – A : EFFLUENTS

Sl. No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Costal Areas
		(a)	(b)	(c)	(d)
1.	Colour & odour	Colourless/ Odourless as far as practible	--	See 6 of Annex-1	See 6 of Annex-1
2.	Suspended Solids (mg/l)	100	600	200	a. For process wastewater – 100 b. For cooling water effluent 10% above total suspended matter of influent.
3.	Particular size of SS	Shall pass 850	--	--	--
5.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature	Shall not exceed 5°C above the receiving water temperature	--	--	Shall not exceed 5°C above the receiving water temperature
7.	Oil & Grease mg/l max.	10	20	10	20
8.	Total residual chlorine	1.0	--	--	1.0
9.	Ammonical nitrogen (as N) mg/l max.	50	50	--	50
10.	Total Kajeldahl nitrogen (as NH_3) mg/1 max.	100	--	--	100
11.	Free ammonia (as NH_3) mg/1 max.	5.0	--	--	5.0
12.	Biochemical Oxygen Demand (5 days at (20°C) mg/1 max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/1 max.	250	--	--	250
14.	Arsenic (as As) mg/1 max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg) mg/1 max.	0.01	0.01	--	0.001
16.	Lead (as pb) mg/1 max.	01.	1.0	--	2.0

Sl. No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Costal Areas
		(a)	(b)	(c)	(d)
17.	Cardmium (as Cd) mg/1 max.	2.0	1.0	--	2.0
18.	Hexavalent Chromium (as Cr + 6) mg/l max.	0.1	2.0	--	1.0
19.	Total Chromium (as Cr) mg/l max.	2.0	2.0	--	2.0
20.	Copper (as Cu) mg/l max.	3.0	3.0	--	3.0
21.	Zinc (as Zn) mg/l max.	5.0	15	--	15
22.	Selenium (as Sc) mg/l max.	0.05	0.05	--	0.05
23.	Nickel (as Nil) mg/l max.	3.0	3.0	--	5.0
24.	Cyanide (as CN) mg/l max.	0.2	2.0	0.2	0.02
25.	Fluoride (as F) mg/l max.	2.0	15	--	15
26.	Dissolved Phosphates (as P) mg/l max.	5.0	--	--	--
27.	Sulphide (as S) mg/l max.	2.0	--	--	5.0
28.	Phennolic compounds as (C_6H_5OH) mg/l max.	1.0	5.0	--	5.0
29.	Radioactive materials a. Alpha emitter micro curle/ml. b. Beta emitter micro curle/ml.	 10^{-7} 10^{-6}	 10^{-7} 10^{-6}	 10^{-8} 10^{-7}	 10^{-7} 10^{-6}
30.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
31	Manganese (as Mn)	2 mg/l	2 mg/l	--	2 mg/l
32.	Iron (Fe)	3 mg/l	3 mg/l	--	3 mg/L
33.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	--	0.2 mg/l
34.	Nitrate Nitrogen	10 mg/l	--	--	20 mg/l

NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutants	Time Weighed Average	Concentrate of Ambient Air		
			Industrial Residential, Rural and other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1.	Sulphur Dioxide (SO_2), µg/m³	Annual *	50	20	-Improved west and Gacke
		24 Hours **	80	80	- Ultraviolet fluorescence
2.	Nitrogen Dioxide (NO_2), µg/m³	Annual *	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 Hours **	80	80	- Chemiluminescence
3.	Particulate Matter (size less than 10µm) or PM_{10}µg/m³	Annual *	60	60	-Gravimetric - TOEM
		24 Hours **	100	100	- Beta Attenuation
4.	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$µg/m³	Annual *	40	40	-Gravimetric - TOEM
		24 Hours **	60	60	- Beta Attenuation
5.	Ozone (O_3) µg/m³	8 Hours **	100	100	- UV Photometric - Chemiluminescence
		1 Hours **	180	180	- Chemical Method
6.	Lead (Pb) µg/m³	Annual *	0.50	0.50	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper. - ED-XRF using Teflon filter
		24 Hours **	1.0	1.0	
7.	Carbon Monoxide (CO) mg/m³	8 Hours **	02	02	- Non Dispersive Infra Red (NDIR) Spectroscopy
		1 Hours **	04	04	
8.	Ammonia (NH_3) µg/m³	Annual*	100	100	-Chemiluminescence
		24 Hours**	400	400	- Indophenol Blue Method
9.	Benzene (C_6H_6) µg/m³	Annul *	05	05	-Gas Chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10.	Benzo (a) Pyrene (BaP)-Particulate phase only, ng/m³	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11.	Arsenic (As), ng/m³	Annual*	06	06	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni),ng/m³	Annual*	20	20	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Tel : 2564033/2563924
EPABX : 2561909/2562847
E-mail: paribesh1@ospcboard.org
Web site : www.ospcboard.org

ODISHA

OFFICE OF THE
STATE POLLUTION CONTROL BOARD, ODISHA
[DEPARTMENT OF FOREST & ENVIRONMENT, GOVERNMENT OF ODISHA]
Paribesh Bhawan, A/118, Nilakantha Nagar, Unit – VIII
Bhubaneswar – 751 012, INDIA

By Speed Post
Through online

No. 5113 / **IND-II-CTE-6463** Date 26-03-2021 /

CONSENT TO ESTABLISH ORDER

In consideration of the online application no. **3180772** for obtaining Consent to Establish for **Jajang Iron Ore Mine of M/s JSW Steel Ltd.**, the State Pollution Control Board is pleased to convey its Consent to Establish under section 25 of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 for **production of Iron Ore of quantity 12.80 MTPA (ROM) and maximum waste (OB/IB/SB) of quantity 28.589 MTPA along with installation of Crushing, Screening plants and Railway Siding as follows:**

Sl. No.	Particulars	Existing production capacity of Iron Ore along with capacity of the Crushing, Screening and Railway Siding	Proposed production capacity of Iron Ore along with capacity of the Crushing, Screening and Railway Siding after expansion
1.	Production Capacity	16.5 MTPA (12.8 MTPA ROM by fresh excavation + 3.7 MTPA by collection from old dumps/material stacks)	12.8 MTPA (ROM)
2.	Operation of Stationary Crusher of capacity	1X150 TPH, 1X600 TPH	NA
3.	Operation of Mobile Crusher of capacity	15X100 TPH	3X360 TPH, 2X200 TPH, 1X175 TPH
4.	Operation of Mobile Screen of capacity	7X150 TPH, 12X300 TPH	10X400 TPH, 1X180 TPH, 1X170 TPH
5.	Operation of Stationary Screen of capacity	1X250 TPH	NA
6.	Railway siding of handling capacity of sized iron ore and iron ore fines	7.2 MTPA	18.2 MTPA

over an area of 669.078 ha (as per DGPS Survey)/666.150 ha (as per ROR) land in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda, Tehsil Barbil in the district of **Keonjhar,** Odisha with the following conditions.

GENERAL CONDITIONS:

1. **This Consent to Establish is valid for the product, method of mining and capacity mentioned in the application form. This order is valid for five years. The proponent shall do substantial mining activities for the proposal within a period of five years from the date of issue of this Consent to Establish order. If the proponent fails to do substantial mining activities for the proposal within five years then a renewal of this Consent to Establish shall be sought by the proponent.**
2. The mine shall apply for grant of Consent to Operate under Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 & under Section 21 of Air (Prevention & Control of Pollution) Act, 1981 at least 3 (three) months before the commencement of production and obtain Consent to Operate from this Board.
3. No change in mining technology and scope of working shall be made without prior approval of the Board.
4. **This Consent to Establish is subject to statutory and other clearances from Govt. of Odisha and/or Govt. of India, as and when applicable.**

SPECIAL CONDITIONS:

GENERAL:

1. **The proponent shall obtain Environmental Clearance as per EIA Notification, 2006 and production activity for the proposal shall be commenced after obtaining Environmental Clearance.**
2. **The mine shall install digital display board at mines main gate for display of environmental information for public view within 15 days.**
3. **The mine shall comply all 09-points action plan as per the CSIR NEERI.**
4. **Solar power generation system shall be installed inside the mining lease hold area.**
5. The mine shall implement the Pollution Control Measures and safeguards as proposed in the Environment Management Plan (EMP) of Environment Impact Assessment (EIA) report.
6. The proponent shall submit six monthly progress report every year (i.e. June and December) of mining activity of the project to the Board (at Head Office and Regional Office) for record and verification.
7. The unit shall obtain NOC from CGWA for using of ground water for getting Consent to Operate of State Pollution Control Board, Odisha.
8. The proponent shall obtain requisite permission from the Water Resources Department, Govt. of Odisha for drawal of water.
9. The method of mining shall be Fully Mechanized open cast mining.
10. Adequate care shall be taken to prevent creation of ruts and pot holes in the connecting roads.
11. Speed limit of dumpers/trucks inside the premises shall not exceed 10 kmph.

12. After operation of railway siding, the proponent shall submit an annual return to concerned Regional Office in the prescribed format as per **Annexure – I** by 31st May every year incorporating the quantities and types of materials handled during the preceding financial year (i.e. 1st April to 31st March).

13. A green belt of adequate width and density preferably with local species along the periphery of the mine, inactive dumps, backfilled area, vacant area, colony and any other vacant area shall be raised so as to provide protection against particulates and noise to ameliorate the environment. A detailed plantation programme in this regard shall be prepared and submitted at the time of making application for Consent to Operate for assessment.

14. The project proponent shall develop greenbelt in 7.5 m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole green belt shall be developed within first 5 years starting from windward side of the active mining area. The development of greenbelt shall be governed as per the EC granted by the MoEF&CC, Govt. of India irrespective of the stipulation made in approved mine plan.

15. The project proponent shall carryout plantation / afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by plating the native species in consultation with the State Forest Department / Agriculture Department / Rural development department / Tribal Welfare Department / Gram Panchayat such that only those species be selected which are of use to the local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 saplings per hectare. Adequate budgetary provision shall be made for protection and care of trees.

16. The slope of dumps shall be vegetated in scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface runoff. The selection of local species regulates local climatic parameters and help in adaptation of plant species to the microclimate. The gullies formed on slopes should be adequately taken care of as it impacts the overall stability of dumps. The dump mass should be consolidated with the help of dozer / compactors thereby ensuring proper filling / leveling of dump mass. In critical areas, use of geo textiles / geo-membranes / clay liners / Bentonite etc. shall be undertaken for stabilization of the dump.

17. A separate environmental management cell with suitable qualified personnel should be set up under the control of a Senior Executive, who will report directly to the Head of the organization.

18. The Board may impose further conditions or modify the conditions stipulated in this order during installation and/or at the time of obtaining consent to operate and may revoke this clearance in case the stipulated conditions are not implemented.

19. The above conditions will be enforced, inter-allia, under the provisions of the water (Prevention & Control of pollution) Act, 1974 and Air (Prevention & Control of Prevention) Act, 1981 and Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rule.

20. The unit shall abide by Environment (Protection) Act, 1986 and the relevant rules framed thereunder.

WATER POLLUTION:

21. Domestic effluent shall be discharged to soak pit via septic tank constructed as per BIS specification.

22. Garland drains along with settling pit shall be provided around the iron ore fines stock yard to control washout of fines from the stockyard along with surface runoff.

23. Surface run-off from OB dump area, mineral stock yard, top soil storage area and rain water to be pumped from quarry shall be routed through adequate settling pond (designed maximum hourly rain fall basis) to meet prescribed standard of SS - 100 mg/l and Oil & Grease-10 mg/l before discharge into natural stream/water courses during monsoon.

24. At stockpile and loading plant area, a network of drains shall be constructed at a depth of 1.5 meter below the lowest level on the sites parallel to the stockpile area with interconnected box culverts. The sloping of surface shall be given inward to the stockpiles so that surface water will only infiltrate in to the drain.

25. The proponent shall do renovation of existing structure as it was an old mine before going for mining activity.

26. Wheel wash facilities are to be provided to minimize transfer of mud from unpaved approach roads to main paved and/or public roads.

27. Garland drain shall be provided along the boundary wall at the appropriate places depending upon the slope of the area, inside the railway siding. Provision shall be made for collection of wash water from the garland drain and the water, so collected shall be treated in a sedimentation tank for further use inside the premises for green belt or water sprinkling etc.

28. In case the wastewater contains any substance which is harmful to the environment, the same shall be treated to remove the substance so as to meet the prescribed norms.

AIR POLLUTION:

29. **Fixed auto sprinklers on both sides of major haul road, approach road of Railway siding and approach roads of the mine shall be installed within one month and frequency of water sprinkling through mobile water tankers shall be enhanced at the said areas till installation of fixed auto sprinklers.**

30. **Regular water sprinkling through mobile water tankers shall be carried out at mineral stockpile area, mines approach road and transportation road (Banspani to Bamebari) to avoid generation of dust during movement of vehicles.**

31. **04 nos. of CAAQM shall be installed within one month as per the vesting CTO order. Fugitive and AAQ monitoring shall be carried out as per vesting CTO order and report shall be submitted to the Board regularly. Online digital display Board fo size 6ftx4ft as per CPCB specification shall be installed at the main entry gate of the mine for public view.**

32. The proponent shall install one Online Continuous Ambient Air Quality Monitoring Station (CAAQMS) in transportation route inside the mining lease area to monitor PM_{10}, $PM_{2.5}$, SO_2, NOx, CO and other important parameters for online real time data transmission through GPRS system to SPCB RTDAS server and also upload data to CPCB.

33. Drill shall be wet operated or with dust extractors and controlled blasting shall be practices. Pre-wetting of blasting site shall be practiced.

34. The proponent shall abide by the stipulations made in MoEF&CC, Govt. of India notification No. G.S.R. 809 (E), dated 4.10.2010 (copy enclosed as **Annexure – I**).

35. The primary crusher, screen and secondary crusher shall be placed in covered shed. All the conveyor shall be covered with corrugated GI Sheets.

36. Both dust suppression (dry fog) and extraction (bag filter) system shall be provided at all dust generating source such as crushing, screening & material transfer points etc. such that, particulate matter concentration in ambient air shall not be more than 1200 $\mu g/m^3$ at a distance of 25.0 ± 2.0 m from the source of fugitive emission in the predominant down wind direction as per MoEF&CC, Govt. of India notification No. G.S.R. 809(E), dated 04.10.2010 (copy enclosed as **Annexure – I**). Fabric bags and cages in bag house shall be checked regularly and replaced whenever required. Separate online energy meters shall be installed for all the pollution control equipment and centralized records shall be maintained for verification of the Board from time to time.

37. The suction points of dust extraction system shall be provided at primary crusher discharge chute, screen, all transfer points, secondary crusher discharge chutes and any other dust generating sources. This system shall be connected to bag filters so that particulate matter emission from the stack shall not exceed 100 mg/Nm^3 as per MoEF&CC, Govt. of India Notification no-GSR.-809(E) dated 4th October 2010 (copy enclosed as **Annexure-I**). Stack height for de-dusting unit shall be calculated as per above notification of MoEF&CC, Govt. of India i.e. $H = 74\ Q^{0.27}$ where H and Q are stack height in meter and particulate matter (PM) emission in ton/hr respectively.

38. All the product conveyor of the screens shall discharge the product into a hopper and chute arrangement fitted with dust extraction and bag filter system. Chute shall be maximum 3 meter height from the ground level. Fixed auto sprinklers shall be provided in the stock yard of product.

39. The mine shall make provision to collect the fine products in hopper instead of heaping by free falling to avoid the dust nuisance. The ore fines shall be stacked properly and systematically with retaining wall at the toe to avoid washings during rain. Ore fine transportation shall be done in covered truck.

40. Dust suppression on mine haul roads, active OB dumps and mine working benches shall be done by spraying water through water sprinklers along with chemical binders/wetting agents at frequent interval in order to reduce water consumption and to improve retention and re-absorption capacity of water. Water sprinklers of fixed type shall also be provided at the mine HEMM maintenance shop, other service centers and approach roads from mines to raw material handling & product handling area to prevent the generation of dust to be air borne.

41. Adequate measures shall be taken for control of noise levels in the work environment of mine area so that noise levels at the boundary line of mining lease area shall not exceed 75 dB (A) during day time (06:00 AM to 09:00 PM) and 70 dB(A) during night time (09:00 PM to 06:00 AM).

42. The crushing unit shall not be operated in the night time between 6.00 PM and 6.00 AM.

43. Three Ambient Air Quality Monitoring Stations for 24 hours operation should be established in the core zone as well as in the buffer zone for PM10, PM2.5, SO2, NOx and CO monitoring. Location of the stations should be decided in consultation with the State Pollution Control Board. Data on ambient air quality (PM10, PM2.5, SO2, NOx and CO) should be submitted to the State Pollution Control Board once in six months.

44. Planting of trees all along the connecting road and regular grading of such road shall be carried out to prevent generation of dust due to movement of dumpers/trucks. Greenbelt of adequate width shall also be provided in the available vacant areas on other side of railway siding

45. Retaining wall of 07 meter height shall be provided all along the railway siding.

46. The height of material stack within storage areas must be kept below the height of the boundary wall at all times to prevent the material from being air borne.

47. Fixed type of water sprinklers shall be provided in the railway siding and stockyard. Sprinkler systems must be maintained and be kept in a good operable condition at all times.

48. Dust suppression arrangement shall be provided on approach road by using water sprinklers / mobile water tanker.

49. All entry points, internal roads and loading/unloading areas must be adequately compacted for movement of heavy vehicles by using low permeability material and be cleaned regularly to minimize potential of dust generation and off-site impact.

50. Proper housekeeping at the material storage areas, loading & dispatch areas, service facilities, etc. shall be practiced.

51. Ambient Air Quality inside the premises shall conform to the National Ambient Air Quality Standard prescribed for industrial and mixed used area under the Environment Protection Act, 1986.

52. During transportation of material by trucks / tippers / wagons the vehicles shall be properly covered with tarpaulin sheets.

SOLID AND HAZARDOUS WASTE:

53. Hazardous waste storage area shall be earmarked before disposal of hazardous waste as per guidelines.

54. Top soil should be stacked separately with proper slope at earmarked site (s) with adequate measures and shall be used for reclamation and rehabilitation of mined out areas.

55. At stockpile and loading plant area, a network of drains shall be constructed at a depth of 1.5 meter below the lowest level on the sites parallel to the stockpile area with interconnected box culverts. The sloping of surface shall be given inward to the stockpiles so that surface water will only infiltrate in to the drain.

56. The OB/waste dumps shall be properly dressed benched stopped at low angle (300) with terracing and bamboo barricades in the slopes making retaining walls stone barriers at the toe of the dumps gully plugging etc. to prevent the solid erosion during monsoon, besides establishing vegetation on dump top as well as its slope surface. In difficult cases, hydro-seedling technique or use of geo-tiles mat embedded with seeds shall be adopted.

57. The proponent shall comply to the provisions of Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 and amended thereafter.

Encl: As above

MEMBER SECRETARY

To,

The Deputy Managing Director,
Jajang Iron Ore Mine of
M/s JSW Steel Ltd., JSW Centre,
Bandra Kurla Complex, Mumbai, Maharastra.

Memo No._____/Date_____/

Copy forwarded to:

1. The Secretary, MoEF&CC, Govt. of India, New Delhi.
2. The Secretary Steels & Mines, Govt. of Odisha, Bhubaneswar
3. The Director, Directorate of Mines, Govt. of Odisha, Bhubaneswar
4. The District Magistrate & Collector, Keonjhar.
5. The Deputy Director of Mines, Joda, Keonjhar.
6. The DFO, Keonjhar.
7. The Regional Officer, SPC Board, Keonjhar.
8. Consent to Operate Section, SPC Board, BBSR
9. Hazardous Waste Management Cell, SPC Board, BBSR
10. Copy to Guard file

CHIEF ENV. ENGINEER

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 4th October, 2010

G.S.R. 809(E).—In exercise of the powers conferred by Sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following Rules further to amend the Environment (Protection) Rules, 1986, namely:-

1. (1) These rules may be called the Environment (Protection) (Sixth Amendment) Rules, 2010.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in schedule I, after serial number 17 and the existing entries relating thereto, the following serial number and entries shall be inserted, namely :-

<table>
<tr><th>S. No.</th><th>Industry</th><th>Parameter</th><th>Standard</th></tr>
<tr><td>(1)</td><td>(2)</td><td>(3)</td><td>(4)</td></tr>
<tr><td>"18</td><td rowspan="6">Iron Ore Mining and Ore Processing</td><td colspan="2">A. Emission Standards for Stack for De-dusting Unit</td></tr>
<tr><td></td><td>Particulate matter</td><td>100 mg/ Nm³</td></tr>
<tr><td></td><td>Stack height **</td><td>15.0 m</td></tr>
<tr><td></td><td colspan="2">** Stack height for De-dusting unit shall be calculated as $H=74\ Q^{0.27}$, where H and Q are stack height in metre and particulate matter (PM) emission in tonne/hr respectively, i.e.

Q (kg/hr) — H (metre)
up to 2.71 — 15
2.72 - 7.86 — 20
7.87 - 17.96 — 25
17.97 - 35.29 — 30

Note:- Stack attached to De-dusting unit shall have minimum height of 15.0 metres and would be atleast 2.50 metres above the top-most point of the nearby building/shed or plant in the mine.</td></tr>
<tr><td></td><td colspan="2">B. Fugitive Emission Standards</td></tr>
<tr><td></td><td>Particulate matter</td><td>1200 µg/m³</td></tr>
<tr><td></td><td colspan="2">Note:- Fugitive emission shall be monitored in the predominant downwind direction at a distance 25.0±2.0 metres from the source of fugitive emission as per following:</td></tr>
</table>

1	2	3	4
		Area	**Monitoring location**
		Mine face/ Benches	Drilling, excavation and loading applicable for operating benches above watertable
		Haul Roads/ Service Roads	Haul roads to ore processing plant, waste dumps and loading areas and service road
		Crushing plant	Run-off mine unloading at hopper, crushing areas, screens and transfer points
		Screening Plant	Screens, conveying and transportation of ore discharge points
		Ore Storage & Loading	Intermediate stock bin/pile areas, ore stock bin/pile areas, wagon/truck loading areas
		Waste dump	Active waste/reject dumps
		C. Effluent Standards	
		pH	5.5-9.0
		Suspended solids (non-rainy day)	50 mg/l
		Suspended solids (rainy day)	100 mg/l
		Oil & grease	10 mg/l
		Note:- (i) All efforts shall be made to reuse and re-circulate the treated effluent. (ii) The aforesaid effluent standards shall be complied with for sewage, service water, beneficiation of ore washwater and surface run-off put together.".	

[F. No. Q-15017/21/2007-CPW]

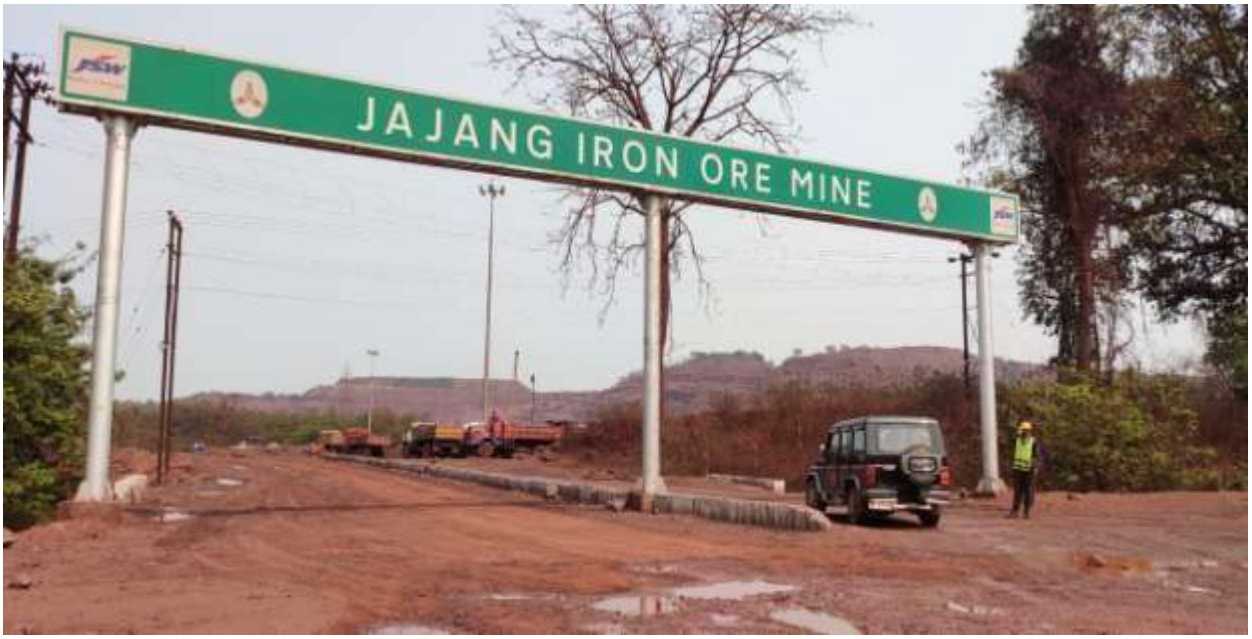
RAJNEESH DUBE, Jt. Secy.

Note :The principal rules were published in the Gazette of India vide number S.O. 844 (E) 19th November, 1986; and subsequently amended vide S.O. 433 (E) dated 18th April 1987; S.O. 64 (E), dated the 18th January 1988 and recently amended vide G.S.R. 97(E), dated the 18th February, 2009; G.S.R. 149 (E), dated the 4th March, 2009; G.S.R. 512(E), dated the 9th July, 2009; G.S.R. 543 (E), dated the 22nd July, 2009; G.S.R. 595(E), dated the 21st August, 2009; G.S.R. 794 (E), dated the 4th November, 2009; G.S.R. 826 (E), dated the 16th November, 2009; G.S.R. 01 (E), dated the 01st January, 2010; G S.R. 61 (E), dated the 5th February, 2010; GSR 485(E), dated the 9th June, 2010: GSR 608 (E), dated the 21st July, 2010 and GSR 739 (E), dated. the 9th September, 2010.

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ANNEXURE II

Site Specific Wildlife Conservation Plan for Jajang Iron Ore Mine of M/s JSW Steel Ltd. in Barbil Tehsil of District Keonjhar, Odisha.



In compliance to the letter no. F.No. J-11015/57/2020-IA.II(M) dated – 05/02/2021 by the Impact assessment Division of Ministry Of Environment, Forest &Climate Change, Government of India, under the standard TOR for production of 12.8 million TPA (ROM) of Iron Ore with maximum waste of 28.589 MTPA (OB/IB/SB) along with screening, crushing of mining project stated in condition No. 16 & 18

Prepared by
Divisional Forest Officer
Keonjhar Forest Division, Keonjhar

PREFACE

Keonjhar district of Odisha is considered to be one of the richest in terms of Forest resources, Biodiversity and minerals. Iron ore deposit in Odisha has heralded the industrial revolution which is the foundation and the raw material for industrial development since 1904. The iron ore demand is increasing at a greater pace. In 2016-17, India's iron ore production level was above 212.64 million tonnes which in terms of global iron ore output was 9.13 percent.

Human activities pose the greatest threat to wildlife because increasing human population results in expanding need of mankind. Wildlife is one of the most gracious gifts of nature to this land, which is as rich in its variety and colours as its numbers. Wildlife management is an ancient phenomenon. Vedas contains hymns in praise of animals with the specific God or Goddess as the best way of conservation of wildlife.

Jajang Iron Ore Mining lease was granted in favor of M/s JSW Steel Limited for period of 50 years through e-auction process for winning iron-ore for non-captive purpose of steel manufacturing. In pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 and the Mineral (Auction) Rules, 2015, Govt. of Odisha issued the notice inviting tender dated December 6, 2019 for commencement of the auction process to grant the mining lease in respect of Jajang Iron Ore Block over an area of 669.078 ha. as per DGPS (666.15 ha. as per ROR) for a resource size of about 34.87 Million tones (Mt). The e-auction process was conducted in accordance with the tender document and the mineral auction rule, 2015 for the said mineral block and M/s JSW Steel Limited was declared as the preferred bidder under Rule 9(9)(iii) of Mineral (Auction) Rules 2015.

Without rejudice to the generality of the provisions under section 8B (2) of the MMDR Act, 1957, the details of the valid rights , approvals, clearance licenses, and the alike held by the previous lessees are vested in favor of M/s JSW Steel Ltd. by the Govt. of Odisha for a period of 2 years from the date of execution of lease deed or till the date of getting fresh approvals, clearance , licenses, permits and the like, whichever is earlier vide order No.-4190/SM, dated 29.05.2020.

M/s JSW steel Limited being successful bidder upon execution of mining lease deed, or the successful Bidder shall immediately, but not later than one hundred twenty days from the date of execution of mining lease, apply afresh for all necessary rights, approvals, clearances licenses and like under the applicable statutes, rule and regulation, as the case may be, for obtaining the necessary clearance to enable further continuance of the mining operations beyond two years and vesting order shall be valid for a period of two years from the date of execution of new lease deed or till the date of getting all fresh approvals, clearance, licenses, permits, and the like whichever is earlier."

Subsequent to signing of the MDPA, M/s JSW Steel Limited has made payment of the third installment being the eighty percent of the upfront value and executed and registered the mining lease with the Government of Odisha on 27.06.2020 and the mining lease was granted in favor of M/s JSW Steel Limited for a period of 50 years w.e.f 27.06.2020.

Ministry of Environment, Forest & climate change (Impact Assessment Division) 'Govt. of India vide F.No. J-11015/57/2020-IA. II (M) dated 05.02.2021 issued TOR (Terms of reference) under EIA notification 2006 for EIA study to issue Environmental Clearance for the above project.

In para 16 &18 of Standard Terms of Reference (TOR) for mining Project MOEF has stipulated as under.

Para 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".

Para 18- "A detailed biological 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 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 wild life Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.

As per MOEF notification, it is mandatory to obtain environmental clearance for expansion and modernization of existing projects or activities. JSW proposes to increase the production in this lease area from 12.8 MTPA (ROM) of Iron Ore with maximum waste of 28.589MTPA JOB/B/SB) with screening, crushing.

Therefore in pursuance to the above letter of MOEF & C.C and TOR stipulated there in, this site specific wild life management plan/conservation plan is prepared basing on the TOR in para 16 and 18 of standard TOR for mining project.

As per stipulation detail Biological study containing flora, fauna, endangered, endemic and RET species and impact mining project and detailed mitigative measures are being narrated in the foregoing chapters both for core and buffer (10 km radius) areas of the mine.

A Detailed Biological Study has been done prior to the preparation of this Management plan, encompassing the existing flora, fauna and their habitat. We have taken up extensive study of the flora and fauna in the core zone and the buffer zone of the Mining Lease and have had intensive interactions with the officials of forest, mining and other departments working in the area, besides the forest field staff, VSS and local villagers etc.

We gathered information of movement of Elephants in groups in the Impact Zone of the mine area though rarely man-animal conflicts have taken place in few occasion along with instances of crop damage by the elephant herds within the zone of influence. However, the area does not form part of any National Park or Sanctuary but it is at a distance of 18.5 Km from the Boundary of the Karo – Karampada Elephant Corridor. Taking all aspects into account we have prepared the Wildlife Management Plan based on the Guidelines issued by the Principal Chief Conservator of Forests (Wildlife) & CWLW Odisha vide Memo no. 9094 Dt. 17.09.2021.

Divisional Forest Officer
Keonjhar Forest Division
Keonjhar

Divisional Forest Officer
Keonjhar Division

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EXECUTIVE SUMMARY

The Jajang iron mine was earlier operated by M/s Ranguta Mines Ltd. whose lease was expired on 31.3.2020.

In pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 and the Mineral (Auction) Rules, 2015, Govt. of Odisha issued the notice inviting tender dated December 6, 2019 for commencement of the auction process to grant the mining lease in respect of Jajang Iron Ore Block over an area of 666.15 ha. as per ROR, DGPS (669.078 ha.) in villages Jajang, Jadibahal, Palashaka and Bandhuabeda under Barbil Tehsil of Keonjhar District, Odisha.

The e-auction process was conducted in accordance with the tender document and the mineral auction rule, 2015 for the said mineral block and M/s JSW Steel Limited was declared as the preferred bidder under Rule 9(9)(iii) of Mineral (Auction) Rules 2015.

The present lessee started its mining operation over 666.15 ha.

The applied RML area consists of :

Sl. No.	Area	Details
1	Total concession area	666.15 ha. as per ROR (669.078 ha. as per DGPS computation)
2	Forestland with status	Forest – 543.916 ha.
3	Non-Forest Govt & Private land with status	125.162 ha.
4	Revenue survey details of the area	Referred to Land Schedule.

In cognizance the letter No. **J**-11015/57/2020-IA.II(M) dt. 5.2.2021**,** by the Impact assessment Division of Ministry of Environment, Forest & Climate Change, Government of India , under the Standard TOR for Mining Project stated in the condition No. 16 & 18.

Para 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".

Para 18- "A detailed biological 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 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 wild life Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.

A Detailed Biological Study has been done prior to the preparation of this Management plan, encompassing the existing flora, fauna and their habitat. We have taken up extensive study of the flora and fauna in the core zone and the buffer zone of the Mining Lease and have had intensive interactions with the officials of forest, mining and other departments working in the area, besides the forest field staff, VSS and local villagers etc.

The Jajang Iron ore mines of M/s JSW Pvt. Ltd. is located in the village (s) of villages of Jajang. Jadibahal, Palasa (ka) Bandhuabeda under Tehsil Barbil, District Keonjhar, Odisha.

According to the jurisdiction of forest department, the project area comes as under Forets beat Jajang, Forest section Bamebari, Forest Range- Berbil, Division- Keonjhar,

The lease area falls between Latitude 21054'44.23926" N - 219 56 08.1152" N and Longitude 85926'14.555"E - 850 26'50.70226" E on Survey of India Topo sheet No. 73 G/5 (F44N5).

There are no perennial nala in the lease area. The seasonal water ways like gullies, streamlets and nalas drain the surface run-off water during rainy season. Two nalas namely Tapadihi Nala and Karo Nadi pass within the lease are.

A small stream exists on the northern side of the lease area, which meets river Baitarani. River Baitarani flows outside the lease area on eastern side. The eastern side is drained by gullies which meet Baitarani River. Study of the ZOI reveals that important ridges and river channels have by and large are with northwest and south east trend. All the major perennial water courses flow towards north – west and east. The water divide between the two sub – watersheds (Kundra nalla and Baitarani) also trends northwest and south west.

The particular land scape i.e lease area is not source of any river and stream. However some seasonal Nalas water channels originate from the lease area and drain the surface run-off to river Baitrani which flows on the north east side of the lease.

The common species of Flora resent in the Project Area and Project Impact area comprise of Babul, Acacia, Sal, Mahul, Kumbhi, Kendu, Boro, Champa, Kadamba etc. The forest type present is 3C/C2e (ii) Tropical Moist Deciduous Forest and 5B/1CNorthern Tropical Dry Deciduous Forests.

The common Species of Wildlife found in the Project Area and Project Impact Area the mammals are Wild Boar, Junglr Cat, Elephant, Hyena, Jackal, Sloth Bear, Indian Hare etc. The Reptiles in and around are Chandra boda, Ajagara/Rock Python, Indian Rock Lizard etc. The Avian species in the surrounding being Jungle Fowl, Patridge, Samll Blue Kingfisher, Indian Roller, Indian Cuckoo etc along with the amphibian species of Burrowing frog, Brahmuni benga etc.

The area does not form part of any National Park or Sanctuary but it is at a distance of 18.5 Km from the Boundary of the Karo – Karampada Elephant Corridor.

The climate in the area is generally cold in winter between November & February and hot is summer between March and June. The monsoon sets in late June and continues up to the end of August. Temperature shows the variation of 9 degree C to 44 degree C.

The Wildlife both in Project area and the Project Impact Area are likely to be affected due to Mining activities and ancillary activities of transportation and carrying of minerals and ore in the mining zone. Though there doesn't seem to be any significant effect on forest cover and habitat for wildlife, but the effects of noise, air, sound pollution along with lightening and other anthropogenic pressures cannot be pre-permitted.

Movement along Karo – Karampada Elephant corridor takes place by the elephants of Odisha and Jharkhand. These elephant move to Karo RF, Uliburu RF, Siddhamath RF, Baitarani RF, Chamakpur RF and Mahaparabat PRF during crop season and stay up to harvesting season i.e. month of December every year and sometimes beyond and cause crop damage on their movement path in Keonjhar Forest Division.

The Project Impact area of Jajang Iron Ore Mines rarely sees man-animal conflict, though important measures are suggested to mitigate the threat to wildlife particularly to the elephants and Sloth Bear in the Buffer zones.

INTERVENTIONS IN THE PROJECT AREA TO BE IMPLEMENTED BY THE PROJECT PROPONENT AT PROJECT COST :

1. M/s JSW Steel Ltd. has proposed Plantation on degraded forest lands, reclaimed pits OB dumps and safety zone inside forest land etc. as per Environmental Plan.
2. Provision have been made for Graded bund all along the of the lease area wherever necessary to allow surface run off during rain to percolate in to the ground instead of causing water pollution in the nalas.
3. Provision for Photo voltaic fencing around the active mining pits inside the ML area.
4. Supply 10 units of high frequency ultra-sonic Sound elephant repellents to the D.F.O., Keonjhar Forest Division with cost of maintenance.

5. Establishing Bulk messaging System for immediate message spreading from field to all grass-root level forest Officials, ROs, ACFs & D.F.O., Keonjhar including the maintenance cost.
6. Provision of Long Range Rechargeable Flash Light torches 200 nos to be supplied to the strategic villagers/VSS members/elephants trackers to wade away elephants/sloth bears.
7. Provision for Purchase and supply of Android based Mobile handsets for quick message transmitting and immediate communication.
8. Provision of 02 (Two) nos. Drone camera with accessories to Divisional Forest Office Keonjhar or monitoring of wild animals in stress in forest areas.
9. Provision of a hire vehicle with POL for movement of rapid movement team to the man-elephant conflict site.
10. Provision of health camp and cattle immunization camps.

INTERVENTIONS INSIDE THE PROJECT IMPACT AREA :

A) Keonjhar Forest Division.

1. Provision for fodder plantation consisting of fodder species, fruits bearing species for the wild animals by the side of nalas, swamps located insides of forest areas of impact zone.
2. Provision of the firefighting squad with basic firefighting equipment located at the proximities of forest areas will be selected to assist in fire control activities.
3. Provision proposed to procure strategic tools such as 10 nos. of fire blowers.
4. Provision for soil and moisture conservation measure in Sidhamatha, Baitarani and Chamakpur forest block to prevent soil erosion and enhancement of natural regeneration.
5. Fencing of Unguarded open wells 10 Nos.
6. Provision of warning & wading system to prevent elephant intrusion along with maintenance of same.
7. Provision for augmentation of staff strength by creation of a new cadre of Anti-poaching/Anti depredation squad.
8. Provision for construction of grain store house.
9. Provision for supply of metallic grain bin to the victim of crop and house damage to store their grains.
10. Provision for elephant proof trench to prevent entry of elephant to the villages.
11. Provision for Camera trap with infrared.
12. Provision for Manchan (Mini watch tower) to watch the movement of elephant and to alert the villagers against crop/house.
13. Provision for large size radium painted sign board at the elephant road crossing points on NH/State Highway. Inscribing awareness for the vehicles/publics.
14. Provision for annual clearance of shrubs/herbs/grass at the site of road crossing of elephants at a width of 50 meter on both the side of road/NH/SH.
15. Provision for Corpus Fund.
16. Monitoring and evaluation and procurement of satellite maps have been proposed.

B) Bonai Forest Division.

1. Provision for augmentation of staff strength by creation of a new cadre of Anti-poaching/Anti depredation squad.
2. Establishing Bulk messaging System for immediate message spreading from field to all grass-root level forest Officials, ROs, ACFs & D.F.O., Bonai including the maintenance cost.
3. Supply 5 units of high frequency ultra-sonic Sound elephant repellents to the D.F.O., Bonai Forest Division with cost of maintenance.
4. Provision of Long Range Rechargeable Flash Light torches 200 nos. to be supplied to the strategic villagers/VSS members/elephants trackers to wade away elephants/sloth bears.
5. Provision for Camera traps and equipments etc.
6. Provision for warning & wading system to prevent intrusion of elephants in to villages/corn fields.
7. Provision for fire blowers to extinguish forest fire and preparation of fire line wherever required.
8. Provision for paddy harvester for the villagers for early harvesting of paddy from their field and to store in safe place to avoid crop damage by wild elephants.
9. Provision for Corpus Fund.
10. Provision for cattle immunization camps.

The Plan has been prepared for a period of 10 years. Interim revision may be done evaluating the result of the presumptuous. The Project proponent undertakes to prepare subsequent plans in continuation to this plan.

M/s JSW Steel Ltd. will carry out works proposed in this plan with respect to the project area under the supervision of DFO, Keonjhar Forest Division, who will execute different interventions in the project impact area under the supervision of monitoring of The Regional Chief Conservator of Forests, Rourkela.

750.768 lakh

The Total cost of the Plan including 20% extra for escalation of wage rate and material costs is Rs. **749.208 lakhs**. From the said an amount **Rs. 470.400 lakhs** and **Rs. 278.808 lakhs** shall be spent by the **DFO, Keonjhar Division** & **Bonai Division** respectively for execution of different interventions in the Project Impact Area of both the divisions. The Project proponent M/s JSW Ltd. shall deposit said amount in adhoc CAMPA fund with respective Divisional Forest Officer after approval of the plan.

471.96 lakh

In addition to the above, M/s JSW Steel Ltd. shall be executing different interventions as proposed in the plan at the project cost besides various safeguard measures as prescribed under Mining Plan, Environment Management Plan and submitting compliance to various authorities.

Divisional Forest Officer
Bonai Division

Divisional Forest Officer
Keonjhar Division

Chapter-I

INTRODUCTION:

a) Brief Description of project :

JSW steel a flag ship company of the diver sited US$ 14 billion JSW Group which has a leading presence in sectors such as steel, energy, infrastructure, cement, sports among the others. From a single manufacturing unit in the early 1980s, JSW steel ltd today, is one of the foremost integrated steel company in India with an installed capacity of 18 MTPA and was planning to scale up in India and overseas. It has been widely recognized for its business and operational excellence.

Jajang Iron ore mines (erstwhile lessee M/s Ranguta Mines Limited) was one of the mines whose lease expired on 31.03.2020. Government of Odisha vide letter No. 30007/s & M/Bhubaneswar/IV (Misc) SM-66/2016 dated 18th March 2020 issued the notice for grant of Mining Lease (ML) for Jajang Iron Ore Block over an area of 666.15 ha as per ROR (669.078 ha. as per DGPS computation) in villages Jajang , Jadibahal, Palsa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar District, Odisha with a mineable reserve size of about 34.87 Million tones (Mt).

In pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 and the Mineral (Auction) Rules, 2015, Govt. of Odisha issued the notice inviting tender dated 6th December, 2019 for commencement of the auction process to grant the mining lease in respect of Jajang Iron Ore Block Odisha. The e-auction process was conducted in accordance with the tender document and the mineral auction rule, 2015 for the said mineral block and M/S JSW Steel Limited was declared as the Preferred Bidder under Rule 9191 (iii) of mineral (Auction) Rules, 2015.

Without rejudice to the generality of the provisions under section 8B (2) of the MMDR Act, 1957, the details of the valid rights , approvals, clearance licenses, and the alike held by the previous lessees are vested in favor of M/s JSW Steel Ltd. by the Govt. of Odisha for a period of 2 years from the date of execution of lease deed or till the date of getting fresh approvals, clearance , licenses, permits and the like, whichever is earlier vide order No.- 4190/SM, dated 29.05.2020.

M/s JSW steel Limited being successful bidder upon execution of mining lease deed, or the successful Bidder shall immediately, but not later than one hundred twenty days from the date of execution of mining lease, apply afresh for all necessary rights, approvals, clearances licenses and like under the applicable statutes, rule and regulation, as the case may be, for obtaining the necessary clearance to enable further continuance of the mining operations beyond two years and vesting order shall be valid for a

period of two years from the date of execution of new lease deed or till the date of getting all fresh approvals, clearance, licenses, permits, and the like whichever is earlier."

Subsequent to signing of the MDPA, M/s JSW Steel Limited has made payment of the third installment being the eighty percent of the upfront value and executed and registered the mining lease with the Government of Odisha on 27.06.2020 and the mining lease was granted in favor of M/s JSW Steel Limited for a period of 50 years w.ef 27.06.2020.

b) Cost of the project :

Total total capital investment is about **485 crore** which includes the cost of the mine development, plant and machinery, utility fecilities and mine closure cost.

c) **Location** :

The Jajang Iron ore mines of M/s JSW Pvt. Ltd. is located in the village (s) of village Jajang, Jadibahal, Palasa (ka) Bandhuabeda under Barbil Tahsil, of Keonjhar District, Odisha.

Forest Beat	:	Jajang
Forest Section	:	Bamebari
Forest Range	:	Badbil
Forest Division	:	Keonjhar
G.P.	:	Jajang
CD Block	:	Joda
District	:	Keonjhar

The lease area falls between Latitude 21054'44.23926" N - 219 56 08.1152" N and Longitude 85926'14.555"E - 850 26'50.70226" E on Survey of India Topo sheet No. 73 G/5 (F45N5).

The project impact area (10 km radius) comes under Survey of India Topo Sheet No. F45N5, F45N9, and F45H8 & F45H12. Spreading over two Divisions i.e. Keonjhar Division and Bonai Division.

d) **Nature and extent of land required** :

Sl. No.	Area	Details
1	Total concession area	666.15 ha. as per ROR (669.078 ha. as per DGPS computation)
2	Revenue Forest land with status	Forest – 543.916 ha.
3	Non-Forest Govt & Private land with status	125.162 ha.

e) **Condition imposed in state-I/EC regarding SSWLCP** :

On application of user agency, Ministry of Environment, Forest & climate change (Impact Assessment Division) 'Govt of India vide F.No. J-11015/57/2020-IA. II (M) dated 05.02/.2021 issued TOR (Terms of reference) under EIA notification 2006 for EIA study to issue Environmental Clearance for the above project.

In para 16 &18 of Standard Terms of Reference (TOR) for mining Project MOEF has stipulated as under.

Para 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".

Para 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 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 wild life Department and details furnished. Necessary allocation of funds for implementing the same should be made as part of the project cost.

Therefore, in pursuance to the above letter of MOEF & C.C and TOR stipulated there in, this **Site Specific Wild Life Conservation Plan** is prepared basing on the TOR in para 16 and 18 of standard TOR for mining project.

Besides as per stipulation a detail Biological study of the study area encompassing flora & fauna, endangered, endemic and RET species separately for core and buffer zone based on field survey indicating schedule of the fauna has been done and detailed mitigative measures with budgetary provision for their conservation are being narrated in the foregoing chapters both for core and buffer (10 km radius) zone of the mine.

Chapter-II

A) Description of project area and impact area.

Project area : The project area/lease area spreading over an area of 666.15 ha. occurs on Survey of India topo sheet No. 73G/5 (F45N5) between latitude 21054'44.23926" N - 219 56 08.1152" N and Longitude 85926'14.555"E - 850 26'50.70226" E. The elevation of the lease area varies from 415-411 mt. from the mean sea level. It is octagonal in shape & the north eastern boundary coincides with the bank of Baitarain River. Joda–Bamebari–Dubna road is just passing in the extreme western part and Jakhapura-Bansapani railway line branch of East cost railway divide the lease area form the south to north of the lease area. The area is a hilly terrain with rugged topography and has a few seasonal and semiperenial nalas.

General Geology : This deposit forms a part of Banded Iron Formation (BIF). Due to intensive deformational events, various fold patterns developed in the area. Due to weathering, it is difficult to establish the exact succession of rocks with in the area.

A generalized succession may be given as follows:

	Soil
	Laterite
	Dolerite
	Granite
Iron Ore Series	Banned Hematite Jasper (BHJ)
	Iron Ore Deposits
	Shale
	Shale with Managanese Ore

The Banded Hematite Jasper (BHJ) constitutes the permanent ridges, which are capped with Iron Ore. At foot or slope of the hills, deposition of float ores is also noted.

All the rocks occurred in the area chemically consists of Fe, Al, Si, P, O, etc. There is no toxic material with these rocks.

i) **Locations :** The Jajang Iron ore mines of M/s JSW Pvt. Ltd. is located in the village (s) of village Jajang, Jadibahal, Palasa (ka) Bandhuabeda under Tehsil Barbil, District Keonjhar, Odisha.

ii) **Land use** : The present (Exesting) land use pattern, proposed land use pattern at the end of plan period and post mining land useis furnished as under :

DETAILS OF EXISTING (PRESENT) LAND USE PATTERN

Particulars	Area in Ha
Area under mining	243.862
Storage of top soil	-
Waste dump site	44.495
Mineral storage and MSP	49.873
Infrastructure workshop, admin, Building etc.)	0.13
Roads	9.304
Own railways line & siding	13.112
Tailing pond	-
Effluent Treatment plant	-
Mineral separation plant	-
Mine camp (Township area)	10.271
Others (Greenbelt + Plantation) water reservoir	34.653
Parking plaza/ Parking yard	0
Solar power system	0
Sub Total	405.700
Others un disturbed	263.378
Grand total	669.078

Source: IBM Approved Mine plan

PROPOSED LAND USE AREA AT THE END OF PLAN PERIOD

Particulars	Area in Ha
Area under mining	277.378
Storage of top soil	-
Waste dump site	34.727
Mineral storage and MSP	70.16
Infrastructure workshop, admin, Building etc.)	1.63
Roads	9.304
Own railways line & siding	13.112
Tailing pond	-
Effluent Treatment plant	-
Mineral separation plant	-
Mine camp (Township area)	10.271
Others (Greenbelt + Plantation) water reservoir	34.653
Parking plaza/ Parking yard	3.16
Solar power system	26.89
Sub Total	481.285

Particulars	Area in Ha
Others un disturbed	187.793
Grand total	**669.078**

POST MINING LAND USE

Sl. No.	Name of Mining features	Name of Post Mining Land Use	Area (Ha)
1	Quarry	Reclamation (back filling & Plantation/re-grassing)	94.24
2	Quarry	Rehabilitation (Plantation/re-grassing)	171.641
3	Quarry	Rehabilitation (Water Reservoir)	9.71
4	Waste Dump	Dump Plantation	40.697
5	Infrastructure	Office, colony will be handed over to state govt.	1.63
6	Mineral Processing Plant & Storage	Plantation	70.16
7	Railway line	Plantation	13.112
8	Construction of road	Plantation	9.304
9	Safety zone(ML Boundary)	Plantation	34.653
10	Parking plaza/Parking yard		3.16
11	Solar Power system		26.89
12	Sub total		475.197
13	Camp area	---	10.271
14	Undisturbed area	--	178.527
15	Grand Total	---	669.078

Source: IBM Approved Mine plan

iii) **Human habitation** : The lease area/mine area do not contain any human habitations. Hence mining activities do not involve displacement of any human settlement.

B) Project impact area :

The project impact area at a radius of 10 KM fall in both Keonjhar division and Bonai division (Sundargarh district) with an approximate area of **228 Sqkm. and 26 Sqkm.** respectively.

i) The forest area of **Keonjhar division** part comprises Chamakpur RF, part of Siddhamatha RF, part of Baitarani RF and Revenue forest like Mahaparabata, Dandahudi, Manguguru and Hillocks containing open scrubs forest and dence sal forest such as

Bisadhara pahada, Geraeda pahada, Ranga pahada, Jandaragi pahada, Pilitangara pahada occring the project impact area.

Banai division part of impact area contains only some fragmented patches of open scrubs forests surrounded by villages and habitations.

ii) **Land use** of the impact area are as follows :

- Reserve Forest area is about 11,544 ha.
- Revenue Forest comprising of open mixed forest is about 9,676 ha.
- Hence total forested area is about 21,220 ha.
- Total homestead, agricultural and Govt. non-forest land comprises about 15,556 ha.

iii) **Human habitation** : There are about 75 nos. of villages and hamlets in the project impact area of the mine in both the divisions with a total population of around 43,335. This population has 67% S.T. and 9% S.C. The mining and allied activities employ 73.6% of workers, agriculture 11.9% (seasonal), which together make 41% work force. Non workers constitute 57% of the population. About 5,000 trucks are engaged in ore transportation. This brings in a floating population of 10,000 plus to the zol. All human activities in forest or in its surrounding affect wildlife in one way or other.

Inside the project impact area, there area about 57 nos. of active and inactive mining leases occurring both in forest land Govt. non-forest and tenanted land covering an area of about 1178 ha. honey combing the entire project impact area and leaving the wildlife habitat in fragmented condition

iv) The project area & the impact area does not form part of any wildlife sanctuary, national park, Eco-sensitive zone, Elephant & Tiger reserve, Biosphere reserve & Elephant corridor.

A statement showing below the distances of nearest protected areas, tiger reserve, elephant reserve & Ramasora sites, Elephant corridors are furnished below :

Sl. No.	Elephant corridor	Km
1	Maulabhanja, Jiridimali, Anantpur	110.8km
2	Kartapat Uriadani	279.2 km
3	Kotagrah Chandrapur	298.6 km
4	Badampahad Karida East	76.7 km
5	Badampahar Dhbadhobin	60.2 km
6	**Karo Karampada**	**18.5 km**
7	West Bengal Deuli Suliapada	157.1 km
8	Hadgarh-Kuldhia	115.3 km
9	Buguda central RF	184.8 km
10	Nuagaon Baruni	156.5 km
11	Barpahar Tarva Kantamal	214.8 km
12	Tal Kholgarh	180.2 km
13	Telkoi Palhara	62.7 km
14	Kanheijena Anantpur	98.3 km
15	Similipal- Hadgarh –	100.6 km

Sl. No.	List of National Park, Sanctuary, Tiger Elephant Reserve, Ramsar site Odisha	Distance from the project site (Kms)
National Park		
1	Similipal(Proposed National Park)	73.2
2	Bhitarkanika(National Park)	207.6
Wildlife Sanctuary		
1	Bhitarkanika	194.7
2	Balukahnd-konark	235.4
3	Baisipalli	170.7
4	Badrama	115.8
5	Chilika(Nalban)	248.2
6	Chandka-Damapara	167.7
7	Debrigarh	177.6
8	Gahirmatha (Marine)	212.4
9	Hadgarh	118.1
10	Khalasuni	112.3
11	Kuldiha	126.8
12	Nandankanan	176.4
13	Similpala	67.2
14	Satkosia gorge	145.2
15	Sunabeda	330.3
16	Karlapat	332.7
17	Lakharibeli	303.8
18	Kotogada	278.2
19	Kapilash	140.5

Tiger Reseve		
1	Similpala	67.2
2	Satkosia	145.2
Elephant Reserve		
1	Mahandi	145.2
2	Mayurbhanja	40.2
3	Sambhalpur	115.8
Ramsar Site		
1	Bhitarkanika	186.7
2	Chilika	226.5

v) In view of TOR in para-18 of the above MoEF letter a detail biological study of the project area and project impact area have been carried out from March 2021 to May 2021 to study the flora and fauna. Therefore, study of flora, fauna, forests etc. of the project impact area has been included in the biodiversity study of the area.

The bio diversity study has been conducted by Maharaja Sriram Chandra Bhanja Deo University (Erstwhile) North Orissa University, Baripada the work of which has been assigned by the User Agency to collect information that would help in developing site specific wildlife conservation plan. In addition, the information collected would serve as a protocol, which would aid in demonstrating or exhibiting the status of the landscape of interest to the concerned stakeholders to undertake appropriate restoration measures. Hence the present study aims at assessing the biodiversity of lease and its buffer area of 10 km radius with the following objectives.

The basic objectives of the assignment are to rationalize the protocol for an effective Biodiversity management plan for the proposed project area. This has been attempted by the following objectives:

- Collection and synthesis of secondary information on the status of biodiversity in project area.

- Undertake intensive field survey to assess the status of floral & faunal component in different habitats in core and buffer areas of project site.

- Authenticating the report on Wildlife management plan by forest department authority.

- Identification and listing of flora and fauna which are important as per the Wildlife (Protection) Act 1972.

- Suggest conservation and management plan to improve the habitat quality of the project area and to conserve the overall biological diversity of flora and faunas in the study area.

Activities undertaken during the study:

1. **For Flora survey:**
   - Tree, shrub, herb, climber and grass species identification and
   - enumeration
   - Diversity of species under plantations
   - Analysis of Rare-Endangered-Threatened flora

2. **For Fauna survey**
   - Documentation of Avian, Reptilian, Amphibian, Mammal and
   - other faunal diversity
   - Observations by direct and indirect evidences (Direct evidence- Sighting and hearing, Indirect evidence- Pug marks, nests and other signs
   - Analysis of Scheduled species.

3. Habitat/microhabitat diversity in the project site and surrounding areas within 10 km range from the site.

4. Photo documentation.

Approach of the study :
To assess the ecological issues and document flora and fauna associated with the project following tasks were undertaken :

1. Preliminary visit on the site
2. Review of literature
3. Core Site and Buffer area Survey

<u>Methodology</u>

Review of literature :
The purpose of the literature study was to identify habitats and species of local conservation value which may not have been present or apparent during the survey visit (e.g. spring/monsoon plants). The study was also helpful in understanding the historical biodiversity and ecological status of the site.

The desk study was carried out by referring the hard copy literature related to ecology and biodiversity of the region or of other related areas encompassing the proposed site.

Habitat Survey :
To collect data on flora (Herbs, Shrubs and Trees) and fauna (Birds, Insects, Reptiles, Mammals) various strategies were practiced. These strategies differed as per the habit and habitat of concerned group of species.

vi) **Flora** :
The structure and composition of vegetation and forest cover was studied by using phytosociological methods of vegetation survey, to analyze and estimate biodiversity, density, dominance and frequency of different members of plant populations. Observations were made in the forest area (as possible) as well as in non-forest area by laying plots and adopting quadrate method. The quadrate method includes laying down square sample plots or units for quantitative analysis of vegetation. It is actually the sample plot method given by Clements (1898); Philips (1959); Muller and Ellenberg (1974) and Rau and Wooten (1988) EIA Hand Book ch.7, pp.44). Quadrate sizes of 1 m x 1m, 5m x 5m and 10m x 10m were taken for herbs, shrub and trees respectively.

Co-existence and competition both are affected directly by the number of individuals in the community. Therefore, it is essential to know the quantitative structure of the community. To characterize the community as a whole, certain derived parameters are used i.e. Density, Frequency, Abundance, Importance Value Index and Simpson Diversity Index give a clear picture of community structure in quantitative terms. The value of a parameter as estimated from the representative samples it is generally near to the real value.

To characterize the vegetation in the study area, the data was collected and analyzed for describing the properties of vegetation with reference to species composition and functional attributes. Importance Value Index is the average of Relative Density, Relative Dominance, and Relative Frequency. The formulae incorporating different parameters analyzed and assessed for obtaining the baseline status of terrestrial biodiversity is presented as below:

Method for Analyzing Phytosociological Characteristics of Vegetation
Formulae used for various calculations are :

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

$$\text{Frequency (F)} = \frac{\text{Number of quadrats of occurrence}}{\text{Total number of quadrats studied.}} \times 100$$

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

Relative Frequency (RF) = $\frac{\text{Number of occurrence of a species}}{\text{Total number of occurrence of all species}} \times 100$

Species diversity indices like Shannon-Wiener Index (H) and Simpson Index (CD) were calculated as per Magurran (1988) using following formulae :

Shannon-Wiener Index (H') = $-\sum pi \ ln \ pi$
Simpson index (Cd) = $\sum pi^2$

Where, *pi* is the proportion of individuals of the ith species; $pi = Ni / N$, *Ni* is the number of individuals in the i^{th} species and *N* is the total number of individuals of all species in the stand.

Species diversity is one of the efficient ways to analyze community structure. Simpson Diversity Index takes into account the density of individual species as well as total density of all species. Lower values of Species Diversity Index indicate a healthy ecosystem and the higher values show disturbance in an ecosystem due to environmental stress.

Fauna and Avifauna:
The assessment of wild fauna was mostly based on random sightings. The Core zone is a mining dominated landscape and therefore not much sightings of fauna were possible. The Faunal diversity in the core site was limited to Butterflies, insects, Rats and common lizards. This has a very poor avifaunal diversity. Possibility of bigger mammals is very low due to the cumulative disturbance caused by the mine dominated landscape, blasting and operation . In the Buffer region due to the presence of reserve forests, there was a good diversity of birds, butterflies and other insects.

To study faunal diversity and richness in the area, extensive survey was done for all part of the Study area to collect data on invertebrates, fishes, amphibians, reptiles, birds and mammals. Information on invertebrates was obtained through direct searching method, which include visual encounter surveys (Heyer *et al*, 1994).Butterflies are small insects. Which require to identify, very close study. So for the identification we had to catch the butterflies with the help of butterfly net and after photography and identification released these into the same habitat. For better identification of the butterflies used the book of Haribal(1992), Kunte(2000), and Kehimkar (2008). For fishes trapping method was used, which is one of the most versatile fish censusing method (Sutherland, 1996). Like that of invertebrates taxonomic and ecological data on herpetofauna in the area was collected

systematically through direct searching method. Avifauna of the study area was surveyed through visual encounter by line and road transect method (Buckland *et al,* 1993). In addition to these methods vocal individuality method (Saunders and Wooler, 1988) was also used to identify some bird species, because many species of birds are detected by their calls and songs (Rappole *et al*., 1993). In case of mammalian fauna modified transect method (Burnham *et al.*1980) was used and transects were laid randomly to find out abundance and rarity of mammals. Animals on both side of the transect were listed. Direct and indirect evidences were collected from primary and secondary sources and people were also interviewed to collect data from them (Das, 2010). The indirect evidences such as scats/droppings, feathers, scales or hairs were collected to get species level confirmation in doubtful cases. Permanent hair materials preserved and were used as reference materials for comparison. The observations made during the study phase in the site are as follows:

Sampling Stations:
The propose project is located in the Jajang, Jadibahal, Palsa (Ka), Bandhuabeda, villages of Barbil in the district of Keonjhar. Majority of the region falling in the 10 km radius consist of Industrial landscape, very limited Agricultural landscape and Forest landscapes often interrupted by mining projects.

Sampling locations were strategically selected to collect maximum data on vegetation pattern, faunal diversity and Habitat diversity. In total 20 samples were taken around 10 sampling locations in areas demarcated as core zone (lease area) and buffer zone (upto 10 km from leasehold) of Jajang mine.

The study for biological environment were taken in forest area(reserved forests), like Chamkpur RF – 1 km, Baitrani RF – 3 km , Sidhamatha RF – 6 km& Mahaprabat Forest – 3.5 km. and villages Jajang, jadibahal, Palasa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar district.

Observations:
Observations were made for all possible habitats and flora-fauna species in and around the site (except microorganisms). All possible landscape features and areas in the site and buffer areas were visited to collect the required amount of data. The observations recorded are site, time and season specific observations. However, the actual observation data was supported by the data obtained from secondary sources (reports, research papers, literature survey) to gather a wide and in-depth perspective.

The ecological richness and sensitivity of the locations were examined critically. Almost all the major habitats in the buffer area were visited and observation was recorded.

Habitat and Forest Type Diversity:

The project is located in the Jajang village of the Keonjar district. The mining lease area is approachable from NH 215 road which divides the lease area in to 2 parts. It can be approached from Barbil which is situated at a distance of 23km (by road) in the Northeast or from Koira which is at a distance of 11 km (by road) in the Southwest. The nearest Rail Head is at Barbil (both Passenger and goods train). The region falls in to the North Western part of Orissa state and is bounded on the North by Jharkhand State, on the South by Jharsuguda & Sambalpur district, on the east by the Rourkela Forest division and the West and Northwest by Chhatishgarh state.

The region falling in to the 10 km radius from the project location is diverse in habitat and therefore study of Habitat and Forest type diversity was undertaken to understand different types of habitats and forests that are prevalent in the region.

Habitats are decisive factors and determine the diversity and distribution of flora and fauna in any given ecosystem. Therefore, it is vital to understand dynamics and diversity of habitats and micro ecosystems in and around the proposed project. Actual field observation coupled with Toposheet and Google earth images were used to characterize and distinguish landscape diversity in the study site and the buffer area. The overall examination was carried out by making actual visits at various pre marked locations in the core site (lease area) and the region falling within the 10 km radius of the project location (Buffer area). The buffer area was divided in to two parts (5km and 10km) to make the assessment and interpretation convenient.

vii) **The Core Zone** :



The lease area is an undulating terrain with occasional hills within the area, studded with flat topped low ridges, reassembling a relict type of topography controlled by differential hardness of rocks. The maximum RL of the area is 660m. and the minimum RL of the area is 498m.

The area show scattered vegetation as most of the area is utilized for mining and related allied activities. The area is mainly covered by bushes. The core site (Lease area) has plantation areas and some small vegetation patches that include forest based species. The forest based species are low in numbers. The tree divesity indicated dominance of Shorea robusta(Sal) followed by plantation specific such as a cassia siamea

(Chakhunda) and gmelina arborea (shivan) but the herbs and shrubs diversity was dominated by weeds such as Ageratum and Eupatorium.

The small patches of forest vegetation is potential for being used as nesting-browsing habitats for faunal species such as a Birds, Butterflies, Moths, Rodents, Hare, Reptiles and Lizards.

viii) Areas within 10 km range: Buffer zone.

Within the 10 km area comprising of Buffer zone, there are some major reserve forests such as Chamkpur RF – 1 km, Baitrani RF – 3 km, Sidhamatha RF – 6 km & Mahaprabat Forest – 3.5 km. These forests represent the natural ecology of the region and are mostly characterized by plant species such as*Shorea robusta, Diospyros melanoxylon, Diospyros montanna, Terminalia arjuna, Terminalia tomentosa, Anogeissus latifolia, Buchanania lanzan, Haldina cordifolia* and *Madhuca indica* etc. The overall landscape is undulating and the elevation ranges from 1900-2300 ft.

The dominant vegetation in the forests in the Buffer zone can be broadly categorized as a Moist and Dry Sal Forest (Government of Orissa 1994). The forest type prevalent in the buffer area can be classified on the basis Champion and Seth classification (1968) as Northern Tropical Moist Deciduous Sal (80 %) and Northern Tropical Dry Deciduous forest (20%).

Majority of the landscape falling in the buffer zone is dominated by industrial and mining projects, wastelands and discontinuous agricultural landscapes. Natural landscape and forest cover is interrupted by various mining projects and there has been cumulative degradation of the natural landscape. Majority of the reserve forests observed during the study were fragmented.

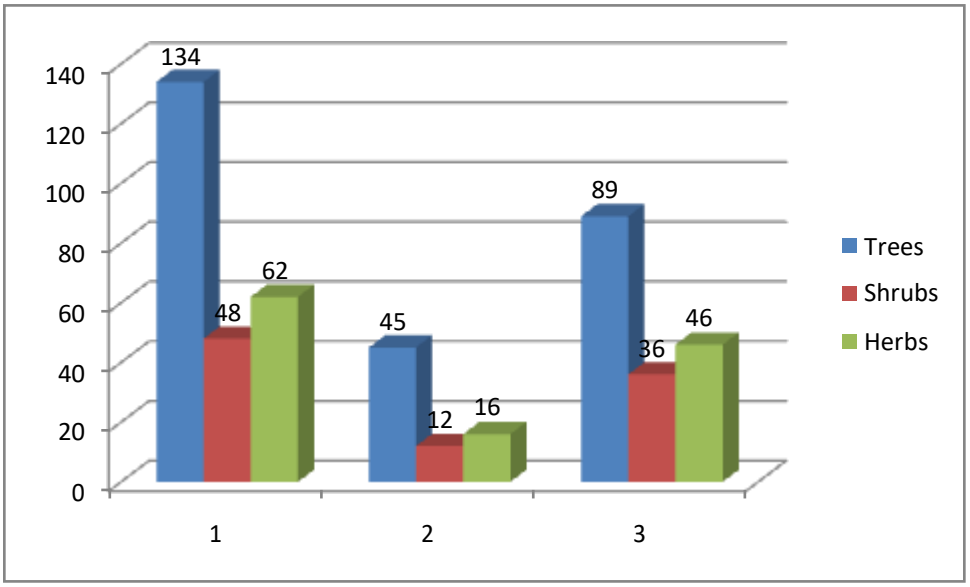
Floristic diversity

The vegetation in the RF / PF areas in the study area,

For the present biological study of Jajang, Twelve (12) transects for vegetation cover and transects for fauna study were studied in each site to evaluate the vegetation composition and wildlife status. The common and dominant species was recorded in the data sheet in order to prepare the inventory for wildlife fauna and flora. The longitude and latitude were recorded from the study site to know the accurate location provided in the table below :

List of Latitude & Longitude for quadrate study.

Sl. No.	Name of site	Latitude	Longitude	Altitude in meters
1	Mines	21° 56’23.0658"N	85°25'35.8788"E	444.06
2	Mines	21° 56’35.30796"N	85°26'5.31868"E	420.77
3	Mines	21° 55’57.93924"N	85°25'51.00708"E	538.78
4	Lease area	21° 55’57.66996"N	85°25'51.03012"E	435.19
5	Road side towards mines	21° 56’35.5532"N	85°26'4.93872"E	538.78
6	Plantation	21° 56’30.89688"N	85°25'59.65284"E	435.34
7	Plantation Village forest	21° 56’31.24752"N	85°26'2.27664"E	437.11
8	Sal vegetation plot	21°56’27.25693"N	85°25'54.4422"E	461.17
9	Water body in the core area	21°55’55.29108"N	85°25'1.72128"E	448.16
10	Baitarini River	21°1’45.8454"N	85°07'22.91808"E	78.97
11	Boundary pillar	21° 55’28.03152"N	85°27'11.3022"E	444.06
12	Gurutuan Village	21° 55’10.07052"N	85°27'23.80644"E	437.11



Habit-wise status of floristic composition of study area

Sl. No	Habit	Species	Core area	Buffer area
1	*Trees*	134	45	89
2	*Shrubs*	48	12	36
3	*Herbs*	62	16	46
Total		**244**	**73**	**171**

BASELINE STATUS OF FLORA

Flora of the project area and impact areas are classified in to in to Terrestrial and Aquatic flora.

Terrestrial Flora

Terrestrial flora consists of the following :

1) Agriculture crops cultivated (cereals, pulses and vegetables) during rainy season (Kharif) and post rainy moths of winter season (Rabi);
2) Commercial crops;
3) Natural vegetation of Forest type includes endemic species/ endangered species.
4) Plantations and Agro-forestry species and
5) Grass lands.

1. Floral diversity in Core Area :

In total 73 plant species belong to 45 trees, 12 shrubs, and 16 herbs were recorded during the field survey. The core zone mainly consists Forest land. The core zone is dominated with species like *Acacia auriculiformis, Shorea robusta, Aegle marmelos, Azadirachta indica, Terminalia tomentosa, Bauhinia vahlii, Grewia tillafolia, Adina cordifolia, Ficus racemosa* and *Tinospora cordifolia*. The details list of flora is given in list of Flora is given in Table No.4.

2. Floral diversity in Buffer Area :

In total 171 plant species belong to 89 trees, 36 shrubs, and 46 herbs were recorded during the field survey The higher frequency species in buffer area are *Shorea robusta* followed by *Azadirachta indica Aegle marmelos, Syzygium cumini, Pongamia pinnata, Semicarpus anacardium*, *Ficus bengalensis, Emblica officinalis, Terminalia arjuna, Lagerstroemia parviflora,* and *Saraca indic,*. The details list of flora is given in list of Flora is given in Table No –.4: List of Plants (Tree species in core area)

LIST OF FLORA IN THE CORE ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Acacia/ Sunajhari	*Acacia auriculiformis*	Mimosaceae	
2	Babul	*Acacia nilotica*	Mimosaceae	
3	Bela	*Aegle marmelos*	Rutaceae	
4	Chatiana	*Alstonia scholaris*	Apocynaceae	
5	Amba	*Mangifera indica*	Anacardiaceae	
6	Mahanimba	*Ailanthus excels*	Simarubaceae	
7	Sirisa	*Albizia procera*	Mimosaceae	
8	Nima	*Azadirachta indica*	Meliaceae	
9	Panasa	*Artocarpus heterophylla*	Moraceae	

Sl. No.	Local name	Botanical name	Name of class/Family	
10	Chara	*Buchanania lanzan*	Anacardiaceae	
11	Kanchana	*Bauhinia racemosa*	Cesalpiniaceae	
12	Siali	*Bauhinia variegate*	Caesalpiniaceae	
13	Simili	*Bombax ceiba*	Bombaceae	
14	Sunari	*Cassia fistula*	Caesalpiniaceae	
15	Khakada	*Casearia elliptica*	Flacourtiaceae	
16	Kumbhi	*Careya arborea*	Lecythidaceae	
17	Kendu	*Diospyros melanoxylon*	Ebenaceae	
18	Dimiri	*Ficus hispida*	Moraceae	
19	Boro	*Ficus bengalensis*	Moraceae	
20	Mahula	*Madhuca longifolia*	Sapotaceae	
21	Karanja	*Pongamia pinnata*	Fabaceae	
22	Palasha	*Butea parviflora*	Fabaceae	
23	Karada	*Cleistanthus collinus*	Euphorbiaceae	
24	Putuli	*Croton roxburghii*	Euphorbiaceae	
25	Sisoo	*Dalbergia sissoo*	Fabaceae	
26	Pahadia sisso	*Dalbergia latifolia*	Fabaceae	
27	Sahada	*Streblus asper*	Moraceae	
28	Sal	*Shorea robusta*	Dipterocarpaceae	
29	Siju	*Euphorbia neriifolia*	Euphorbiaceae	
30	Rohini	*Soymida febrifuga*	Meliaceae	
31	Jamun	*Syzigium cumini*	Myrtaceae	
32	Kasi	*Bridellia retusa*	Euphorbiaceae	
33	Kochila	Strychnos nuxvomica	Loganiaceae	
34	Kurei	*Holarrhena antidysentrica*	Apocynaceae	
35	Khaira	*Acacia catechu*	Mimosaceae	
36	Asana	*Terminalia tomentosa*	Combretaceae	
37	Arjuna	*Terminalia arjuna*	Combretaceae	
38	Eucalyptus	*Eucalyptus hybrid*	Myrtaceae	
39	Mahanimba	*Melia azadirachta*	Meliaceae	
40	Gambhari	*Gmelina arborea*	Verbenaceae	
41	Tentuli	*Tamarindus indica*	Caesalpiniaceae	
42	Teak	*Tectona grandis*	Verbenaceae	
43	Borakoli	*Ziziphus oenoplia*	Rhamnaceae	
44	Krushna chuda	*Delonix regia*	Caesalpiniaceae	
45	Kusuma	*Schleichera oleosa*	Sapindaceae	

LIST OF SHRUB SPECIES IN THE CORE ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Basanga	*Adhatoda zeylanica*	Acanthaceae	
2	Murga	*Agave americana*	Agavaceae	
3	Dahanimari	*Ageratum conyzoides*	Asteraceae	
4	Ata	*Anona squamosa*	Annonaceae	
5	Siali	*Bauhinia vahlii*	*Caesalpiniaceae*	
6	Polash	*Butea parviflora*	Fabaceae	
7	Noi palaso	*Butea superba*	Fabaceae	
8	Arakha	*Calotrpis gigantean*	Asclepiadaceae	
9	Kharkhari	*Clerodendrum viscosum*	Verbenaceae	
10	Koarada	*Cleistanthus collinus*	Phyllanthaceae	
11	Atundi	*Combretum roxburghii*	Combretaceae	
12	Putuli	*Croton roxburghii*	Euphorbiaceae	

LIST OF HERB SPECIES IN THE CORE ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Arkho	*Calotropis gigantea*	Asclepiadaceae	
2	Arkho	*Calotropis procera*	Asclepiadaceae	
3	Buroria	*Canscora diffusa*	Gentianaceae	
4	Nalita	*Chorcorus olitorius*	Tiliaceae	
5	Bano sorisa	*Cleome viscosa*	Capparidaceae	
6	Kharkhari	*Clerodendrum infortunatum*	Verbenaceae	
7	Bansaru	*Colocasia esculenta*	Arecaceae	
8	Kansira	*Commelina benghalensis*	Commelinaceae	
9	Nalita	*Corchorus aestuans*	Tiliaceae	
10	Gotha	*Croton oblongifolius*	Euphorbiaceae	
11	Jhunjhunca	*Crotalaria albida*	Fabaceae	
12	Chhani	*Crotalaria calycina*	Fabaceae	
13	Banhaldi	*Curcuma aromatica*	Zingiberaceae	
14	Talmuli	*Curculigo orchiodes*	Amaryllidaceae	
15	Salaparni	*Desmodium gangeticum*	Fabaceae	
16	Pita alu	*Dioscorea wallich*	Dioscoreaceae	

LIST OF FLORA (TREE SPECIES) IN THE BUFFER ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Acacia/ Sunajhari	*Acacia auriculiformis*	Mimosaceae	
2	Babul	*Acacia nilotica*	Mimosaceae	
3	Khaira	*Acacia catechu*	Mimosaceae	
4	Kuruma	*Adina cordifolia*	Rubiaceae	
5	Bela	*Aegle marmelos*	Rutaceae	
6	Mahanimba	*Ailanthus excels*	Simarubaceae	
7	Sirisa	*Albizia procera*	Mimosaceae	
8	Chatiana	*Alstonia scholaris*	Apocynaceae	
9	Cashew	*Anacardium occidentale*	Anacardiaceae	
10	Dhaura	*Anogeissus latifolia*	Combretaceae	
11	Kadamba	*Anthocephalus kadamba*	Rubiaceae	
12	Matha saga	*Antidesma ghaesembilla*	Euphorbiaceae	
13	Nunannunia	*Antidesma acidum*	Meliaceae	
14	Bantala	Ardisia solanacea	Myrsinaceae	
15	Panasa	*Artocarpus heterophylla*	Moraceae	
16	Nima	*Azadirachta indica*	Meliaceae	
17	Hinjal	Barringtonia acutangula	Myrtaceae	
18	Kanchana	*Bauhinia racemosa*	Cesalpiniaceae	
19	Siali	*Bauhinia variegate*	Caesalpiniaceae	
20	Simili	*Bombax ceiba*	Bombaceae	
21	Kasi	*Bridellia retusa*	Euphorbiaceae	
22	Chara	*Buchanania lanzan*	Anacardiaceae	
23	Palasha	*Butea parviflora*	Fabaceae	
24	Palas	*Butea monosperma*	Fabaceae	
25	Potua	*Catunaregam spinosa*	Rubiaceae	
26	Kumbhi	*Careya arborea*	Lecythidaceae	
27	San chakunda	*Cassia siamea*	Caesalpiniaceae	
28	Sunari	*Cassia fistula*	Caesalpiniaceae	
29	Khakada	*Casearia elliptica*	Flacourtiaceae	
30	Kumbhi	*Careya arborea*	Lecythidaceae	
31	Karada	*Cleistanthus collinus*	Euphorbiaceae	
32	American simili	*Ceiba pentadra*	Malvaceae	
33	Bheru	*Chloroxylon swietenia*	Flindersiaceae	
34	Kendu	*Diospyros melanoxylon*	Ebenaceae	
35	Putuli	*Croton roxburghii*	Euphorbiaceae	

Sl. No.	Local name	Botanical name	Name of class/Family	
36	Sisoo	*Dalbergia sissoo*	Fabaceae	
37	Pahadia sisso	*Dalbergia latifolia*	Fabaceae	
38	Krushna chuda	*Delonix regia*	Caesalpiniaceae	
39	Kukurdanti	*Garuga pinnata*	Burseraceae	
40	Kurei	*Holarrhena antidysentrica*	Apocynaceae	
41	Rai	*Dillenia pentagyna*	Dilleniaceae	
42	Gambhari	*Gmelina arborea*	Verbenaceae	
43	Ghurudu	*Gardenia gummifera*	Rubiaceae	
44	Siju	*Euphorbia neriifolia*	Euphorbiaceae	
45	Eucalyptus	*Eucalyptus hybrid*	Myrtaceae	
46	Dimiri	*Ficus hispida*	Moraceae	
47	Boro	*Ficus bengalensis*	Moraceae	
48	Amba	*Mangifera indica*	Anacardiaceae	
49	Achu	*Morinda pubescens*	Rubiaceae	
50	Amla	*Phyllanthus emblica*	Euphorbiaceae	
51	Baula	*Mimusops elengii*	Sapotaceae	
52	Bankapasia	*Kydia calycina*	Malvaceae	
53	Moi	*Lannea coromandelica*	Anacardiaceae	
54	Siddha	*Lagerstroemia parviflora*	Lythraceae	
55	Manda	*Macaranga peltata*	Euphorbiaceae	
56	Mahula	*Madhuca longifolia*	Sapotaceae	
57	Kamala gundi	*Mallotus phillippensis*	Euphorbiaceae	
58	Karanja	*Pongamia pinnata*	Fabaceae	
59	Mahanimba	*Melia azadirachta*	Meliaceae	
60	Champa	*Michelia champaca*	Magnoliaceae	
61	Debadaru	*Polyalthia longifolia*	Annonaceae	
62	Parashi	*Millusa velutina*	Annonaceae	
63	Godikoima	*Mitragyna parvifolia*	Rubiaceae	
64	Gandhasal	*Polyalthia cerasoides*	Annonaceae	
65	Gangasiuli	*Nyctanthes arbor-tristis*	Nyctanthaceae	
66	Patharchampa	*Ochna obtusata*	Ochnaceae	
67	Phanaphana	*Oroxylum indicum*	Bignoniaceae	
68	Radhachuda	*Peltophorum ferrugineum*	Caesalpiniaceae	
69	Rimuli	*Protium seeatum*	Burseraceae	
70	Piasal	*Pterocarpus marsupium*	Fabaceae	
71	Muchukunda	*Ptetospermum acerifolium*	Malvaceae	
72	Kusuma	*Schleichera oleosa*	Sapindaceae	
73	Kochila	Strychnos nuxvomica	Loganiaceae	
74	Jamun	*Syzigium cumini*	Myrtaceae	

Sl. No.	Local name	Botanical name	Name of class/Family	
75	Tentuli	*Tamarindus indica*	Caesalpiniaceae	
76	Teak	*Tectona grandis*	Verbenaceae	
77	Bhalia	*Semicarpus anacardium*	Anacardiaceae	
78	Sal	*Shorea robusta*	Dipterocarpaceae	
79	Rohini	*Soymida febrifuga*	Meliaceae	
80	Genduli	*Sterculia urens*	Sterculiaceae	
81	Sahada	*Streblus asper*	Moraceae	
82	Asana	*Terminalia tomentosa*	Combretaceae	
83	Arjuna	*Terminalia arjuna*	Combretaceae	
84	Bahada	*Terminalia bellirica*	Combretaceae	
85	Harida	*Terminalia chebula*	Combretaceae	
86	Kharkas	*Trema orientalis*	Ulmaceae	
87	Kangra	*Xylia xylocarpa*	Fabaceae	
88	Kanteikoli	*Ziziphus mauritiana*	Rhamnaceae	
89	Borakoli	*Ziziphus oenoplia*	Rhamnaceae	

LIST OF FLORA (SHRUB SPECIES)IN THE BUFFER ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Basanga	*Adhatoda zeylanica*	Acanthaceae	
2	Murga	*Agave americana*	Agavaceae	
3	Dahanimari	*Ageratum conyzoides*	Asteraceae	
4	Atta	*Anona squamosa*	Annonaceae	
5	Siali	*Bauhinia vahlii*	*Caesalpiniaceae*	
6	Polash	*Butea parviflora*	Fabaceae	
7	Noi palaso	*Butea superba*	Fabaceae	
8	Arakha	*Calotrpis gigantean*	Asclepiadaceae	
9	Kharkhari	*Clerodendrum viscosum*	Verbenaceae	
10	Koarada	*Cleistanthus collinus*	Phyllanthaceae	
11	Atundi	*Combretum roxburghii*	Combretaceae	
12	Putuli	*Croton roxburghii*	Euphorbiaceae	
13	Arguna	*Cycas circinallis*	Cycadaceae	
14	Dudura	*Datura metal*	Solanaceae	
15	Boinchakoli	*Flacourtia jangomas*	Flacourtiaceae	
16	Ranikathi	*Flemingia chappar*	Fabaceae	
17	Bhurudu	*Gardenia gummifera*	Rubiaceae	
18	Modimodica	*Helicteres isora*	Sterculiaceae	
19	Kurei	*Holarrhena pubescens*	Apocynaceae	
20	Gileri phul	*Indigofera cassioides*	Fabaceae	

Sl. No.	Local name	Botanical name	Name of class/Family	
21	Basanga	*Justicia adhatoda*	Acanthaceae	
22	Nagairi	*Lantana camara*	Verbanaceae	
23	Manjuati	*Lawsonia inermis*	Lythraceae	
24	Kamalagundi	*Mallotus philippensis*	Euphorbiaceae	
25	Khirkichikanta	*Mimosa himalayana*	Mimosaceae	
26	Bhusunga	*Murraya koenigii*	Rutaceae	
27	Gangasiuli	*Nyctanthes arbor-tristis*	Oleaceae	
28	Poksunga	*Pogostemon benghalensis*	Lamiaceae	
29	Giringa	*Pterospermum acerifolium*	Sterculiaceae	
30	Potua	*Randia dumetorum*	Rubiaceae	
31	Gaba	*Ricinus communis*	Euphorbiaceae	
32	Arguna	*Vernonia aspera*	Asteraceae	
33	Begonia	*Vitex nigundo*	Verbenaceae	
34	Dhatuki	*Woodfordia fructicosa*	Lythraceae	
35	Kankoli	*Ziziphus oenopila*	Rhamnaceae	
36	Barokoli	*Zyzyphus xylopyrus*	Rhamnaceae	

LIST OF FLORA (HERBS SPECIES) IN THE BUFFER ZONE OF JAJANG IRON ORE MINES				
Sl. No.	**Local name**	**Botanical name**	**Name of class/Family**	
1	Indramaris	*Acalypha indica*	Euphorbiaceae	
2	Apamaranga	*Achyranthes aspera*	Amaranthaceae	
3	Dantari	*Acaccia pennata*	Mimosaceae	
4	Dhatuki	*Woodfordia fruticosa*	Lythraceae	
5	Pauncia	*Aerva lanata*	Amaranthaceae	
6	Madranga	*Alternanthera sessilis*	Amarantha	
7	Bankolthi	*Atylosia scarabaeoides*	Fabaceae	
8	Leutia saga	*Amaranthus viridis*	Amaranthaceae	
9	Ban olua	*Amorphophallus bulbifera*	Arecaceae	
10	Mamuri	*Antidesma diandrum*	Euphorbiaceae	
11	Pokasungha	*Ageratum conyoides*	Asteraceae	
12	Jhalai	*Byophytum sensitivum*	Oxalidaceae	
13	Poksunga	*Blumea lacera*	Asteraceae	
14	Puruni	*Boerhavia diffusa*	Nyctaginaceae	
15	Bana chakunda	*Cassia tora*	Caesalpiniaceae	
16	Bana sorish	*Cleome viscosa*	Capparaceae	
17	Arkho	*Calotropis gigantea*	Asclepiadaceae	
18	Arkho	*Calotropis Procera*	Asclepiadaceae	
19	Buroria	*Canscora diffusa*	Gentianaceae	
20	Nalita	*Chorcorus olitorius*	Tiliaceae	

Sl. No.	Local name	Botanical name	Name of class/Family	Sl. No.
21	Bano sorisa	*Cleome viscosa*	Capparidaceae	
22	Kharkhari	*Clerodendrum infortunatum*	Verbenaceae	
23	Bansaru	*Colocasia esculenta*	Arecaceae	
24	Kansira	*Commelina benghalensis*	Commelinaceae	
25	Nalita	*Corchorus aestuans*	Tiliaceae	
26	Jhunjhunca	*Crotalaria albida*	Fabaceae	
27	Banhaldi	*Curcuma aromatica*	Zingiberaceae	
28	Talmuli	*Curculigo orchiodes*	Amaryllidaceae	
29	Salaparni	*Desmodium gangeticum*	Fabaceae	
30	Pita alu	*Dioscorea wallich*	Dioscoreaceae	
31	Mayurchulia	*Elephantopus scaber*	Asteraceae	
32	Chitakuti	*Euphorbia hirta*	Euphorbiaceae	
33	Baincha koli	*Flacourtia jangom*	Flacourtiaceae	
34	Anatamula	*Hemidesmus indicus*	Asclepiadaceae	
35	Kalam saga	*Ipomea aquatic*	Convolvulaceae	
36	Bhuinkurwan	*Ixora arborea*	Rubiaceae	
37	Baigaba	*Jatropha curcas*	Euphorbiaceae	
38	Banmali	*Jasminum arborescens*	Oleaceae	
39	Kala mahajal	*Lygodium flexuosum*	Lygodiaceae	
40	Lajkoli	*Mimosa pudica*	Mimosaceae	
41	Mundi	*Mitragyna parviflora*	Rubiaceae	
42	Lamiaceae	*Ocimum basilicum*	Bantulasi	
43	Bhuin anal	*Phyllanthus niruri*	Euphorbiaceae	
44	Bichhuati	*Tragia involucrate*	Euphorbiaceae	
45	Bisalyakarani	*Tridax procumbens*	Asteraceae	
46	Gileri	*Tephrosia purpurea*	Fabaceae	

LIST OF FLORA (CLIMBERS) OF JAJANG IRON ORE MINES				
SL No	**Local name**	**Botanical name**	**Name of class/Family**	
1	Atundi	*Combretum roxburghii*	Combretaceae	
2	Baidanka	*Macuna pruriens*	Papilionaceae	
3	Bichhuati	*Tragia plukenetii*	Euphorbiaceae	
4	Muturi	*Smilax macrophylla*	Liliaceae	
5	Suamloi	*Ichnocarpus frutiscens*	Apocynaceae	
6	Gulchi	*Tinospora cordifolia*	Menispermaceae	
7	Noi palaso	*Butea superba*	Fabaceae	

LIST OF GRASS LAND SPECIES IN THE CORE ZONE/BUFFER ZONE

Sl. No.	Botanical name	English name	Name of class/Family	Core zone	Buffer zone
1	Apluda mutica L.	Mauration grass	Poaceae	+	+
2	Aristida setacea Retz.	Broom grass	Poaceae	+	+
3	Arundo donax L.	Giant Reed	Poaceae	-	+
4	Bambusa arundinaceae L.	Bamboo	Poaceae	+	+
5	Cynodon dactylon (L.) Pers.	Bermuda grass	Poaceae		
6	Dactyloctenium aegyptium(L.) Willd.	Crow foot grass	Poaceae	+	+
7	Eragrostis amabilis (L.) Wight &Arn.	Love grass	Poaceae	+	+
8	Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.	Spear grass,	Poaceae	+	+
9	Imperata cylindrical (L.) Raeusch	Cogon grass	Poaceae	+	+
10	Setaria faberi Herrm	Japanese bristle grass	Poaceae	+	+

Source : Field survey and Interaction with local peoples

FAUNAL DIVERSITY

The Core site is a mining dominated landscape and therefore not much sightings of animal was possible. The faunal diversity in the core site was limited to Butterflies, insects, Rats and common lizards. The core site has a very poor Avifaunal diversity. Possibility of bigger mammals is very low due to the cumulative disturbance caused by the mine dominated landscape. In the Buffer region due to the presence of Reserve forests, there was a good diversity of Birds, Butterflies and Other insects.

To study faunal diversity and richness in the area, random sightings were preferred and various methods of observation were practiced. For reptiles, stone lifting was done; rock crevices and wall space of structures in the site were checked. Amphibians were searched near the stagnant water pools and small streams. Insects were observed on underside of leaves, nests, rock crevices, bushes and other places. Birds were studied by undertaking several field trails in and around the site.

The observations made during the study phase in the site are as follows:

Mammal diversity:
No mammals other than common Squirrel and domesticated cows or dogs were seen in and around the core site. On random survey and talking with local people, it was learnt that Jackals and Sloth bear are found in the reserve forest areas in the buffer region. On the basis of direct sightings, questioners and indirect evidences, the presence of faunal species such as Wild Boar, Jackals, Fox, Hare, Porcupine and Indian Mongoose were validated.

List of Mammals that can be found in the buffer region is attached in the Table.

Avian diversity:
In areas falling within the core zone (lease area) and adjoining areas, 05 species of birds were observed during the study. The observations were made based on direct sightings and birdcalls. In the observed list of birds, none of the species were classified as Endangered or rare. All of these birds observed were of least concern classification. It must be noted here that though the birds species recorded during the survey are of least concern classification, necessary steps must be undertaken to reduce the impact on the reserve forest areas that support majority of the Avian diversity. A list of Bird species observed during the study is shown in Table

Reptile and Amphibian diversity:
During the survey, 3 species of reptiles and 2 species of amphibians were found in areas close to the project site. On expanding the survey to nearby ranges in the Buffer region, 9 species of reptiles and 4 species of amphibians were encountered. The list of Reptiles and amphibian species is shown in Table

There is no Wild Life Sanctuary or National Park within the study area of 10 km. Karo - Karampada elephant corridor is located at about 12.5 km from the mine lease area. The site specific Wildlife Conservation Plan has been prepared & got approved by PCCF (Wildlife), Chief Wildlife Warden, Odisha. The detailed faunal species is as follows:

LIST OF MAMMALS WITHIN THE CORE AREA				
Sl. No.	**Local Name**	**English Name**	**Zoological Name**	**Schedule**
1	Barha	Wild Boar	*Sus scrofa*	III
2	Bilua	Jackal	*Canis aureus*	II
3	Heta	Hyaena	*Hyaena hyaena*	III
4	Jhinka	Porcupina	*Hystyrix indica*	IV
5	Neula	Mongoose	*Herpestes eduardsii*	II
6	Gunduchi musa	Striped squirrel	*Funambulus pennati*	IV

LIST OF BIRDS WITHIN THE CORE AREA				
1	Bana kukuda	Jungle fowl	*Gallus gallus*	IV
2	Kapta	Ring Dove	*Streptopelia chinensis*	IV
3	Koel	Cuckoo	*Eudynamis Scolopaceus*	IV
4	Kumbhatua	Crow pheasant	*Centropus asiatisa*	IV
5	Gunduri	Patridge	*Perdicula asiatisa*	IV
6	Bani	Common Myna	*Acridotheres tristis*	IV
7		Common tailorbird	*Orthotomus sutorius*	IV
8		Red vented bulbul	*Pycnonotus cafer*	IV
LIST OF REPTILES WITHIN THE CORE AREA				
1	Dhamana	Rat snake	*Ptyas mucosus*	II
LIST OF AMPHIBIANS WITHIN THE CORE AREA				
1	Frog	Common Indian toad	*Euphlyctis cyanophlyctis*	IV
2	Frog	Indian Bull frog	*Hoplobatrachus tigerinus*	IV

Fauna in Buffer Zone

LIST OF MAMMALS WITHIN THE BUFFER AREA				
Sl. No	**Local Name**	**English Name**	**Zoological Name**	**Schedule**
1	Barha	Wild Boar	Sus scrofa	III
2	Bana bilei	Jungle cat	Felis chausaffinia	II
3	Bilua	Jackal	Canis aureus	II
4	**Hati**	Elephant	Elephas maximus	**I**
5	Heta	Hyaena	Hyaena hyaena	III
6	Jhinka	Porcupina	Hystyrix indica	IV
7	Neula	Mongoose	Herpestes eduardsii	II
8	**Bhalu**	Sloth bear	Melursus ursinus	**I**
9	Mankad	Langoor	Presbytis entellus*I*	III
10	Neula	Mangoose	Herpestes edurdsii *I*	II
11	Thekua	Hare	Lepus nigricollis	IV
LIST OF BIRDS WITHIN THE BUFFER AREA				
1	Bana kukuda	Jungle fowl	*Gallus gallus*	IV
2	Kapta	Ring Dove	*Streptopelia chinensis*	IV
3	Koel	Cuckoo	*Eudynamis Scolopaceus*	IV
4	Kumbhatua	Crow pheasant	*Centropus asiatisa*	IV
5	Kau	House crow	*Corvus splendens*	V
6	Gunduri	Patridge	*Perdicula asiatisa*	IV
7	Sua	Indian myna	*Acridotherses tristris*	IV
8	Macharanka	SmallBlueKingfisher	*Alcedoatthis*	IV

9		Little egret	*Egretta garzetta*	IV
10	Roller	IndianRoller	*Coraciasbenghalensis*	IV
11	Kite	Pariah Kite	*Milvus migrans lineatus*	IV
12	Drongo	BlackDrongo	*Dicrurusadsimilis*	IV
13	Cormorant	LittleCormorant	*Phalacrocorax niger*	IV
14	Bulbul	RedVentedBulbul	*Pycnonotuscafer*	IV
15	Greenbulbul	Chloropsis(greenbulbul)	*Chloropsisaurifrons*	IV
16		Black-naped Oriole	*Oriolus chinensis*	IV
17		Green Bee-eater	*Merops orientalis*	IV
18	Kite	Black Kite (Pariah Kite)	*Milvus migrans*	-
19		Purple Sunbird	*Nectarinia asiatica*	IV
20	Haladibasanta	Black-naped Oriole	*Oriolus chinensis*	IV
21	Haladibasanta	Black hooded oriole	*Oriolus xanthornus*	IV
22		Common tailorbird	*Orthotomus sutorius*	IV
23	Ghar chatia	House sparrow	*Passer domesticus*	IV
24		Yellow Wagtail	*Motacilla flava*	IV
25	Sua	Alexandrine Parakeet	*Psittacula eupatria*	IV
26	Flycatcher	Asian Paradise-Flycatcher	*Terpsiphone paradise*	IV
27		Brown-headed Barbet	*Megalaima zeylanica*	IV
28		Common Babbler	*Turdoides caudatus*	IV
29	Pipit	Paddyfield Pipit	*Anthus rufulus*	IV
30		Pied bushchat	*Saxicola caprata*	IV
31		Purple rumped sunbird	*Leptocoma zeylonica*	IV
32		Scarlet Minivet	*Pericrocotus flammeus*	IV
33		White browed wagtail	*Motacilla maderaspatensis*	IV

LIST OF REPTILES WITHIN THE BUFFER AREA

1	Chandra boda	Chandra boda	*Vipera russelli*	II
2	**Ajagara**	Rock Python	*Python molurus molurus*	**I**
3	Chiti	Common Indian Krait	*Bungarus caeruleus*	IV
4	Naga sapa	Indian cobra	*Naja naja*	II
5	Dhamana	Rat snake	*Ptyas mucosus*	II
6	Bahurupi endua	Pohelaendua	*Chamaeleozeylanicus*	II
7	Endua	Common garden lizard	*Calottes versicolor*	III
8	Endua	Indian Rock Lizard	*Psammophilus Blanfordanus*	IV
9	Chamepei neula	Snake skink	*Riopa punctata*	IV

LIST OF AMPHIBIANS WITHIN THE BUFFER AREA				
1	Frog	Indian Bull Frog	Rana tigrina	IV
2	Frog	Frog	Rana hexdactyla	IV
3	Frog	Water skipper	Rana cyanohryictis	IV

Checklist of Butterflies in Core and Buffer Area

Sl. No.	Scientific name	Common name	Status	Core Area	Buffer Area
	Tirumala limniacae	Blue tiger	Common	+	+
	Danaus chrysippus	Plain Tiger	Common	+	+
	Ixias Marianne	White –orange Tip	Common	+	+
	Papilio polytes	Common mormon	Common	+	+
	Precis orithya	Blue Pancy	Common	-	+
	Precis hierta	Yellow Pansy	Common	+	+

Odonates of Study Area

Sl. No	Family	Scientific name
1	Aeshnidae	*Anax guttatus*
2	Gomphidae	*Ictinogomphus rapax*
3		*Paragomphus lineatus*
4	Libellulidae	*Bradinopyga geminate*
5		*Branchythemis sp*
6		*Crocothemis servilia*
7		*Neurothemis fulvia*
8		*Orthetrum pruinosum*
9		*Potamarcha obscura*
10		*Potamarcha congener*
11		*Tramea basilaris*
12		*Trithemis pallidinervis*
13	Coenagrionidae	*Aciagrion hisopo hisopa*
14		*Agriocnemis pygmaea*
15		*Ceriagrion olivaceum*
16		*Cercion malayanums*
17		*Cercion calamorum*
18		*Ischnura aurora*
19	Lestidae	*Lestes elatus*
20		*Lestes viridulus*
21	Protoneuridae	*Disparoneura sp*

Soil fauna includes Microfauna, Mesofauna and Macrofauna as Collembola (Springtails), Lumbricina (earthworms), nematodes, Isoptera (termites), Acari (mites), Enchytraeid worms, small Diplopoda (millipedes), and many small larval and adult insects, Macrofauna: Isopoda (woodlice), larger Diplopoda, earthworms, Isoptera (termites), Coleoptera (beetles),Diptera (flies), ants, and molluscs.

Aquatic Fauna in the project area-

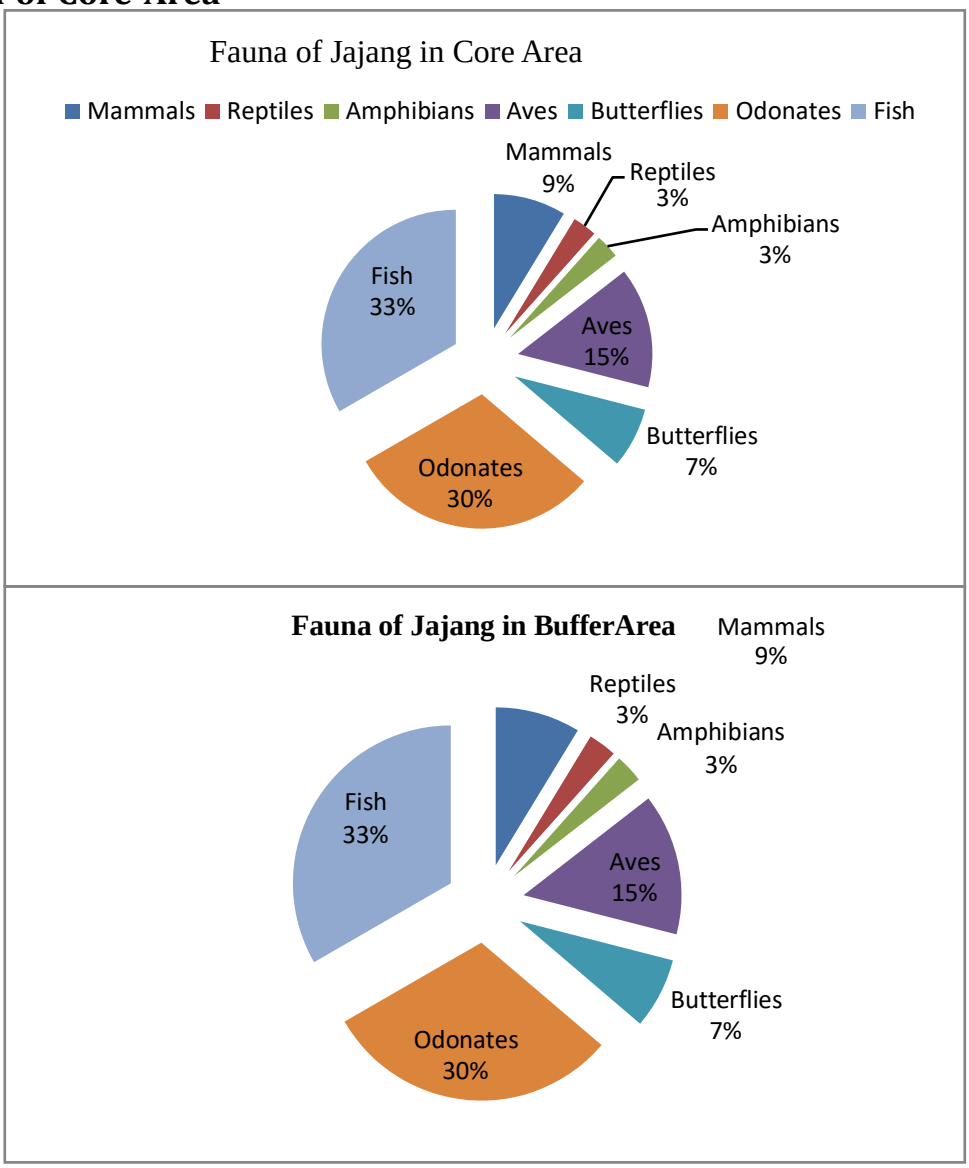
Fish diversity recorded in study area

Sl. No	Family	Scientific name	Status in
1	Catla	*Catla catla*	LC
2	Rohu	*Labeo rohita*	LC
3	Mrikali	*Cirrhinus mrigala*	LC
4	Bata	*Labeo bata*	LC
5	Puti	*Puntius ticto*	LC
6	Magur	*Clarias batrachus*	LC
7	Singhi	*Heteropheustis fossilis*	NA
8	Sol	*Ophiocephalus str iatus*	LC
9	Lata	*Ophiocephalus punctatus*	NA
10	Fali	*Notopterus notopterus*	LC
11	Mahurali	*Amblypharyngodon mola*	LC
12	Dandikiri	*Rasbora daniconius*	LC
13	Karandi	*Punctitus conchonius*	LC
14	Mentua	*Garra mullya*	LC
15	Kantia	*Hemibagrus menoda*	LC
16	Tudi	*Macrognathus aculeatus*	LC
17	Chandakudi	*Chanda nama*	LC
18	Gadisha	*Channa punctata*	LC
19	Chingudi	Prawn sps.	LC
20	Pita Kerandi	Puntius conchonius Puntius conchoniu	LC
21	Baunsapatri	Salmophasia bacaila Salmophasia bacaila	LC
22	Kantia	*Mystus vittatus*	LC
23	Kau	*Anabas cobojius*	LC

LC= Least Concern, NA= Not Assessed

Percentage presence of all Fauna types in the Study Area

Fauna of Core Area



Excepting schedule – 1 fauna like Elephant, Sloath Bear& Rock Python & other Fauna as narrated above no other Fauna are noticed in the study area. Besides there are **no endemic** species are found in the study area however Elephant is the only schedule – 1 Fauna (threatened species) are noticed here.

ix) **Movement pattern of mega fauna, wildlife corridors, human wildlife conflict** :

Due to mosaic of mines, human habitations and agricultural land, forest connectivity between Chamakpur, Baitrani, Siddhamatha & Mahaparbat PRF is drastically affected.

One important source of water is Baitani River but most animals are prevented to make use of the river water due to cluster of mines on its west bank and further beyond. Fragmentation of the habitat has affected movement pattern of elephants, and made the forest vulnerable to loss of species and disappearance of genetic diversity within the species by isolating populations of several animals, creating conditions for inbreeding and paving the way for extinction.

As lease area do not involve any forest blocks & includes only bushy revenue forest & surrounded by habitations and other infrastructure like railways, roads etc., hence mega wild life like Elephant hardly visits the lease site. Besides the Karo-Karampada Elephant corridor is about 18 KM from the lease outside the project impact area.

Elephants in different groups consisting of 7 too to 17 nos. in each group, known to visit the villages of Panduposi and Harmutu and Karo RF Karampda R.F, Tholkabad R.F of Jharkhand respectively are Elephants habitats. Elephnts move in sidhamatha, Baitrani R.F occurring in impact zone and which are transient habitats. More evidences of Elephants have been recorded under eastern impact zone from depredation data.

- One group migrates from Sidhamatha RF reaches Baitrani RF crosses Kundra nala and then move to Sidhamatha Pahad and then move to Jharngan, Goldaru, Thakurani RF, and Pandrashi PF and come back in same route.
- Another group migrating from Baitrani RF, reaches Khuntpani, Banshapani, Banshapani Pahad and come back in the same route.
- Also wild elephants move to Chamakpur RF, Maha-parbat DPF & adjoining forest patches located around the villages at times during crop season causing man/animal conflict.

As working of mines has influenced to a great extent the movement of Elephants, still there are few number of cases of man and animal conflict including conflict between man and elephant in the process a few human kill was occurred one during 2014 & one during 2016.

There are also instances of killing of other wild animals such as, wild pig Saliaptani and male spotted deer, within the zone of influence.

There are also cases of damage to houses, cops and domestic animals caused by elephant. The details of human and elephant and damage to house, crop and domestic animals as well as information on other wild life access has been enumerated in the forth coming paras.

x) **Man-animal conflict** :

A detail statement of man animal conflict, crop damage, compensation paid, human injury/death wild animal kill of Keonjhar division from the period 2010-11 to 2019-20 is furnished below :

Human death injury

Year	Human death due to Elephant attack	Human death due to Bear attack	Human death due to wild Boar attack	Others	Total
2019-20	8		1		**9**
2018-19	7	6			**13**
2017-18	8	2			**10**
2016-17	7	2	1		**10**
2015-16	10				**10**
2014-15	8	1			**9**
2013-14	6	2			**8**
2012-13	19	3			**22**
2011-12	3	4			**7**
2010-11	7				**7**

Crop Damage

Man animal conflict data for the year 2016-17 to 2020-21 with compensation										
Year	**Human kill**		**Human injury**		**House Damage**		**Crop damage**			**Total**
	Nos of decease	**Compassionate Amount (in Rs.)**	**Nos of Victim**	**Compassionate Amount (in Rs.)**	**Nos of Victim**	**Compassionate Amount (in Rs.)**	**Nos of Victim**	**Area Damaged (in Acr.)**	**Compassionate Amount (in Rs.)**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
2016-17	10	3000000.00	34	445000.00	102	340000.00	3762	951.70	9525220.00	13310220.00
2017-18	9	2900000.00	26	415000.00	216	800000.00	3517	905.58	9150740.00	13265740.00
2018-19	14	5600000.00	30	530000.00	104	576000.00	3514	856.256	8707922.00	15413922.00
2019-20	9	3600000.00	38	380000.00	335	2116000.00	3581	904.71	9111540.00	15207540.00
2020-21	6	2nos-800000.00 4nos-160000.00 (advance paid) Total-Rs.960000.00	54	840000.00	139	606000.00	3859	836.49	8541616.00	10947616.00

Elephant Death During 2016-17 to 2020-21								
Sl No.	**Date of Occurrence**	**Sex**	**Name of the Range**	**Name of the Village**	**Name of the Forest**	**Cause of death**	**Latitude**	**Longitude**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
2016-17								
Nill								
2017-18								
1	22.04.2017	Female-40years	Telkoi	Udayagigi (Munda Sahi)		Due to septicemia	N- 21-18-47	E-85-22-27.44
2	14.11.2017	Female-7years	Keonjhar	Near Village Dumuria Rashi field		Natural	N-21-27-27.4	E-85-34-09.0
	Total	2 Nos						
2018-19								
1	24.07.18	Male-12 to 14 Years	Champua	Chamakpur KF. 150 meters away from river Baitarani	Chamakpur KF	Due to shock arising from septicemia	N-21-59-45.93	E- 85-28-21.93
2	21.11.18	Female-30 Years	Keonjhar	Basantpur & Naranpur between Railway Station		Due to Train accident	N- 21-34-39.9	E- 85-38-49.6
3	28.03.19	Male Calf- 1 Month old	Champua	Mahaparbat DPF, Near village Hatimara Chhak	Mahaparbat DPF	Due to cardial (there is Fighting among the male elephant & Female elephant	N-21-51-14.6	E-85-25-16.6
	Total	**3 Nos**						

2019-20								
1	09.04.19	Female- 15 to 20 years	Ghatagaon	Near Gayalmunda Village		Anthrex	N- 21-27-43.7	E- 85-46-15.1
2	22.08.2019	Male Calf	Ghatagaon	Near Balijodi Village		Road Accident	N-21 22 51	E-85 55 33
3	22.08.2019	Adult Female	Ghatagaon	Near Balijodi Village		Road Accident		
4	22.08.2019	Female	Ghatagaon	Near Balijodi Village		Road Accident		
5	07.10.2019	Female	BJP		Uper Sumanth KF	Natural	N- 21 32 44	E- 85 33 52
6	19.02.2020	Male Calf	BJP		Taramakanta DPF	Natural	N-21 37 27	E-85 16 24
	Total	6 Nos						
2020-21								
1	05.05.2020	Gender could not be ascertained	Champua		Kasia KF		N- 21 46 48.3	E- 85 25 11.5
2	24.05.2020	Male(Single Tusker)	Champua		Chamakpur KF	Due to Accute Tympanitis	N- 22 0 49.4	E- 85 29 4.4
3	14.06.2020	Male	Champua		Baitarani A RF	Due to Electrocution	N- 21-58-31.08	E- 85-26-13.7
4	14.06.2020	Female	Champua		Baitarani A RF	Due to Electrocution	N- 21-58-31.08	E- 85-26-13.7
5	03.07.2020	Male Baby elephant	Barbil		Sidhamath RF	Due to respinatory failure		
6	11.09.2020	Female	Keonjhar		Barabanka RF	Presure impacts on hearts & lungs	N-21 21 06	E- 85 58 33
7	16.10.2020	Male calf	BJP	Nadapani village	Taramakanta DPF		N- 21 42 32.0	E- 85 21 49.0

From the above figures it is establishment that no man-Elephant conflicts is recorded in the project area of Jajang mines. Whatever Man-animal conflict recorded in the past is in the project impact area comprising of forest blocks like Chamakpur, Baitrani, and Sidhamatha & Mahaparabat etc. The reason of Elephant death is due various diseases, electrocution& accident etc, for which mitigative measures are being proposed.

ix) **Other project or their impact area in the impact area of the JSW Jajang Iron Ore Mines** :

The lease area is divided by Jhakapura Bansapani branch of east cost railway from south to north Kalimati - Joda state highway passes bordering the lease area. Beside some village roads, Panchayat roads pass by the side of the lease.

The lease area is surrounded by a cluster of mines of other lessee which are narrated below in a tabular form of course, among those mining lessees some are functional and some are non functional of present

LIST OF ADJOINING LEASE AREA.

SL. NO	NAME OF THE MINE	NAME OF THE LESSEE/ MINE OWNERS	AREA IN HECT	LENGTH	DIRECTION
1	BANDHABEDA Fe MINE	M/S RANGUTA SONS (P)LTD.	22.226	37 mt	EAST
2	PALASA Fe MINE	M/S PATTNAIK MINERALS	106.53	330 mt	WEST
3	BAMEBARI Fe & MN MINE	M/S TISCO	140	0 mt	SOUTH
4	UNCHABALI Fe & MN MINE	M/S ESSCAL MINNING IND.	107.306	2609 mt	SOUTH
5	UNCHABALI Fe & MN MINE	SRI S.N. MOHANTY	19.63	3254 mt	SOUTH
6	UNCHABALI Fe & MN MINE	SMT. INDRANI PATTNAIK	106.1127	4455 mt	SOUTH
7	UNCHABALI Fe & MN MINE	SRI BASANT KUMAR MOHANTY	12.95	5751 mt	SOUTH
8	UNCHABALI Fe & MN MINE	SRI K.C PRADHAN	33.22	5973 mt	SOUTH
9	UNCHABALI Fe & MN MINE	SRI S.D SHARMA	25.45	5858 mt	SOUTH
10	BALDA PALASA & JAJANG Fe MINE	M/S OMC LTD.	681.521	638 mt	SOUTH
11	JAJANG Fe MINE	T.B LAL & CO.	22.69	293 mt	NORTH
12	JILLINGAHAR Fe & MN MINE	M/S OMC LTD.	656.2	351 mt	NORTH
13	JAJANG Fe & MN MINE	SRI H.G PANDYA	100.173	332 mt	NORTH

14	GURUBEDA Fe & MN MINE	M/S OMC LTD.	656.2	2165 mt	NORTH
15	BHALUBEDA Fe & MN MINE	SRI MR DAS	5.139	2888 mt	NORTH
16	GURUBEDA Fe MINE	SRI S.C PADHEY	69.776	3088 mt	NORTH
17	CHAMAKPUR Fe MINE	NARAYANI & SONS	79.794	3572 mt	NORTH
18	BHALUBEDA Fe MINE	M.I.S	62.322	4110 mt	NORTH-EAST
19	CHAMAKPUR Fe MINE	SRI K.C PRADHAN	35.383	6551 mt	NORTH-EAST
20	LARADA MN MINE	S.LAL & CO	202.343	5251 mt	NORTH
21	KHUNTAPANI Fe & MN MINE	SRI S.N MOHANTY	15.378	6726 mt	NORTH
22	BANAPANI Fe & mn mine	SRI S.C PRADHAN	41.682	5318 mt	NORTH-WEST
23	BAITARANI Fe MINE	Dr.S. PRADHAN	52.892	7075 mt	NORTH
24	INGANIJHARANMN MINE	M.D DEB	266.313	6712 mt	NORTH
SL. NO	**NAME OF THE MINE**	**NAME OF THE LESSEE/ MINE OWNERS**	**AREA IN HECT**	**LENGTH**	**DIRECTION**
25	INGANIJHARANMN MINE	M.D DEB	844.93	7873 mt	NORTH
26	JODA Fe MINE	M/S TISCO (JODA EAST)	621.093	6285 mt	NORTH
27	KUDRUPANI Fe & MN MINE	SR R.B DAS	60.255	7719 mt	NORTH-WEST
28	CHORUNDA & KUDRUPANI MN MINE	M/S OMC LTD.	416.835	7027 mt	NORTH-WEST
29	TIRINGPAHAR Fe MINE	M/S OMC LTD.	79.3	5263 mt	NORTH-WEST
30	GURUNDA Fe & MN MINE	M/S TISCO	978	3313 mt	NORTH
31	TIRINGPAHAR Fe MINE	M/S TISCO	195.54	5650 mt	NORTH-WEST
32	JARIBAHAL Fe & MN MINE	M/S TISCO	91	1182 mt	WEST
33	JORURI Fe & MN MINE	TARINI MINIRALS	66.368	1605 mt	WEST
34	KHANDBANDH Fe MINE	M/S OMC LTD.	366.311	2395 mt	WEST
35	KHANDBANDH & JORURI Fe MINE	M/S KALINGA MINING CORP.	73.228	2751 mt	NORTH-WEST
36	JALHURI & BANSPANI Fe & MN MINE	SRI A.RAY & Smt M.RAY	82.109	4899 mt	WEST
37	DALPAHARFe & MN MINE	SRI D.C JAIN	801.172	4793 mt	NORTH-WEST
38	PALASA Fe MINE	M/S PATTNAIK MINERALS	106.53	589 mt	WEST

SL. NO	NAME OF THE MINE	NAME OF THE LESSEE/ MINE OWNERS	AREA IN HECT	LENGTH	DIRECTION
39	BALDA PALASA & JAJANG Fe MINE	M/S OMC LTD.	681.521	638 mt	WEST
40	BALDA Fe MINE	M/S SIRAJUDDIN & CO.	335.594	3522 mt	SOUTH
41	SIAL JODA & GURUDA MN MINE	M/S OMC LTD.	1011.472	2891 mt	SOUTH-WEST
42	GURUDA MN MINE	M/S SIRAJUDDIN & CO.	40.064	3140 mt	WEST
43	SIAL JODA & GURUDA MN MINE	M/S M.G RANGATA	715.639	5432 mt	SOUTH-WEST
44	DARTA IRON & MN MINE	MATADIN SARDA	32.375	6920 mt	SOUTH-WEST
45	GANUA IRON & MN MINE	M/S M.G MOHANTY	82.083	7617 mt	SOUTH-WEST
46	MALDA IRON &MN MINE	M/S TISCO	86.975	5617 mt	WEST
47	MALDA IRON &MN MINE	M/S TISCO	95.283	6740 mt	SOUTH-WEST
48	GANUA IROM & MN MINE	SRI S.N MOHANTY	14.159	5758 mt	SOUTH-WEST
49	GANUA MN MINE	SRI S.N MOHANTY	3.604	5674 mt	SOUTH-WEST
50	GANUA IROM & MN MINE	M/S K.J.S ALLUWALIA	23.3	7135 mt	SOUTH-WEST
51	GANUA IROM & MN MINE	SRI K.C PRADHAN	12.53	5808 mt	WEST
52	GANUA IROM & MN MINE	D.K BAI PANDYA	129.179	6735 mt	WEST
53	GANUA IROM & MN MINE	MAITRI SUKLA	102.89	5536 mt	WEST
54	GANUAGIDEI MANDAJORA IRON & MN MINE	MATADIN SARDA	55.604	8312 mt	WEST
55	PATABEDA IRON & MN MINE	M/S M.G MOHANTY	14	4899 mt	WEST
56	PATABEDA IRON & MN MINE	M/S M.G MOHANTY	19.425	4451 mt	WEST
57	PATABEDA IRON MINE	M/S M.G MOHANTY	28.397	5224 mt	WEST

From the above mining leases occurring in the project impact area about 15 nos. are functional at present and although leased out by Govt. are non-functional at present.

About 68 numbers of sites specific wild life conservation plan have been approved by PCCF wild life & CWLW Odisha pertaining to different forest diversions in Keonjhar forest division where 57 site specific conservation plan pertaining to mining sector have been approved in entire division. As

most of the mines are located in Joda & Barbil range hence more than 90% of the plan relate to those ranges. A detail list of site specific conservation plan approved in Keonjhar division are furnished below:

LIST OF APPROVED SPECIFIC WILDLIFE CONSERVATION PLAN OF KEONJHAR DISTRICT

1. M/s S N Pal, Katasahi & Kolha Rudukela, Manganese Ore Mines.
2. M/s Orissa Sponge Iron Ltd. for mining of Iron Ore in Keonjhar dist.
3. M/s T.P. Mohanty of Keonjhar for mining of Iron Ore & Manganese Ore.
4. Dr. Sarojini Pradhan of Kalaparabat Iron Ore Mines.
5. Dr. Sarojini Pradhan of Balita Iron Ore Mines.
6. M/s R.P. Sao, Guali Iron Ore Mines.
7. Sri kamaljeet Singh Ahluwalia of Nuagaon Iron Ore Mines.
8. M/s Sarojini Pradhan of Baitarani Iron Ore Mines.
9. M/s Sarojini Pradhan of Inganijharan Iron Ore.
10. M/s Sarojini Pradhan of Sidhamath Iron Ore.
11. Jururi Iron Ore Mines of Kalinga Mining Co.
12. Kulam Iron Ore Mining of Adhunik Metals Ltd.
13. Jalahuri Iron & Manganese Mines by M/s Mala Roy & others.
14. Inganijharan Iron & Manganese Ore Mines of Bhanja Minerals.
15. M/s K.N. Ram & Co., Roida-II, iron Ore Mines.
16. Sri K.C. Pradhan, Nayagarh Iron Ore Mining in Keonjhar dist.
17. M/s Mideast Integrated Steels Ltd., - Iron Ore Mining Roida-II in Keonjhar dist.
18. M/s Tarini Minerals Pvt. Ltd., - iron Ore Mining in Keonjhar dist.
19. D.R. Patnaik – Murgabeda Iron Ore Mines in Keonjhar dist.
20. M/s Kaypee Enterprises – Thakurani Iron Ore Mining in Keonjhar dist.
21. Smt. Indrani Patnaik – Unchabali Iron and Manganese Mines in Keonjhar dist.
22. M/s Rungta Mines – Jajang Iron & Manganese Mines.
23. M/s Orissa Mining Corporation Ltd. – Bansapani Iron Ore Mines.
24. M/s Hari Machines – Iron Ore at Basantpur.
25. M/s Mangilal Rungta – Siljora-Kalimati Iron and Manganese Mines.
26. Thakurani Iron Ore Mines Block-B of Sri S. Sarada and Sri M. Sarada.
27. M/s D.C. Jain – Sidhamatta Iron and Manganese Mines.
28. M/s Orissa Mining Corporation Ltd. (SGBK Ion & Manganese Ore).
29. M/s Essel Mining & Industries (Langalota Iron & Manganese Mines).
30. M/s Gandhamardan Sponge Industries (Putulipani Iron Ore Mines).
31. M/s OMDC Ltd-Bagiaburu Iron Ore Mines
32. M/s Hargovind Pandey & others,Jajang iron & Manganese Mines
33. M/s BPME C/o OMDC Ltd. Dalki Manganese Minse
34. M/s OMC Ltd.- Gandhamardan Block-B Iron Ore Mine
35. M/s BPME Ltd C/o OMDC Ltd –Kolha- Roida Iron & Manganese Minse
36. M/s OMC Ltd- Tiring Pahar Iron Ore Minse

37. M/s Rungta Sons P Ltd.- Katasahi Manganese Ore Minse
38. M/s ESSEL Mining & Industries – Kasia Iron & Dolmite Minse
39. Khandabandh Iron Ore Mines by M/s Shree Metalicks
40. Jururi Iron Ore & Manganese Minse of M/s Tarini Minerals (p) Ltd.
41. Katamati Iron Ore Mine by M/s OMC Ltd.
42. Khandabandh Iron Ore Mine by M/s OMC Ltd.
43. Khandabandh Iron Ore Mine of M/s Deepak steel and Power Ltd.
44. Gandhamardhan – A Iron Ore Mine of M/s OMC Ltd.
45. Iron Ore fines Beneficiation Plant & Tailing Dam by M/s Brahmani River Pellets ltd.
46. Balda Block Iron Ore Mine of M/s Seerajuddin & Co
47. Benificiation Plant & Integrated steel Plant at Matkambeda by M/s Aryan Iron & Steel Copany (P) Ltd. (AISCO) and M/s International Mineral Trading Co.(P) Ltd (IMTC)
48. Bolani Iron Ore Minse (5.10 sq. miles) of M/s SAIL
49. Jaribahal Iron Ore mines of M/s Patnaik Mineral Pvt.Ltd.
50. Dalpahar Iron & Manganese Ore Minse of Sri D.C.Jain
51. Seremda – Bhadrasahi Manganese & Iron Ore minse of M/s Omc Ltd.
52. Panokoili-Remuli section of NH-215 of M/s NHAI
53. Tiringpahar Manganese Minse of M/s Tata Steel Ltd.
54. Joda West Manganese Mines of M/s Tata Steel Ltd.
55. Bamibari Manganese Minse of M/s Tata Steel Ltd.
56. Khondbond Iron & Manganese Mines of M/s Tata Steel Ltd.
57. Rimuli – Rajamunda Section of NH-215
58. Joda Est Iron & Manmora Manganese Minse of M/s Tata Steel Ltd.
59. Dubuna – Sakradihi Manganese & Iron Ore Minse of M/s OMC Ltd.
60. Sirkagutu Iron & Mn. Mines of Prakash Industries Ltd.
61. Laying of water pipeline and other related infrastructure facilities by M/s Essar Steel India Ltd. For operationalization of Iron Ore Beneficiation plant at Dubuna
62. Karakhendra Steel Plant of M/s Rungta Minse Ltd.
63. 20 MW Power Plant within Karakolha Sponge Iron plant of M/s Rungta Minse Ltd.
64. Bolani Ore Minse (6.9 sq. miles) of M/s SAIL
65. Rehabilitation and upgradation of Singaa-Binjabahal section of NH-6
66. Unchabali (Mahaparbat) Iron Ore Mines of OMC Ltd.
67. Construction of 132KV transmission line from 132/33KV OPTCL Grid Station at Barbil to Kamanda Steel Plant of Rungta Minse Ltd. In Sundargarh District
68. Iron & Mn. Mines of Kushaleswar Minera in Keonjhar district

From the above Site Specific Conservation Plan approved by the PCCF (WL) & CWLW, Odisha the following 20 nos. plans whose project impact area overlap with the project impact area of Jajang mines are narrated below.

Those are as follows :

1. M/s R.P. Sao, Guali Iron Ore Mines.
2. M/s Sarojini Pradhan of Baitarani Iron Ore Mines.
3. M/s Sarojini Pradhan of Inganijharan Iron Ore.
4. Jalahuri Iron & Manganese Mines by M/s Mala Roy & others.
5. Inganijharan Iron & Manganese Ore Mines of Bhanja Minerals.
6. Smt. Indrani Patnaik – Unchabali Iron and Manganese Mines in Keonjhar dist.
7. M/s Rungta Mines – Jajang Iron & Manganese Mines.
8. M/s Orissa Mining Corporation Ltd. – Bansapani Iron Ore Mines.
9. M/s Hargovind Pandey & others,Jajang iron & Manganese Mines
10. M/s OMC Ltd- Tiring Pahar Iron Ore Minse
11. Khandabandh Iron Ore Mines by M/s Shree Metalicks
12. Khandabandh Iron Ore Mine by M/s OMC Ltd.
13. Khandabandh Iron Ore Mine of M/s Deepak steel and Power Ltd.
14. Balda Block Iron Ore Mine of M/s Seerajuddin & Co
15. Dalpahar Iron & Manganese Ore Minse of Sri D.C.Jain
16. Tiringpahar Manganese Minse of M/s Tata Steel Ltd.
17. Joda West Manganese Mines of M/s Tata Steel Ltd.
18. Bamibari Manganese Minse of M/s Tata Steel Ltd.
19. Khondbond Iron & Manganese Mines of M/s Tata Steel Ltd.
20. Unchabali (Mahaparbat) Iron Ore Mines of OMC Ltd.

The user agencies has already deposited their respective approved amount in the CAMPA fund. From the fund deposited by them for the interventions to be implemented in the project impact area, major amount have been spent for undertaking different interventions and work for balance amount have been undertaken in the project impact area.

Chapter-III

Probable Impact of the project on flora and fauna:
The mine is on a hilly terrain with elevation ranging from 415 to 411 meters and hillock running south to north. River Baitrani flows on the east of the area, which receives rain water by 3 seasonal streams flowing from the M.L. area, 2 in east and 1 in NE. The M.L. area has open scrub with species like Shorea robusta, Anogeissus latifolia, Largerstromia parviflora, Terminalia tomentosa, Holarrhena antidysenterica, which is an in a degraded stage of dry mixed deciduous forest . The buffer zone has 3 R.F's, viz Baitrani R.F to N&NW, Chamakpur R.F. to NE&E and Siddhamath R.F. to NW. The above 3 R.F's respectively have Dry mixed deciduous, Dry peninsular Sal and Moist peninsular valley Sal for most part with open to moderately dense stands.

The fauna of M.L. area is represented by small animals like palm squirrel, rat, jungle cat and rufus tailed hare , frogs and toads, lizard, chameleon, rock pythan, crow common myna, coucal etc.

The fauna of Zol include barking deer, languour, rhesus monkey, crow, ring dove, jungle fowl, monitor lizard, snakes etc. Sloth bear and Elephants are two endangered animals which use the habitat beyond the buffer zone.

The mining operations involves clearance of vegetation, blasting, excavation by cateoillar excavators, loading of ore to tippers by wheel and pay loaders, transportation to railway siding, movement of vehicles and labour force, dumping of over burden and sub-grade ore, storage of mineral operation of crushing & screning plant , ore benefication plant, pelletisation plant etc.

All the above activities not only distrub the habitat but also bring about significant geomorphologic changes leading to outright destruction of animals which are less mobile and have narrow home ranges while mobile wildlife species are displaced.

IMPACT WITH IN THE LEASE AREA

i) Habitat Loss

Habitat loss is the outcome of this habitat destruction in which natural habitat is rendered functionally inert to support the native species of flora and fauna. Plants and animals which evolved with the site and got adapted to various habitat niches become homeless and perish due to shock.

Animals with faculty of large home ranges are displaced. Small animals which manage to stay on witness decline in population due to reduced carrying capacity of the area.

Habitat loss means altered N, P, S and C cycles, loss of carbon sequestration, watershed values, pollution and breaking down of pollutants. Land is rendered infertile. Although the habitat loss is termed as temporary and habitat can be rebuild by reclamation and reforestation, in the medium term, some of the changes e.g. nutrient drain is irreversible and only secondary vegetation can be expected with reforestation and animals adapted to grass-shrub stage will come back to begin with.

ii) Loss of top soil, erosion:

For the present, there are 6 O.B. dumps atdifferent locations, 6 mineral stack yards, 'C' block working pit in the southern half & 'B' block working pit in the northern half. In addition, there are 30 small to medium sized pits lying abandoned. Due to unsystematic surface mining in the past for float ore, top soil has been lost at most places. There is threat of soil erosion from dumps, sub-grade mineral stacks, haul roads and land surface in general during rains. Sheet erosion is common. Rill erosion is noticed on the dumps. Soil erosion has an irreversible impact on the nutrient status of the residual soil which can support only degraded vegetation and plants of lower status in the scale of succession. Consequently, the number and variety of animals this can support will be low and that too of such species which have low nutrition requirements.

iii) **Moisture loss**:

One seasonal nala originate from the M.L. area all draining to Baitarani River at the north east side. With the change in landscape configuration and soil loss, there will be moisture loss as well. In short, the watershed function of the area will be lost. There will be less percolation due to clogging of soil pores and change in soil structure and accelerated run off, rendering seasonal nalas to become mere depressions. Lack of moisture keeps the vegetation stunted and excludes the habitat utilization for most part of the year even by smaller animals.

iv) **Water pollution**:

The runoff from the M.L. areas carry red silt with iron and manganese fines and contaminate the streams and the Baitarani River. Such brown red water is due to heavy sediment load iron and Manganese ions are in river water in 3 forms: (i) Insoluble suspended matter which gives the brown red colour: (l) Soluble matter in shape of salts; (iii) Organic iron in form of colloidal compounds. Fortunately, the iron content is within permissible limits and not harmful to animals. However, it imparts a peculiar odor to the water and animals generally avoid its use if alternate choice is available within the home range. The turbidity, however, affects the aquatic life, fish and turtoises by reduction in production of plankton. This is a priority concern, as river Baitarani is just on the eastern boundary of the mine.

v) **Forest fire** :

Forest fire is common in mining belt due to large workforce, transporters and other floating population. Villagers, while collecting fuel wood etc may also accidentally set fire. As the predominant wind direction is SW, the fire may come from residential area of the mine or from the mines situated on the northern side. Plantations will be raised in the mine area during the plan period. The plantations will be severely damaged and small animals sheltered within this cover will also be charred to death. Fires leave the trees injured and stressed, which remain susceptible to further attack by fungi and insects. Non establishment of plantation defeats the purpose of reclamation and safety zone.

vi) Accidental fall of animals in pits :

Existing quarries are 'B' DIOCK1230 x 360m and "C' block 1040 x 280m. Their working depths are 70m and 87m respectively. Such deep mining pits are dangerous to wild animals of migratory nature, which may not have mental cognition of the changed geo-morphology. Any accidental fall for such unsuspecting animals could be fatal.

vii) Pollution of the habitat :

Pollution is an undesirable change in the physical, chemical or biological characteristics of air, land and water that may or will affect living conditions or life on earth. Pollutants are residues of things we produce, use or throw away. The extent of pollution is directly proportional to our demands on natural resources which are continuously on rise. In the mining scenario, we mainly have dust pollution, noise pollution and vibration, water pollution and light pollution.

viii) **Dust pollution**:

The ill effects depends on size of particles, concentration of particles, chemical nature of particles and substratum on which it is deposited. The latter includes vegetation type, leaf surface, surface roughness and wetness and predominant wind direction. Physical effects on plants may be blockage and damage to leaf stomata, shading from sunlight leading to reduced photosynthesis, reduced rates of growth and plant vigour. Regeneration of forest is affected by reduced seeding. Reduced plant vigour means susceptibility to fungal and insect attack. Dust acts negatively on the useful roles played by predators of defoliators, sap suckers and borers. Huge clouds of dust disrupt normal living conditions of wild animals. It affects the wild habitat, food and drinking water resources. Dust triggers aggressive immune responses in animals, which may cause damage to lungs. As a balancing act to stress, the heart rate may increase, curtailing the activity cycle. Dust can also carry bacterial, fungal or viral pathogens and make the stressed animals vulnerable to disease.

ix) **Noise pollution**:

Noise from working machines and men could result in hearing loss, if the noise levels are 85 db or higher. Noise may mask animal signals like alarm call, mating call or call of a predator and impinge survival or reproduction. Noise is a stressor which may result in animals abandoning the site to a safer location. Constant rumble of machineries and tippers may mask the down chorus of birds, particularly of males calling females upsetting courtship, breeding and hence population structure. Constant exposure to noise may lead to weak immunity and affect hormonal levels, hampering body function.

x) Road development and traffic related disturbance:

There are 3 arterial roads, one leading from B.P. No. 31 & 30 on the western corner from Joda to Bamebari in west and going on NW border to B.P. No 21A on the north, two running southwards from B.P. No. 21A to B.P. No. 48 and third, going northwards from B.P. No.48 to Jajang railway siding. There are several approach roads to mine pits, dumps and screening plants: The entire road length is 16 km. Besides there is a Village road from B.P. 11 to B.P. 21 on the north & north east of the mine from which a road is proposed to the pelletisation plant. There are 27 dumpers of 35t capacity in the mine. For both O.B. and ore transport, 612 trips will be made in two shifts up and down. For 12 hours working, this works out to 51 trips/hour or almost 1 dumper every minute on the road over 3 km. This is considerable disturbance to the habitat. Further road construction will add to the disturbance and fragment the habitat. A Road accident of small and sluggish animals is a strong possibility.

xi) D.K.B. Railway Line :

Railway line from Banspani to Nayagarh runs in an arch on the northern, central, eastern & south-eastern side of the M.L. area from B.P. No. 21-5-52 dividing the area into two parts. This is a potential threat to wild animals choosing to cross the line and go to Baitarani river. Accidents may happen.

xii) Littering of the site:

About 400 people will work in the mine area including labourers engaged by various contractors while leftover food may attract animals like hyena, jungle cat, crow, kites and monitor lizards, ingestion of wrappers, particularly polythene and cellophane material may choke their alimentary canal. The mine camp will also generate domestic waste from residential houses. Littering offends everybody, aesthetically unpleasant and hazardous to health also. Piles of fitter also emit offensive smell due to fermentation of biodegradable waste.

IMPACT WITH IN PROJECT IMPACT AREA

i) Fragmentation of habitat:

Due to mosaic of mines, habitations and agriculture, forest connectivity between Chamakpur, Baitarani and Siddhamath is drastically affected. One important source of water is Baitarani River but most animals are prevented to make use of the river water due to cluster of mines on its west bank and further beyond. Fragmentation of the habitat has affected movement pattern of elephants. Fragmentation may make the forests vulnerable to loss of species and disappearance of genetic diversity within the species by isolating populations of several animals, creating conditions for inbreeding and paving the way for extinction.

ii) Forest degradation & habitat loss:

Forest is degraded as more and more mines open up and break forest land. The combined effect of illicit felling by work force, floating population, forest fire, dust, smoke, erosion, nutrient drain and warming of the locality due to pollution contribute to forest degradation. The species are lost at an accelerated rate. Those that persist do not regenerate. The vigour of the plant growth is lost. The food and cover value of the habitat is lost. Thus a natural forest habitat is rendered functionally weak to support animal species. The situation in remote forest areas, where anthropogenic and mine stressors are minimal, due to congregation of animals displaced from mine habitat, stiff competition for available resources and space ensues. Due to over grazing and browsing, the carrying capacity of the habitat is reduced. Reduced carrying capacity of the remote forest means decline in population and ultimate extinction. In short, habitat loss is the loss of bio-regenerative capacity of the natural system.

iii) Loss of biodiversity:

Biodiversity is variability in species, phenotypicand genotypic, species richness and diversity in population, community structure and ecosystems. Biodiversity is disappearing because of direct drivers like rapid change in land use and land cover, fragmentation, over exploitation of plants, poaching of animals, pollution, and habitat loss and over all climate change. Indirect drivers are population growth or population intrusion, economic activity (mining & industries) and technological advancement. High biodiversity signifies maturity of the ecosystem, where stability against external disturbance and nutrient conservation is good. In such a system, food chains are web like, stratification and spatial heterogeneity is well organized. The latter two give rise to high degree of niche specialization, meaning very narrow food and micro habitat requirements. Such specialist plants and animals are first victims of extinction e.g. Sáraca ashoka of stream banks and fish life, which become vulnerable to loss of perenniality, pollution with sediment and opening of canopy. Loss of species is an irreversible loss because this cannot be recreated with application of technology. When

several species are lost, ecosystem resilience is impaired, food & cover values are cut of drastically and area is rendered unproductive.

iv) Forest fire:

Forest fires are common in tropical forests. However, inmining belt, its impact is significant as the forest ecosystem is already stressed due to large work force, honey combing of forest and pollution. Forest fires, not only burns leaf litter, it consumes humus, useful micro flora and fauna in soil, make the soil caked and hardened. A chain reaction ensues loss of soil by accelerated run off, retarded sub-soil seepage, nutrient drain, annihilation of seeds, seedlings and delayed or absence of regeneration. Although a few grass species, usually annuals and fire hardy ones come up as a result of fire, but this happens at the cost of several browsable undergrowth. The net result is loss of food and cover to several species of wild animals. Direct impact is charting away of young of animals having no faculty to escape, eggs of ground nesting birds and slow moving pythons and lizards. Repeated fires scorch the bark of many trees and making the trees diseased and vulnerable to fungal and insect attack. Fire displaces many birds as well from their nests in the high branches or burrows in trunk. Fire also affects the habitat utilization pattern at least temporarily. Lot of dead insects is made available on the ground for insectivorous birds but many useful insects are also lost. Forest fires generate lot of green house gases as well as warming up the environment.

v) Absence of clean water:

Baitarani River flows from south to north inthe middle of the buffer zone forming one boundary of the mine. Kundra nala on NE, Jalpa nala on south and Kakarpani nala on west are other nalas, which are more or less perennial. There are some 50 mines in the catchments of these rivers/nalas within the Zol. The flowing water is highly turbid with sediment load washed out from themines. As such, there is lack of clean water for animals.

vi) Probable increse int the vehicular traffics and its impact:

Some 1000 trucks transport ores to buyer's destination directly or to railway siding at Banshpani, Barbil, Bamebari Camp - Joda route passes through area. As such, there is continuous disturbance to the habitat from the heavy traffic. Free movement of animals during night is affected due to constant flashing of head lights. Traffic jam, further aggravates the problem and makes an impenetrable barrier on the road. This also contributes to dust pollution.

NOISE POLLUTION, WATER, AIR AND UNDERGROUND POLLUTIONS ETC.AND ITS PROBABLE IMPACT ON FLORA.

vii) Air pollution:

Air pollution has synergic effect in that hydrocarbonsreleased from diesel vehicles combine with other pollutants in atmosphere to produce more pollutants. Hydro carbons combine with Nitrogen oxides in ultra violet radiation to release Peroxy Acetyl Nitrate (PAN) and ozone. PAN is quite toxic and known as "photo chemical smog" which kills plant by interfering with photosynthesis. Ozone increases respiration of leaves, thus, killing the plant by depletion of its food reserves. Depletion of plant life negatively impacts animal life.

Direct effect of smog is respiratory distress in animals.

viii) Noise pollution:

Noise from working machines and men could result in hearing loss, if the noise levels are 85 db or higher. Noise may mask animal signals like alarm call, mating call or call of a predator and impinge survival or reproduction. Noise is a stressor which may result in animals abandoning the site to a safer location. Constant rumble of machineries and tippers may mask the down chorus of birds, particularly of males calling females upsetting courtship, breeding and hence population structure. Constant exposure to noise may lead to weak immunity and affect hormonal levels, hampering body function.

ix) Water pollution:

The runoff from the M.L. areas carry red silt with iron and manganese fines and contaminate the streams and the Baitarani River. Such brown red water is due to heavy sediment load. Iron and Manganese ions are in river water in 3 forms: (i) Insoluble suspended matter which gives the brown red colour: (l) Soluble matter in shape of salts; (iii) Organic iron in form of colloidal compounds. Fortunately, the iron content is within permissible limits and not harmful to animals. However, it imparts a peculiar odor to the water and animals generally avoid its use if alternate choice is available within the home range. The turbidity, however, affects the aquatic life, fish and turtoises by reduction in production of plankton. This is a priority concern, as river Baitarani is just on the eastern boundary of the mine.

x) Depredation of wild animals:

Karo-Karampada interstate elephant corridor is not within the Zol and about 18.5 km away. However, elephants use Siddhamath, Uliburu and to some extent Baitarani R.F. to the west of the mine. Movement of elephants in a disturbed and fragmented habitat results in deflected movement patterns and brings them close to habitation. They get aggressive when their habitat is destroyed movement routes blocked and access to preferred food resources

(standing paddy crop) is denied. As local people consume country brew in weekly hats, a social congregation site of tribal and get intoxicated, they are unable to avoid approaching elephants and flee from the scene. One to two human casualties take place every year. Elephants also damage houses, when they are prevented to feast on mangoes and jack fruit grown in village lands. Sloth bear attack onhumans has been reported during February-April during Mahul flower season, when bears are active feasting on the flowers.

ARTIFACTS WITHIN THE FOREST LANDSCAPE:

a) Rallway:

D.K.B. Railway link is almost 80% complete, except signaling, earth work at some stretches and major bridges. The link passes in the middle of the Zol from north to south. Construction related disturbance apart, when the line will be fully operational, it will stand as a potential danger to wildlife, elephants in particular, crossing the track.

b) Power line:

Besides the main power line that runs between Malda and Joda within the Zol, there are several other 11 KV distribution lines within the area connecting various mines. These lines, due to improper maintenance may sag endangering the lives of elephants through electrocution.

c) Problem of road crossings for mega fauna like Elephant :

As narrated above Malda-Joda State Highway passes in the impact area from south to north bordering the lease area & dividing the wildlife habitats at some points. Therefore, elephants while crossing the road during crop season may face road accident due to movement of heavy vehicles & those shall be other man-animal conflicts. This may be a potential danger in the buffer area.

As there is no movement of mega fauna inside the project area, hence there shall be no impact on the movement of mega fauna if the project is implemented. However there are cluster of mines human habitations, cultivated lands, occurring the impact area there shall be impact on the movement.

Chapter-IV

Mitigation measures required.

PROJECT AREA :
Due to operation of various mining activities, the Wild life present within the lease area will be threatened. Besides the Wild-life habitat is reduced to the extent of forest area involved in the project. The Wildlife Management Plan (Site Specific Conservation Plan) therefore aims at providing safe passage to the existing wild animals from the lease area to the nearby Forest areas and improving the habitat in the surrounding areas. Certain measures are also required to be taken with in the mining area.

The proposed measures can be taken within the project area by the project proponent and beyond the lease area by the Government (Forest Department) with the financial support provided by the user agency.

Based on the perceived threats to wildlife as per the foregoing chapter, the Management Plan is prepared to address almost all such threats. The lease hold area as well as the Impact area and beyond will be treated for habitat improvement so that, more fodder and water will be available for the wild animals.

The life of the mine has been estimated to be 50 years for extractiong of Iron ore.

Interventions inside project area :
The activities taken up in the project area will pose maximum threat to wildlife. It is therefore necessary to minimise such threat. The following steps will be taken within the lease area.

i) Safe passage to Existing Wildlife

It is very important to save the existing wild animals available within the lease area and to divert them to safer locations. It can be possible to achieve such objective by commencing the mining activities from locations situated away from the Forest areas. Thereby the medium and large Wild animals present within the Lease area will find their way to nearby Forest areas.

ii) Restoration of habitat

Within the lease area it will be broken up for the purpose of Mining. It is therefore not practicable to restore the Wild-life habitat in this area until the Mining activities are completed. However, as per approved Mining Plan/Environmental Management Plan the mined out pits shall be reclaimed gradually and plantations of indigenous fodder and fruit bearing species shall be planted to bring back the original ecosystem.

iii) Solid Waste (Overburden) Management

Top soil generated during the mining period, shall be stored temporarily over the designated location. Arrangements for watering the top soil dump through internal perforated pipes shall be made to maintain moisture level in the soil.

All the overburden dumps shall be reclaimed technically and biologically completely as soon as the dumps are declared dead. However, the dump slopes shall be periodically sprinkled with water and plantation shall be carried out over the slopes. Garland drains and toe walls shall be constructed all along the dumping area in order to check the surface run off. These garland drains shall be routed through settling tank where the suspended solid shall settle down and the decanted water shall be used in the beneficiation plant. Iron ore shall also be stabilized by afforestation over dump slopes in the next five years.

During the operation period of mining activity, several first order streams which flows from the top of the hill gets disturbed due to the hill cutting. Re-establishment of directional flow in the streams are important not only because the streams are surface recharge sources for adjoining nalas but also to regulate water flow in the disturbed area in a systematic manner. Long drainage channel shall be constructed along the quarry and dumping areas connected to settling ponds in order to arrest the suspended soild and then finally shall be discharged to the nearby water body. The drainage channels should be of adequate size to meet the load of monsoon run off.

Dump area (overburden & sub grade ore) of 39.146 ha will be gradually planted up with grasses and other suitable species as per dump stabilization provisions. The comprehensive habitat restoration of the lease area will be as follows:

iv) Steps to prevent fall of animals in the mining pits.

In order to prevent accidental fall of animals in the mine pits the following steps shall be taken.

The periphery of the mine lease area will be around 2 kms. It is proposed to erect and maintain solar electric fencing around the entire area to prevent entry of large and medium animals and maintain the same during the plan period.

However small animals like Squirrel, Mongoose etc, and Reptiles may enter in to the area. The working labourers and staff will be educated to protect these animals and divert them towards the forest area.

In-spite of the precautions taken, in case of accidental fall of any wild animal in to the mine pit, the workers will be educated to inform the local forest authorities and act as per their advice.

v) Provision for **graded bund** all along the boundary of the lease area wherever necessary to allow the surface runoff from the lease area to percolate in to ground instead of flowing in to adjoining villages, corn fields & other wild life habitats as a soil & conservation measure.

vi) Provision of hired vehicle for Rapid Response Team:

It is proposed to make a hired vehicle available to the DFO for movement of Rapid Response Team. The proposed expenditure shall be Rs. 51.40 lakhs (Hiring charges of vehicle 37.2 lakhs + POL etc. 14.2 lakhs) for ten years plan period as per approved cost norms of PCCF (WL) & CC, Odisha.

vii) Health Camps and Cattle Immunization:

Health camps and Cattle immunization camps will be organized in the forest fringe villages to get pro-active support for wildlife protection. An amount of Rs.10.00 lakhs (Rs. 5.0 lakhs for cattle emulization camp + Rs. 5.0 lakhs for helth camp) is proposed during the plan period.

viii) Provision for use of drones fitted with cameras for monitoring of wild animal and main animal conflict:

Payment to the expert agency will be made by JSW Steel Ltd. subject to demand note with account details and direction received from the DFO, Keonjhar.

ix) Provision for rechargeable large long range powerful flashlight/torch to be distributed among villagers for assisiting the protection force. 10 nos. to each village for 20 villages = 200 nos. @ Rs. 1000/- per each = Rs. 2.00 lakhs.

x) Supply 10 units of high frequency ultra-sonic Sound elephant repellents to Keonjhar Forest Division @ Rs. 40,000 each frequency and cost of maintenance Rs. 12,000/- per year to disallow movement of elephants to the villages and corn fields to be installed in strategic locations.

xi) Establishing Bulk messaging System for immediate message spreading from field to all grass-root level forest Officials, ROs, ACFs & D.F.O., Keonjhar including the maintenance cost of Rs. 4,000 per year over the plan period

xii) Purchase and supply of android based Mobile handset for quick message transmitting and immediate communication amoung the field staff to control man-animal conflict in the field.

xiii) Mitigative Measures During mining operations as per approved Environmental Plan.

Activities	Impact	Control Measures
Mining Operation	NO2 emissions in the mine mainly occur during blasting operations	• Use of good quality explosives having proper oxygen balance with regular monitoring; • Regular updating of the date of manufacture/expiry to avoid confusions. A normal procedure is in place to check/visually inspect all explosives, and if disintegrated ingredients are spotted, the explosives is not used, even if the date has not expired; and • The primer to column ratio is also rationalized so as to produce minimum NO2.
Transportation of Ore	The mining will be carried out by fully mechanized open cast method using drilling and blasting by deploying HEMM equipment's like hydraulic drills and excavators, wheel loaders, dumpers.	• The high-grade iron ore lumps extracted from the mine will be transported to JSW Steel Plants through railway/port/road and the low-grade ore of Nuagaon, Narayanposhi, Gonua, Jajang & upcoming mines/merchant mines will be beneficiated in the proposed 30 MTPA Grinding & desliming/beneficiation plant to improve the Fe content of the ore. • Post grinding/beneficiation, iron ore of all JSW mine will be transported through slurry transportation system to end use plant through slurry pipeline.
Ore Loading	Ore after crushing & screening is sent to stockyard. Lumps and fine ores are stacked separately. Water sprinkling arrangements have been provided so that there will not pollution.	Transportation of Ore by covered Trucks to nearest railway siding. No over loading.

Activities	Impact	Control Measures
Air Pollution	Drilling Blasting Excavation Ore/OB loading, transportation & unloading Movement of heavy earth moving machinery Wind erosion of exposed mine surface, ore stack & OB dumps	• Proper and proportionate mixing of fuel oil with ammonium nitrate to ensure complete detonation; • Use of adequate booster/primer; and • Proper stemming of the blast hole. • Dust suppression system in the form of water jets installed in all the drill machines for reduction in dust generation during drilling; • Fixed and mobile water sprinklers to suppress dust during hauling; • Dry fog systems in processing plants for dust suppression; and • Coir matting using geo-jute in dumps with plantations. • Installation of pulse jet bag filter at primary crusher of processing plant; • Cylindrical bags made of polyester with antistatic property are used as a filter medium inside bag house; and • Cleaning is controlled automatically by a sequence controller. • Regular maintenance of vehicles and machinery is being carried in order to control emission; • AC cabins for shovel and dumper provided which leads to minimum exposure of the operator to the external environment; • • Dust suppression on exposed area is being done using water trucks and sprinkler provided on the approach to mine, beneficiation plant; • Dust generated due to traffic on haul roads are reduced by water spraying at regular interval of time. Further, no. of pressurized water tanker to be added in the fleet to strengthen the mitigation measures; • Greenbelt development is being developed all along the haul roads and overburden dumps which is going to be enhanced further; • A good housekeeping and proper maintenance practice will be further helping in controlling pollution; • Dust generation due to ore processing at beneficiation plant is controlled by providing dust extraction system at hopper area, dry fog system at all transfer points, network of conveyors, minimize spillage by better management of conveyor system and housekeeping. Further, wind broken wall has been envisaged near the crusher for dry ore to avoid the particles to fly.

AIR POLLUTION CONTROL MEASURES









xiv) Mitigating impact on noise environment.

With the mining operations, due to the deployment of machinery, drilling and blasting for mine development, excavation, transportation and crushing of iron ore and men, it is imperative that noise levels would increase. However, as the mine lease boundary is located 0.5 km away from the nearest settlement, the expected noise levels will not have significant effect on the community.

Mitigating impact due to Noise Pollution

Activities	Impact	Control Measures
Noise Environment	• Due to Drilling • Due to Blasting • Due to Excavation & Transportation • Due to Crushing, Screening & Loading Plant • Dispersion from Mine	• Minimum quantity of detonating fuse is consumed by using alternatively excel non-electrical initiation system; • The prime movers/diesel engines are of proper designed and been properly maintained; • The operator chambers are safe guarded with proper enclosures to reduce the noise levels; and • A thick greenbelt has been provided and further to be taken up in phased manner around the periphery of the mine to attenuate noise and massive plantation in and around lease area. • Provision of protective device like ear muffs/ear plugs; • Provision of sound insulated chamber for the workers deployed on machines producing higher level of noise like bulldozer, drills etc.; and • Reducing the exposure time of workers to the higher noise levels.

NOISE POLLUTION CONTROL MEASURES

WET DRILLING AND DUST EXTRACTOR SYSTEM IN DRILLING OPERATION





xv) Mitigative measures for water environment protection.

Activities	Impact	Control Measures
Water Environment	• The working mine will encounter the water mainly due to rainfall. As mining activities are carried out in hilly topography the rain water flow will be directed by natural slope of the area and will not cause any inundation of the mining area .The nature topography will facility a proper drainage system in the mine. • Impact on Water Resources Due to Mining Operations • Surface Water Resources • Ground Water Resources	• Tailings generated from processing is diverted to High Rate Thickener [HRT] where suspended solids settle down and decanted water is recycled back for re-use in process; • Hydro-cyclone: to recover Fe from slime and slurry, increase life of thickener and increase quality of water; • Treated ETP & STP water used in process & plantation; an • The surface run-off is been collected & used during rainy season, which conserves the fresh water resources. • The mine sump itself acts as good rain water harvesting pond. Sump is crated at the bottom of the working pit and the rainfall directly falling in the mine area is drained towards the sump in the bottom of the mine pit for harvesting it; • Construction of settling pond/percolation pond at various strategic locations across the mine; • Rain water harvesting from roof tops of buildings and other super structures for storage. The roof top rain water is collected and channelized to the recharge well; • Suitable storm water drainage system along the roads is provided to dispose storm water effectively. The surface run-off collected in the storm water

		drains are channelized through a series of settling-cum-percolation ponds before discharged; and • Staggered trenches are proposed to be constructed along the contours so that during sudden storm, good amount of run-off can be harvested which will maintain a good amount of soil moisture content.

xvi) Mitigating impacts on Flora and Fauna

Activities	Impact	Control Measures
Biological Environment	The project spread over an area of 669.078 Ha. has 543.916 Ha of forest area and 125.162 Ha. of non-forest area. **Impact on Flora:** In the existing and proposed mining operations, NOx emissions are mainly due to burning of diesel in mining vehicles. However, the low concentrations of NOx due to operation of the proposed mining operations will have insignificant impact on ambient air quality and NOx concentration will remain within the NAAQ standards. Therefore, the impact of these emissions on the surrounding agro-ecosystem is not envisaged. Extensive plantation comprising of pollutant resistant trees is being carried out surrounding the mine site, which will serve not only as pollution sink but also as a noise barrier. It is expected that with the adoption of these mitigatory measures, the impact due to operation of the will be minimal on the terrestrial ecosystem. **Impact on Fauna:** The adverse impacts on fauna would be mainly due to:	• Enhancement of Green belt development/afforestation will increase flora • Green cover will attract fauna due to plantation of edible trees. • Plants suggested for afforestation and reclamation of back-filled areas. • To broadcast the seeds of fodder legumes such as Hamata (Stylosanthese hamata), Wild Mung gram (Phaseolus trilobus), Yellow Peanut (Arachis pintoi) and non-palatable nitrogen fixing legumes like Sesbania rosrata, Sesbania aculeata and others for bio-remediation and soil reclamation before undertaking any transplantation. They may be grown for one or two seasons to modify and enrich the mineral soil. • • Part from routine transplantation, seeds of Sal, Mahua, Tamarind, Neem, Karanj may be pelletized with well decomposed organic manure mixed with clay and sown in high density at the rate of one for every square meter before the beginning of monsoon. Some of them are

	• Human activity; • Noise; • Land degradation; and • Deforestation. The impact on the fauna of the buffer zone due to the mining activity will be marginal. The fauna is less in occurrence in the study area. Even so, by restricting mining at any time to small areas, impact on fauna will be kept to the minimum. Moreover, progressive plantation with over a period of time will create conditions favourable for fauna.	likely to grow in to big trees over a period of time. • Local mango varieties may be gown in large numbers by directly sowing the seeds. • Where there are large gaps, big shoots of bayan with aerial roots (prop roots) may be directly transplanted to ensure that they can rapidly cover the gaps. • As far as possible to give greater importance to native forest species and saplings of such plants may be procured from the social forest nurseries. • The Jajang mine is also advised to liberally apply compost, vermin-compost and farmyard manure in pits before transplantation of saplings. Biodiversity Conservation Initiatives: • Development of butterfly park; • Artificial niche nesting; • Development of medicinal garden; and • Nursery for development of native species.

xvii) Relevant Provisions of proposed EMP for the project & the interventions over lapping in nature to be specified.

The impact of the project on environment and the mitigation measures have been dealt in detail under chapter-4 of the Environmental Impact Assessment and Environmental Management Plan which is in draft condition & those are furnished below:

a) <u>Impact on Land use and Topography</u>

The Baitarani river flows outside the lease area on eastern side. The eastern side is drained by small nallas which meet with Baitarani river. The ridges and river channels are NW-SE trend. All the major perennial water courses flow towards NW and east. The water divide between the sub water sheds (Kundra & Baitarani) also trends NW-SE. It is evident that water divides that only sub water shed of Baitarani river on the left in relevant to core zone.

The mining was operating since 1957 by previous lessee. The present land use is already under industrial mining purpose. The following changes to land use will occur due to proposed activities. The existing measures which were carried out by the previous lessee will be further strengthened.

- Removal of topsoil;
- Removal of Overburden (OB);
- Dumping of OB; and
- Formation of garland drains around the working pit and OB dump.

Mitigation Measures

Haul Road

The rain water during monsoon season is being controlled by suitably provided cross slopes of about 1% for the benches. While preparing and advancing the benches, main road and other ancillary roads, suitable slope and drainage are being maintained so as to avoid unwanted accumulation of water.

The drainage on the main road is kept towards hill side and roads are given 1% slope towards drainage. So that the water is not accumulated on the roads, the drain width is kept about 1m.

Mine Benches

On the benches, 1°slope is kept away from the face and joining to drainage of the roads so that water is not accumulated on the face.

Discharge to Perennial Nallahs

No wastewater will be discharged from the proposed beneficiation activities. Zero discharge will be maintained in the proposed plant facilities. However, for mining during monsoon season, run-off water from mine is collected in the silt settling ponds created at the lowest bench of the mine where silt get arrested. The overflow rainwater is routed into the low-lying areas through existing check dams &check bunds. The check dams &check bunds are de-silted well before monsoon season every year to ensure clear water to overflow. The de-silted material is stacked separately.

The surface run-off from the external OB dumps is guided through sedimentation ponds and garland drains to the surface water course. These structures remain even after the closure of the mine as it will prevent eroded material from reaching the main drainage/water course of the region.

OB dumps are terraced properly and in addition a buttress wall of sufficient height & width was constructed a few meters distance from foot of the dump in order to avoid the surface run-off.

However, by upgrading the existing mitigation measures, scientificway of mining and better management technique during course of mining activities like stabilization of dumps with plantation, toe wall, garland drains, settling pits, check dams reclamation of the mined-out land and OB dump.

b) Imapact on climatic conditions

The climate condition including temperature variations, wind direction and speed, rainfall and humidity are governed by regional factors and the monsoons. As such the mining and other allied activities will not tend to influence the climate. Further, carbon dioxide (green-house gas) emissions due to fossil fuel in the form of diesel to operate the trucks and earth moving machinery is quite obvious but it is a necessity and hardly pose any adverse impact on climate.

Hence, the mining operations are not likely to cause any adverse impacts on the local climatic conditions.

Mitigation Measures

The operations are being carried out in a limited area and hence negligible climatological impacts are anticipated. Implementation of afforestation and existing rehabilitated plantation work in ML area are beneficial to the climatic conditions.

During the ensuing plan period, it has been envisaged to make the production of 12.80 MTPA (ROM) from B-block and C-block quarries since these blocks were already developed and open having mineable reserve which can meet plant requirements. Both lateral and depth ward development has been proposed to be undertaken to achieve the targeted production.

Land degradation is one of the major outcomes of mining activities and any effort to control adverse impacts is considered incomplete when appropriate land reclamation strategy is not adopted. Since the land degradation in this mine is partially in the form of excavated void and partially in the form of internal dumps, the reclamation strategy also included the program for reclamation of the disturbed land.

Since the mining activities are limited to only core zone, there will not be any adverse impacts of land in the study area.

c) Mined Area Reclamation

About 44.62 ha area is backfilled within the lease area in 5 locations, out of which 2 are in B- Block and 3 are in C- Block. During the plan period an area of 49.60 Ha will be backfilled. Thus the total backfilling area at the end of plan period will be 67.18 ha. It has been planned to reclaim the mined out area by back-filling and plantation/re-grassing.

Reclamation Programme

Utilization of waste:
During the conceptual period total backfilling area will be 87.14 Ha. About 55.33 MT of waste will be generated during plan period and which will be backfilled in 22.56 ha. The backfilling proposed is simultaneous backfilling i.e. backfilling will be undertaken once the area is mined and devoid of ore. The area selected for backfilling will be the extension of the already backfilled area B2 in B-Block.

During the year 2021-22, the backfilling is proposed in between Section N 2800 to 3100 after exhausting the left out ore in part of the section between coordinates N 2426600 to 2427000; E 337600 to 338000, which will extension of the B2 backfilled stages. During the year 2022-23, the backfilled stages of the previous year (2021-22) will be extended in the southern direction, between Section N 2600 to 3000 after exhausting the left out ore in part of the section between coordinates N 2426600 to 2427000 ; E 337600 to 338000 and between sections N1300 to N1600; coordinates Northing N2425000 to 2425800 & Easting E 337200 to 338000 During the year 2034-24, the backfilling is proposed to be carried out over the backfilled stages of the previous years (2021-23) in between Section N 2500 to 3200, between coordinates N 2426600 to 2427000 ; E 337600 to 338000. In the final year 2024-25, it proposed to extend the backfilled stages of the previous years in the southern direction from Section N 2200 to 2800, between coordinates N 2426200 to 242700; E 337200 to 338000. The developments plan are shown in Figure-2.3.

Back-filling details during conceptual period

JSW has planned to reclaim the mined out area by back-filling and plantation/re-grassing in the conceptual period.Concurrent reclamation will be carried out depending upon the exhaust of mineral phase by phase. Out of the total mine area of 275.591 ha, an area of about 94.24 Ha will be covered with plantation/re-grassing after backfilling and 171.641 Ha by bench plantation/re-grassing and 9.71 Ha with water reservoir.

Bench Plantation/re-grassing:
The drilling of the new 57 bore holes till date have augmented the resources thereby increasing the life of the mine. The addition of resources has aided in

enabling production up to the end of this plan period and additional 72 Nos of bore holes are proposed in the plan period, there is potential to increase the resources, Thus, bench plantation/re-grassing will not be possible during this period and shall be taken up in the conceptual period in the areas devoid of ore.

The grass seeding was proposed along the slope of terrace of waste dump and bench slope for preservation of top soil during the process of reclamation and rehabilitation at conceptual period. The grass shall be fresh free from weed and rank vegetation but leaving rhizome with sufficient nodes. Other soil forming local grasses like *dichathiumannultum,cenchrusciliariis* and *panniciumrepones* (lemon grass) vertiver grass, elephant grass, *citrella A, baughanvilla,* would also be used to the above grass.

The target for survival is >70% and budget for afforestation including development of sapling, plantation and maintenance is expected to be around Rs.1,000/- per sapling. This will be spent from the revenue budget.

d) Topsoil Management

If any top soil encountered during excavation of fresh areas will be simultaneously utilized for the afforestation and plantation activity.

e) Existing Mitigation Measures

Adopting suitable, site-specific mitigation measures can reduce the degree of impact of mining on land. Some of the land-related mitigation measures are as follows:

- Implementing adequate protection and conservation plan to conserve top soil.
- During the planning stage, identification of waste storage yard and topsoil being done based on slope and run-off characteristics;
- In-pit dumping of mine waste is promoted wherever possible rather than external dumping. In case of external dumping, proper care is taking for stabilization, by suitable plantations.

f) <u>Soil Conservation Measures</u>

The following control measures to prevent soil erosion and wash-off from freshly excavated benches and dumps will be adopted :

- Garland drains will be provided around the mine wherever required to arrest any soil from the mine area being carried away by the rain water; and
- The inactive dump slopes areprovided with bushes, grass, shrubs and trees to prevent soil erosion after applying top soil.

After exhaustion of the total workable iron ore reserves, within the lease area, the changed land forms will be subjected to post-mining reclamation activities, for best possible land uses.

g) Beneficiation plant:

As far as Beneficiation plant is concerned, finer rejects in the form of filter cake from filter press will be generated. Waste to be generate from the beneficiation plant and it isproposed to dump at exhausted pits. These rejects will be separatelycollected and directly transferred into mine waste dump yard (temporary) and subsequently, backfilled in the mined out void. In case, the reject contains some mineral value, it willseparately stack and used.

h) Management of OB Dumps.

The OB dumps will be reclaimed to greencover. OB dump height and slope are based on slope stability studies; maximum 45° angle as the ultimate slope has been provided in the design. Dumps would be made from top down by end tipping method. The environmental impact shall be on account of dump slope failure resulting in dump collapsing, erosion, dust carryover by wind and siltation of surrounding streams.

- Provision of garland drains all around the dump base are made. A retaining wall is erected around the periphery of the dump to arrest the washed fines. The top of dump as well as slope surface is vegetated for stability. This would prevent erosion as well as dust generation. The overall ultimate slope of dumps maintained at 45°.
- The dumps are provided with all necessary protective features such as toe wall, garland drains and settling tank etc. The terrace angle is maintained in the dump so that it remains less than 37.5°. Afforestation on the dump slopes arebeing done for stabilizing the dump slopes, once a part of the dump slope becomes inactive.
- The terraces are designed so that rainwater is drained out of the dump and there is no accumulation of rain water. The rain water gets channelized to the toe wall and garland drain provided at the base of the dump.
- The waste generated is used for bench floor leveling, maintenance of haul roads & berms, making ramps & haul roads during the plan period and remaining quantity of waste is initially be dumped in the existing and proposed waste dumps.

Stacking of Ore:

The ROM ore shall be beneficiated in processing plants. hence it is envisaged that the ROM ore shall be stacked near the processing plants to ensure the utilization of shovel & dumpers in case of breakdown of plants. These stocks shall also act as a buffer in case of less availability of excavators or dumpers in the mine, in which case the ore will be directly fed from these stocks.

The sub-grade is stacked separately at the earmarked place. Waste rocks encountered during the course of mining are handled separately and used for bench floor leveling, making berms etc. The ore is transported from different mining faces in a pre-determined proportion (for blending different qualities of ore) and deliver the same to the processing plant.

i) Disposal Method of Tailings/Reject

Detailed tailing filtration study was carried out by M/s Outotech, Bangalore & based on the tests conducted Outotec Larox FFP method is recommended for filtrationof slurry.

In filtration stage slurry recirculation valve is closed and slurry inlet valve opened; the slurry flows into the chamber(see brown arrow in the Figure-4.2).In pressing stage the air booster will start pumping the air behind the diaphragm(see blue Arrow in Figure-4.2). The pressing pressure is adjusted to desired level with the pressingair regulator.In air drying stage the air goes in from the membrane side and flows through the cake and comesout from the filtrate side(see blue arrow in figure above far right).

Tailings will be used as mineral reject by installation of filter press which is a fully automatic process, which produces a cake for easy handling and transport, the system is ideal for convenient disposal of tailings. Hence, no tailing dam shall be constructed for the beneficiation plant.

Impact on Air Quality- Mitigation Measures

Opencast mining operations with beneficiation plant contribute towards air pollution in two ways: addition of gaseous pollutants to the atmosphere and the dust particles. The gaseous pollutants include NOx, SO_2 and CO. The sources of pollutants from the mining activity include:

- Operation of Heavy Earth Moving Machinery (HEMM) which mostly run on diesel;
- Excavation;
- Loading /unloading operations;
- Transportation of ore/overburden in dumpers; and
- Ripping, drilling, blasting, crushing and beneficiation operations.

Air pollution sources at the mining site can be classified into three categories, viz., area sources, line sources and instantaneous point sources. Extraction of iron ore by various activities in mining area is considered as an area source. Transportation of ore from mining area to the storage area is considered as line source. Drilling is considered as point source.

PM and NO_2 emissions are envisaged during blasting and transportation operations. But these will be kept under control by monitoring regularly, the emissions from exhaust and by sprinkling of water on haul roads etc.

Even though blasting generates NO_2, it will be instantaneous and intermittent. Also, NO_2 emission from the vehicular movement on surface would be intermittent and get dispersed quickly.

j) Overall Impact due to the Mining Activity

As discussed above, there will be marginal increase in terms of dust load due in ML area due to proposed expansion of Nuagaon iron ore mines including beneficiation plant. However, the above surface activities too cause insignificant impact, which will be confined to the lease area only, while adopting the control measures during the mining operation. Besides, there will not be any adverse impact on ML area, within the boundary and the area outside community with implementation of adequate dust control measures.The Jajangvillage is located in the ML area. The resultant controlled concentrations were found to be 6.0µg/m^3which will be below NAAQ standards. The resultant controlled concentrations at Bandhuabeda and jadibahal villages are 11.8 µg/m^3 and 3.2 µg/m^3.The resultant ground level concentrations on nearby habitat are presented in Table-4.16(C).

MITIGATION MEASURES TO BE REQUIRED IN THE PROJECT IMPACT AREA.

Keonjhar Division :

Due to diversion of forest area of 669.078 ha. (as per DGPS Survey)/666.150 Ha (as per ROR) for mining purpose the wild-life habitat to this extent will be reduced. The congregation of wild animals in the impact area is likely to increase. These animals will therefore be susceptible to greater threats. There will also be additional biotic pressure on the impact area. There are several mining projects within 10km radius. Due to the large extent of mining area adjacent to the current mining project within 10kms radius, the effective impact area will be of 12.008 kms radius. The Management Plan therefore aims at reducing the perceived threats beyond these areas. These activities beyond the Mining project area shall be implemented by the DFO/Forest Department.

Besides this an action plan aiming at proper distribution of food, water and shelter as far as possible and achieving the desired composition of wild fauna population, **with special reference to Schedule-I fauna and endangered species has been dealt in this chapter.**

Now a days conservation of forests and wildlife need participatory based culture. Unless the local communities who are very much associated with the forest and wildlife since time immemorial are taken into confidence through this participatory based culture, no plan/project can be successful.

Hence, while proposing different interventions for protection of forest and wildlife emphasis have been focused on the capacity building of adjoining forest dependent communities and their peripheral developments like Awareness Campaign in this plan.

The different mitigative interventions proposed by DFO, Keonjhar to mitigate the adverse impact of mining in both the divisions are as under.

WILDLIFE HABITAT MANAGEMENT

1. **Restorative intervention in the habitat** :

The Nala flowing inside the forests becomes dry during summer months at most of the sites depriving the available wild fauna from water. Therefore, habitat management creating a conducive environment for sustenance of wildlife and their proliferation is one of the important strategy in preparing this plan. The following measures for improvement of habitat securing food, water and shelter for the wildlife are suggested at the beginning.

It is proposed to improve the wild life habitat outside the project area with the following activities.

The forest blocks surrounding the project area are: Sidhamath & Baitarani Reserved Forests. These Reserved Forests have been placed under Improvement Working Circle, Rehabilitation Working Circle and Protection Working Circle. In these Forests, improvement of forest cover is required to be taken up and the protection mechanism needs to be augmented to preserve the Wildlife habitat. These forests are under heavy biotic pressure and in the process of degradation.

i) Soil and moisture conservation measures.

These areas need to be protected for conservation of forest and wildlife. The interventions are proposed for improment of wildlife habitat through massive soil and moisture conservation measures line gully plugging, check daming contor trench and subsurface dyke etc. required in the above RFs, on consultation with the Forest Department Officials of Keonjhar Forest Division. A lumsum amunt Rs. 15.00 lakhs in proposed for the above work.

ii) **Creation of enrichment plantation by the side of Rivers, nalas & swamp areas** :

It is proposed to create 15 ha. enrichment plantation by the side of penial nalas and swamp area insides Siddhamatha, Baitarani & Chamakpur RF. Besides plantation can be raised on the bank of river Baitarani, Sunanadi etc. flowing inside forest areas. The plantation species shall be fodder, fruit bearing shady type @ 1,000 plant/ha. This plantations shll provide food to the wild-animals pertifcullary to mega harbivoures as the wildlife habitats in the impact zone are devoid of sufficient food for them.

iii) **Fire Protection** :

The fire protection is the most important aspect of forest protection and improvement of habitat. Almost all forest areas being surrounded by human habitations, due to shifting cultivation get burnt repeatedly during summer.

Fire is the most devastating agent for degradation of habitats. It is therefore, proposed to take up fire protection with right earnest. Prior to fire season, the V.S.S and Gram sabha including some revenue villages located and the forest fringe will have to be taken into confidence through awareness programmes and incentives to assist in prevention of forest fire.

Provision of fire blowers : It is proposed to purchase required nos. of fire blowers as, a modern instrument in extinguishing forest fire and laying out fire lines inside forests in addition to conventional fire fighting tools. Purchase of fire fighting equipments – Fire Blowers specifically 10 Nos. at the cost of Rs. 60,000/- per blower has been suggested with a total financial outlay of Rs. 6.00 Lakhs over the span of 10 Years.

Deployment of a Fire fighting squad consisting of 5 members with hird vehicle, POL etc. in the project impact area over the plan period during fire season as per the approved cost norm stipulated by PCCF, (WL) & CC, Odisha @ Rs. 4,61,150/- per annum over 10 years of plan period.

WILDLIFE PROTECTION AND ANTI-DEPREDATION :

a. **Fencing of Unguarded open wells** to prevent elephants and their calfs being trapped has been planned at a cost of Rs. 50,000/- each well in 10 Nos. of strategic locations of such open and unguarded wells in and around the project and project impact area. The net cost allocated for the same according to a Lumpsum basis is Rs. 5 Lakhs over a plan of 10 years.

b. **Augmentation of staff strength by creation of a new cadre of Anti-poaching/Anti depredation squad :** The field staff strength of Barbil Range of Keonjhar Division is not as adequate to extend support for protection of the forests of zone of influence amidst various assignments and workloads. Therefore, it is proposed to build a skilled cadre of young "Anti-Poaching/Anti-depredation Squad" (Wildlife protection squad/antidepredation squad) who will be selected from the forest dwelling communities. 5 nos. youths from different villages/V.S.S will be selected in consultation with the Gram Sabhas/VSS. They will be given elementary training for about a week at the Forest Division Headquarter on relevant aspects of conservation and protection, with the help of resource persons on the subjects.

A curriculum for such training is to be developed encompassing subjects like importance of forests and wildlife, need for their conservation, protection and development, technique of forest regeneration, habitat development, control of forest fire, grazing, poaching, communication methodology to ensure people's participation, tracking of elephants, prevention of depredation by wild life etc.

On completion of training, they will be deployed to work under the guidance of local forest staff. It is also proposed to provide them a hired vehicle with POL and a daily wage driver over the plan period and communication equipments etc to assist the staff in normalising man-elephant conflict wherever occurs. An amount of **Rs. 132.440 lakhs** is provisioned for the purpose.

c) In view of man-elephant conflict in villages of project impact area cusing house damage and raiding food grain, stored in the houses provision is made for construction of **Grain Store House** having plinth area 450 qft. @ Rs. 4,90,000/- per village for 10 strategic villages victim to crop raiding to store food gr`ain with in an amount of **49.00 lakhs.**

d) The villages will be supplied with **Metallic grain bin** 30 nos. per village to store food grain. It is proposed to distribute the bins to 10 villages. The cost shall be @ Rs. 3,500/- per piece to talling to **10.50 lakhs.** This will dicrease damage to houses and food grain explotation in houses of project impact area

e) Provision for **Elephant proof trench** of size $\frac{3\text{m x 1 m.}}{2} x$ 2.5 m. across the entry path of elephant to the villages at strategic locations to prevent house and grain raiding over a length of 2 KM wherever required. The cost of excavation of trench over 2 KM shall be @ Rs. 5,26,374.00 per KM over 2 KM totaling to Rs. **10.72748 lakhs.**

f) Provision for **Manchan (Mini watch tower**) on hillocks and tall trees to watch the movement of elephants and to alert the villagers about elephant movement.

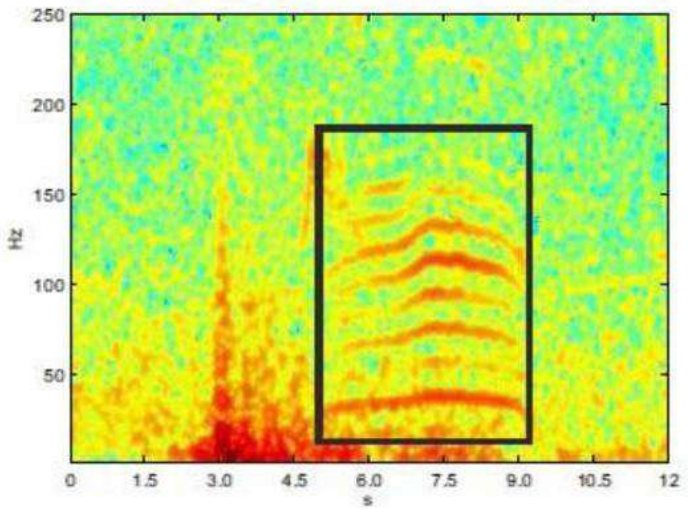
g) Provision for **Paddy Harvester** for the villagers for early harvesting of paddy from their field and to store in safe place to avoid crop damage by wild elephants.

h) Provision for **Camera trap** with infrared.

i) **Solar electric fencing** : Some of the villages regularly affected by elephant depredation can be insulated by installing Solar electric fence around the village. An amount of Rs.5.00 lakhs is proposed for the activity.

j) **Provision for warning and wading system to prevent elephant intrusion :** Acoustic Detection of Elephant Presence in Noisy Environments The communication of elephant with one another is by low frequency sound, which can travel several kilometers. The elephants communicate sound is called rumble, which prolong into infrasound band. The rumble is a harmonic sound. It is the fundamental frequency in the range of 15-35Hz in duration between 0.5 and 5s.The acoustic detection of elephants by their call is currently the most promising approach towards an early warning system that is able to detect the presence of elephants in large field areas.

Figure: Typical Elephant rumble signal



This SYSTEM utilizes all these fears accordingly with the distance of the elephant from the human settlements. The block diagram is shown below. As shown in the figure , our solution involves three PIR sensors and two vibration sensors.

The two vibration sensors have different operating range (say 20m, 15m). When the heavy vibration caused by elephant movement is sensed within 20m, first vibration sensor sends the electrical pulses. It is then compared with the threshold value. If the value matches, the powerful flashing lights are activated. This should drive it back to the forest. Due to this, vibration sensors will turn off the flashing light.

If it doesn't and if the elephant continues in its path without fearing for the light, vibration sensor 2 gets activated once it is within 15m range and sends the electrical pulses, if it matches with the same threshold value and after some distance, it activate three PIR sensors which in turn

activates the sound system which produces bee's sound and with the help of GSM, messages and calls are sent to village representatives and the forest department and alerts them.

If the bee sound drives the elephant back into the forest, again the message comprising of that the elephant are not in human settlement area are send to forest department.

figure: Block Diagram for proposed system

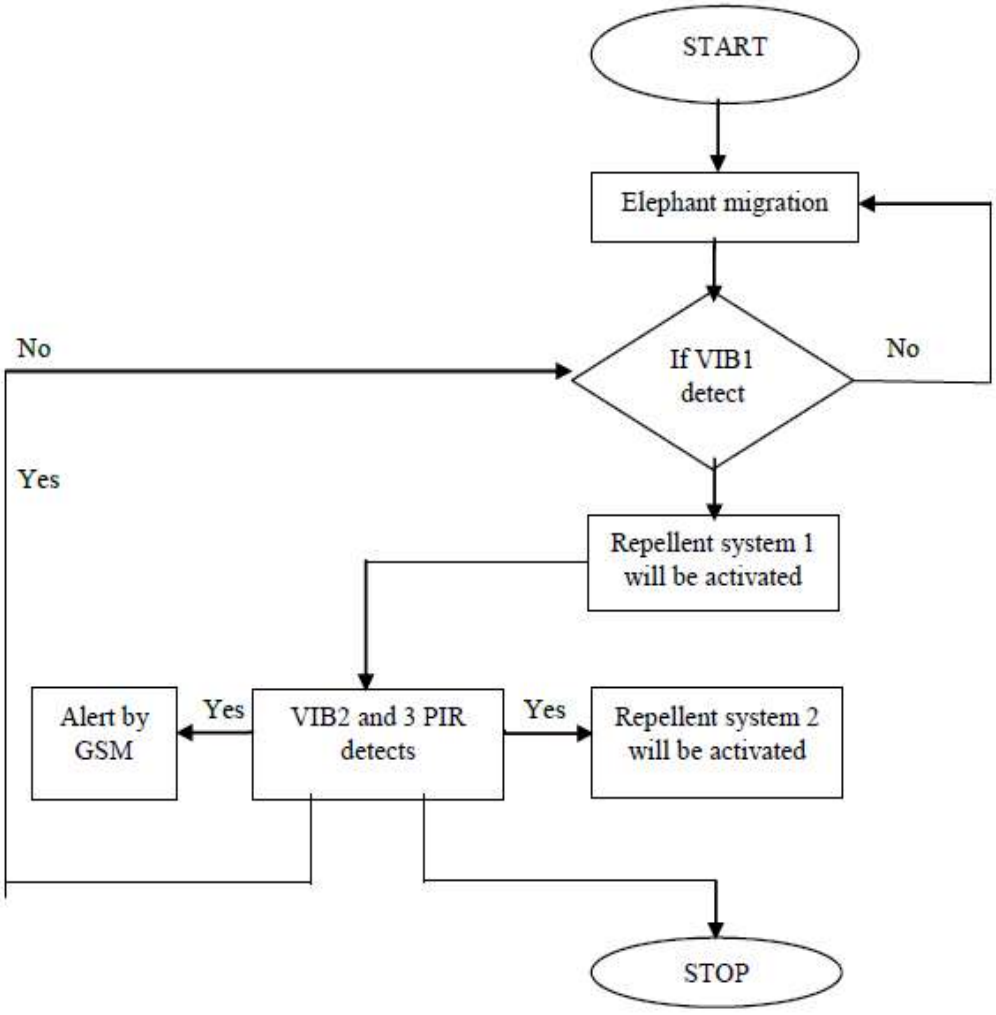
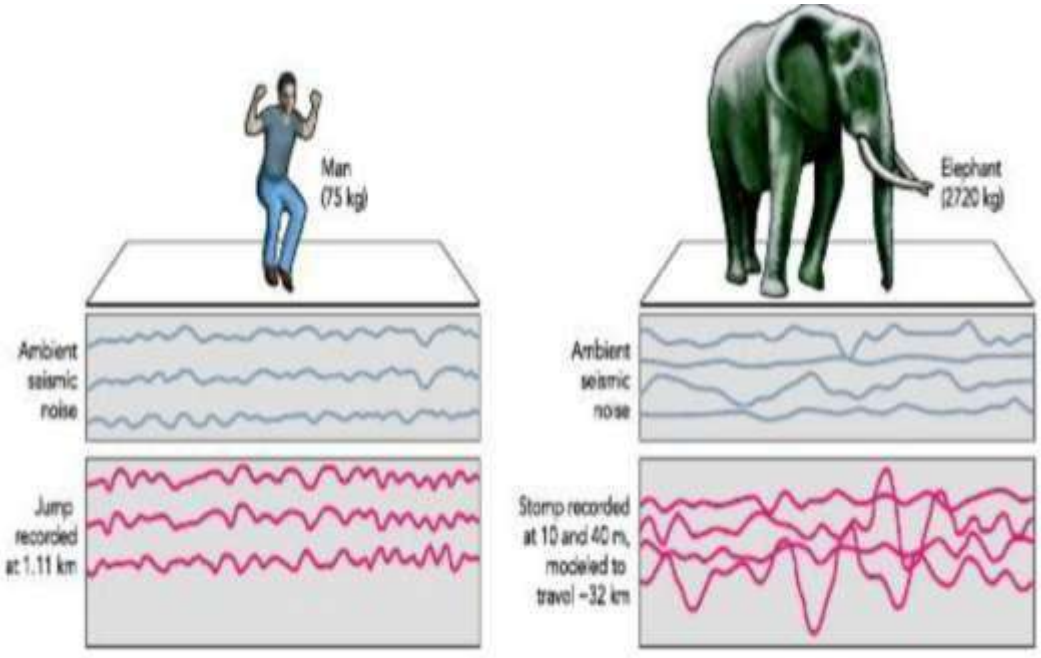
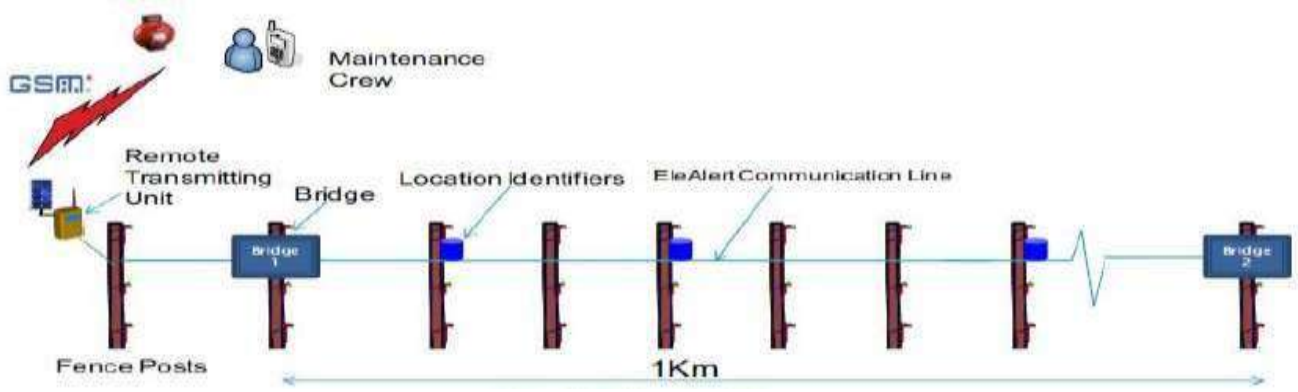


Figure: Flow Diagram to detect the Elephants' Movement

Vibration sensor (SW18020P) Vibration sensors are used for measuring, displaying, and analyzing linear velocity, displacement and acceleration. The two contacts of sensor are not connected in idle condition. When external force is acted upon either by movement or vibration, the sensor's two contact pin are closed and contact is made between the two pins. When the force is removed the terminals of sensor returns back to the open contacts. Sensor is made up of a small spring mechanism, which makes the contact ON when the applied vibration force is at above a certain threshold. Vibration sensor has two legs coming out of it. Normally the two terminal are insulated by a resistance value more than 10MOhm. When someone applies vibratory force on the switch, spring inside the switch vibrates and makes a momentary short circuit between the two terminals.

Electric Fence Intrusion Alert System (eleAlert) The electric fences intrusion system is implemented to detect the intrusion of elephant using fences which separate human and wildlife habitats. This method is to improve the effective electric fences to dominant the elephant conflict in many part of the world. Electric fence intrusion alert system uses a network of sensors to detect and locate damages instantly and alert communities under tread via the mobile communications network.





To wade-away the wild elephants from village area to their habitat forest areas it is proposed to supply 2 units of **Elephant and Mega Wildlife Movement Warning & Wading System** to the D.F.O., Keonjhar Forest Division @ Rs. 15.00 Lakhs each alongwith the cost of maintenance of Rs 20,000/- per year over the plan period, a total cost of **Rs. 32.00 lakhs.**

k) **Awareness** : Wild elephant use to pass from one patch of forest area to another crossing Malda, Joda state highway at some points. Therefore it is proposed to install large size (6' x 4') metaling radium sign board with strong iron angle stay at sutabile height and distance @ 10 each (5 at one side of the road) near each elephant crossing point to alert the vehicles to reduce the speed and to watch the road crossing of the elephyants to prevent of elephant and abvoid casuality. Total 2 nos. of such sign board installation as proposed.

Support activities :

1) **Provision of corpus funds for exgratia** : Due to anticipated impact of mines there shall be man-animals/man-elephants conflict in the project impact area. As a result there shall be human injury/ death, crop and house demage. Therefore in order to mitigate the above situations in the field and to provide immediate compensation to the victims of the above incidents a lumsum amount Rs. 10.00 lakhs is kept as a revolving funds to meet the immediate requirement with the DFO.

2) **Monirоring and evaluation :** In order to monitor and evaluate the above interventions in the field by the higher officers like Divisional Forest Officer, Regional Chief Conservation of Forest and procurement of latest satellite map every year for analysis and to evaluate the plan, provision of Rs. 1.00 lakh is kept per year spreding over plan period totaling to Rs. 10.00 lakhs.

A. Financial implication of the project area.

Sl. No.	Particulars	Remarks
1	Provision for graded bund all along the boundary of the lease area wherever necessary to allow the surface runoff from the lease area to percolate in to ground instead of flowing in to adjoining villages, corn fields & other wild life habitats as a soil & conservation measure	To be implemented by project proponent at the project cost
2	Cost of photo voltaic fencing around the active mining pits inside the ML area over a length of about 2KM to prevent fall of wild animals in to the pit.	-do-
3	Supply 10 units of high frequency ultra-sonic Sound elephant repellents to the D.F.O., Keonjhar Forest Division cost of maintenance.	-do-
4	Establishing Bulk messaging System for immediate message spreading from field to all grass-root level forest Officials, ROs, ACFs & D.F.O., Keonjhar over the plan period.	-do-
5	Provisioon of hired vehicle with POL for movents of rapid response team deployed at DFO office over the plan period i.e 10 years.	-do-

Sl. No.	Particulars	Remarks
6	Provision of long Rechargeable Flash Light torches 200 nos. to be supplied to the strategic villages/VSS members/elephants trackers to wade away elephants/sloth bear	To be implemented by project proponent at the project cost
7	Purchase and supply of android based Mobile handset for quick message transmitting and immediate communication	-do-
8	Provision of 02(Two) nos. Drone camera with accessories for Divisional Forest Officer Keonjhar monitoring of wild animals in stress in forest areas.	-do-
9	Health camp and Cattle immunization camps in the project impact area at regural interval over the plan period.	-do-

The project proponent shall carryout different intervanetion as narrated above in addition to prescriptions imposed in approved mining plan and involvemental management plan and shall hand over the materials mentioned above to mitigate man-elephant conflict to the Divisional Forest Officer at the project cost.

Divisional Forest Officer
Keonjhar Division

B. FINANCIAL IMPLICATION THE PROJECT IMPACT AREA OF KEONJHAR.

Sl. No.	Particulars	Unit	Rate (in Rs.)	Amount (in lakh)
1	**HABITAT IMPROVEMENT**			
	Creation of 15 ha. enrichment plantation of fruits bearing and fodder species mainly Jack fruit, Siali, Bara & Aswastha by the side of nalas & river banks and swampy sites in side forest areas @ 1,000 plant/ha. (as per onetime cost norm vide O.O No. 1109 dt. 8.11.2021 of PCCF, Odisha.	15 ha.	2,34,718/-	35.2077
2	**FIRE PROTECTION**			
i)	Deployment of a Fire fighting squad consisting of 5 members. @ Rs. 4,61,150/ per annum. For 10 years			46.115 46.42
ii)	Provision of fire blowers 10 nos. @ Rs. 60,000/- per each			6.00
3	**SOIL & MOISTURE CONSERVATION MEASURE**			
i)	Improvement of wildlife habitat in Chamakpur, Sidhhamatha and Baitarani RF through soil and moistures like gully plugging, check damming contour trench and subsurface dyke etc. wherever required on lumsum			15.00
4	**ANTIDEPREDATION AND PROTECTION MEASURES**			
i)	Supply of warning and wading system to prevent elephant intrusion along with maintenance of same @ Rs. 20,000/- per annum	02 nos.		32.00
ii)	Fencing of Unguarded open wells to prevent elephants and their calfs being trapped has been planned at a cost of Rs. 50,000/- lumsum each well in 10 Nos. of strategic locations of such open and unguarded wells in and around the project and project impact area over a plan of 10 years.	10 nos.		5.00
iii)	Provision for augmentation of staff strength by creation of a new cadre of **Anti-poaching/ Anti depredation squad** consisting of 5 members @ Rs. 13,24,400/-per year	5 members	13,24,400	132.440

iv)	Provision for a **Grain Store House** having plinth area 450 qft. @ Rs. 4,90,000/- per each per village for 10 strategic villages victim to crop raiding & house damage to store food grain.	10 nos.	4,90,000	49.00
v)	Provision for supply of **Metallic grain bin** 30 nos. per village to store food grain for 10 villages @ Rs. 3,500/- per piece. 300 nos.	10 village	1,05,000	10.50
vi)	Provision for **Elephant proof trench** of size $\frac{3m \times 1m}{2} \times 2.5\ m$. across the entry path of elephant to the villages to prevent house and grain raiding @ Rs. 5,36,374.00 per KM at strategic locations over 2 KM	2 KM	5,36,374	10.72748
vii)	Provision for Camera trap with infrared	20 nos.	50,000	10.00
viii)	Provision for Manchan (Mini watch tower) on hillocks and tall trees to watch the movement of elephants and to alert the villagers about elephant movement.	1 no.	10,00,000	10.00
ix)	Cleaning of shrubs/herbs/grass along the elephant road crossing points at 50 meter width on both sides.		LS	5.00
x)	Provision for metallic radium painted sign board at 2 elephants road crossing sites @ 10 nos. each point, totaling to 20 nos. at strategic locations to avoid accident and casualty of elephants	20 nso.	LS 30,000/- cah	6.00
5	Corpus funds for exgratia			10.00
6	Payment towards cost of monitoring & evaluation procurement of latest satellite maps every year for analysis at division office @ 1.00 lakh per year x 10 years			10.00
	Total		393.30	**391.99018**
	20% cost escalation		78.66	78.398036
	Grand Total		471.96	**470.388216 or 470.400**

(Rupees four crore seventy thousand four hundred) only.

Rupees four crore seventy one lakh ninety six thousand only

Countersigned

Regional Chief Conservator of Forests
Rourkela Circle, Rourkela

Divisional Forest Officer
Keonjhar Division

C. FINANCIAL IMPLICATION THE PROJECT IMPACT AREA OF BONEI FOREST DIVISION

Sl. No.	Particulars	Unit	Rate (in Rs.)	Amount (in lakh)
1	**Antidepredation and Protection measures**			
i)	Provision for five members elephant squad with one hired vehicle & POL charges for 10 year.	1 unit	13,24,400	132.440
ii)	Construction of inter divisional protection camp shed at border for coordination for monitoring of elephant.	1 no.	20,00,000	20.00
iii)	Provision for establishing bulk massaging system for immediate message spreading from field to all grass-root level forest Officials ROs, ACFs & D.F.O Bonai including the maintenance cost of Rs. 4000 per year over the plan period	2 unit.	4,40,000	4.40
iv)	Provision for 5 units of high frequency ultrasonic sound elephant repellents to the DFO, Bonai Division 40,000 each frequency and cost of maintenance Rs. 12,000/- per year	10 units	52,000	5.20
v)	Provision for long rechargeable flash light torchers 50 nos. to be supplied to the strategic villages/VSS members/ elephants trackers to wade away elephants.	200 nos.	1,000	2.00
vi)	Provision for camera traps and equipments etc,	25 nos.	50,000	12.50
vii)	Supply of warning and wading system to prevent elephant intrusion along with maintenance of same @ Rs. 10,000/- per annum	I unit	16,00,000	16.00
viii)	Provision of fire blowers 8 nos. @ Rs. 60,000/- per each	8 nos.		4.80
ix)	Provision for Paddy harvester to be supplied to be villages for early harvesting of paddy and store in safe place to avoid damage of paddy in corn field (Four cylinder 30 HP power paddy harvester).	1 no.	20,00,000	20.00

3	**Support activities.**			
i)	Corpus funds.		L.S	10.00
ii)	Provision for cattle immunization camps in the villages near the wildlife habitats		L.S	5.00
	Total			**232.3400**
	20% cost escalation			46.4680
	Grand Total			**278.808**

(**Rupees two crore seventy eight lakhs eighty thousand eight hundred**) only.

Countersigned

Regional Chief Conservator of Forests
Rourkela Circle, Rourkela

Divisional Forest Officer
Sonai Division

Bonai Division :

Chapter-IV (A)

Animal passage plan :

The project is a mining project comprising of 666.150 ha. & is 18.5 KM away from Karo-Karampada elephant corridor. Besides the project and project impact area does not from part of any protected area, elephant/tiger reserve. Biosphere reserve, elephant habitat zone and eco-sensitive zone. As narrated in Chapter-I elephants occasionally move inside the project impact area during crop season. There is also no National Highway occur either in the project area or project impact area. Therefore no animals passage plan is required relating to this project. However required precautions are have been proposed for elephant movement across the Malda-Joda State highway and other village roads.

Chapter-V

Financial implementation and monitoring :
Total financial implication of the proposal with cash flow statement for 10 years for both Keonjhar & Bonai division are furnished below :

The life of this mining has been estimated to be 50 years. But this plan is proposed for a period of 10 years. After completion of this plan period the same can be evaluated and further steps taken depending on requirement. However, if necessary interim revision of this plan can be taken up depending on the actual requirements.

Regular monitoring and evaluation shall be done by the field officers and RCCF, Rourkela at the time of implementation for which fund has been kept in this plan. Year wise data shall be maintained to assess the trend of man-animal conflict due to implementation of this project and if required interim revisions can be made in consultation with the project proponent. The project proponent shall be give undertaking to prepared new plan one year before expiry of this plan. The PP shall under take to provide necessary assistance as where and when required to mitigate the advours impact generated causing man-animals conflict and degradation of habitat. The PP shall handover the tools, masonarics, vehicles as narrated in the interventions of project area in this plan.

ABSTRACT

CUMULATIVE TOTAL OF FINANCIAL FORECAST OF ACTIVITIES TO BE UNDERTAKEN IN KEONJHAR FOREST DIVISION & BONAI DIVISION GRAND TOTAL (A+B+C)

(in lakhs)

A) PROJECT AREA	Interventions to be implemented by project proponent at the project costs in the project area	
B) PROJECT IMPACT AREA (KEONJHAR DIVISION)	470.400 471.960	749.208 750.768
C) PROJECT IMPACT AREA (BONAI DIVISION)	278.808	

(Rupees seven crore forty-nine lakhs twenty thousand eight hundred) only.

Rupees seven crore fifty lakh seventy six thousand eight hundred only

Countersigned

Regional Chief Conservator of Forests
Rourkela Circle, Rourkela

Divisional Forest Officer
Bonai Division

Approved

Divisional Forest Officer
Keonjhar Division

Divisional Chief Conservator of Forests

B) ANNUAL WORK PLANS AND ANNUAL OUT LAY STATEMENT OF FINANCIALFORECAST OF ACTIVITIES TO BE UNDERTAKEN OVER 10 YEARS SPAN IN THE PROJECT IMPACT AREA (TO BE IMPLEMENTED BY DIVISIONAL FOREST OFFICER, KEONJHAR).

Sl. No.	Particular of works	0th & 1st year (Amount in lakh)	2nd year (Amount in lakh)	3rd year (Amount in lakh)	4th year (Amount in lakh)	5th year (Amount in lakh)	6th year (Amount in lakh)	7th year (Amount in lakh)	8th year (Amount in lakh)	9th year (Amount in lakh)	10th year (Amount in lakh)	Total (Amount in lakh)
1	Creation of 15 ha. enrichment plantation of fruits bearing and fodder species by the side of nals & river banks and swampy sites in side forest areas. Rs. 2,34,718/- per ha.	18.4101	3.6877	2.734	1.251	1.313	1.575	1.457	1.52	1.6	1.6599	35.2077
2	Deployment of a Fire fighting squad.	4.6415	4.6415	4.6415	4.6415	4.6415	4.6415	4.6415	4.6415	4.6415	4.6415	46.415
3	Provision of fire blowers.	6										6.00
4	Soil and moistures conservation measures.	5	5	5								15.00
5	Supply of Warning and wading system.	30.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		32.00

6	Fencing of Unguarded open wells	2.5	2.5									5.00
7	Provision for augmentation of staff strength by creation of a new cadre of Anti-poaching/Anti depredation squad.	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	132.44
8	Provision for a Grain Store House.	24.5	24.5									49.00
9	Provision for supply of Metallic grain bin.	5.25	5.25									10.50
10	Provision for Elephant proof trench.	5.5	5.22748									10.72748
11	Provision for Camera trap with infrared	10										10.00
12	Provision for Manchan (Mini watch tower) on hillocks and tall trees to watch the movement of elephants and to alert the villagers about elephant movement.	10										10.00
13	Clearning of shrubs/herbs/ grass along the elephant road corssing points at 50 meter width on both sides.	1	1	1	1	1						5.00

14	Provision for metalllic radium painted sign board at 2 elephants road corssing sites @ 10 nos. each point, totaling to 20 nos. at strategic locations to avoid accident and casualty of elephants.	6										6.00
15	Corpus funds for exgratia	9										9.00
16	Payment towards cost of monitoring & evaluation procurement of latest satellite maps every year for analysis at division office @ 1.00 lakh per year x 10 year	1	1	1	1	1	1	1	1	1	1	10.00
	Total	**152.41560**	**66.22068**	**27.78950**	**21.30650**	**21.36850**	**20.63050**	**20.51250**	**20.57550**	**20.65550**	**20.51540**	**391.99018**
	20% escalation											78.39804
	Grand Total											**470.38822 or 470.400**

(**Rupees four crore seventy lakhs forty thousand**) only.

C) ANNUAL WORK PLANS AND ANNUAL OUT LAY STATEMENT OF FINANCIALFORECAST OF ACTIVITIES TO BE UNDERTAKEN OVER 10 YEARS SPAN IN THE PROJECT IMPACT AREA (TO BE IMPLEMENTED BY DIVISIONAL FOREST OFFICER, BONAI DIVISION).

Sl. No.	Particular of works	1st year (Amount in lakh)	2nd year (Amount in lakh)	3rd year (Amount in lakh)	4th year (Amount in lakh)	5th year (Amount in lakh)	6th year (Amount in lakh)	7th year (Amount in lakh)	8th year (Amount in lakh)	9th year (Amount in lakh)	10th year (Amount in lakh)	Total (Amount in lakh)
1	Provision for five members elephant squad with one hired vehicle & POL charges for 10 year.	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	13.244	**132.44**
2	Construction of inter divisional protection camp shed at border for coordination for monitoring of elephant.	20										**20.00**
3	Provision for establishing bulk massaging system for immediate message spreading from field to all grass-root level forest Officials ROs, ACFs & D.F.O Bonai including the maintenance cost of Rs. 4000 per year over the plan period	4.4										**4.40**
4	Provision for 10 units of high frequency ultrasonic sound elephant repellents to the DFO, Bonai Division 40,000 each frequency and cost of maintenance Rs. 12,000/- per year	4.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	**5.20**

5	Provision for long rechargeable flash light torchers 50 nos. to be supplied to the strategic villages/VSS members/ elephants trackers to wade away elephants.	2										**2.00**
6	Provision for Camera traps and equipments etc.	12.5										**12.50**
7	Supply of warning and wading system to prevent elephant intrusion along with maintenance of same.	15.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**16.00**
8	Provision of fire blowers	4.8										**4.80**
9	Provision for Paddy harvester to be supplied to be villages for early harvesting of paddy and store in safe place to avoid damage of paddy in corn field	20										**20.00**
10	Corpus funds	10										**10.00**
11	Provision for cattle immunization camps in the villages near the wildlife habitats	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**5.00**
	Total	**106.664**	**13.964**	**13.964**	**13.964**	**13.964**	**13.964**	**13.964**	**13.964**	**13.964**	**13.964**	**232.34**
	20% cost escalation											46.468
	Grand Total											**278.808**

(**Rupees two crore seventy eight lakhs eighty thousand eighty hundred**) only.

Chapter-VI

Maps/Appendics/Plans and cost Schedules/ relevant order

Maps (in 1 = 50,000 scale)

6 (a) Land use plan maps of the project existing and proposed on Survey of India Topo sheet No. F45N5, F45N9, F45H8 & F45H12.

6 (b)
Location Map showing site of elephant movement and wildlife depredation in the project impact area of Jajang Iron Ore Mines.

6 (c) Location map showing the distances of Jajang Iorn Ore Mines of M/s JSW Steel Ltd. from the National Park, Wildlife Santury and Elephant corridor.

6 (d) Location map showing other mining leases and forest diversion in the project impact area of Jajang Iron Ore Mines of M/s JSW steel Ltd. on Survey of India Topo sheet No. F45N5, F45N9, F45H8 & F45H12.

ANNEXURE III

Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation
Central Ground Water Authority (CGWA)
Application for Issue of NOC to Abstract Ground Water (NOCAP)

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

Application Number : 21-4/203/OR/MIN/2009
Old Application Number : 21-4(203)/SER/CGWA/2009
Applied For Renewal : 3rd

1.	**General Information:**	
	Water Quality:	Fresh Water
	Purpose of Renewal Application:	Existing with Additional Ground Water Requirement
	Application Type Category/ Type of Application	Manganese ore
2.	**Name of Mine/Project:**	M/S RUNGTA MINES LIMITED (Presently JSW Steel Limited)
3.	**Location Details of the Mining Unit- (Attach Site, Approved Mining Plan, Topo-sketch of Surrounding 10km Radius Outside) ($) :**	
	Address Line 1 :	M/S RUNGTA MINES LIMITED
	Address Line 2 :	JAJANG IRON AND MANGANESE MINE
	Address Line 3 :	
	State:	ODISHA
	District:	KENDUJHAR
	Sub-District:	JODA
	Village/Town:	Palasa(Kha)
	Latitude:	
	Logitude:	
	Area Type :	Non-Notified
	Area Type Category :	Safe
	Whether industry is MSME:	No
4.	**Communication Address**	
	Address Line 1:	M/S RUNGTA MINES LIMITED (Presently JSW Steel Limited)
	Address Line 2:	BHADRA SAHI, MAIN ROAD
	Address Line 3:	BARBIL
	State:	ODISHA
	District:	KENDUJHAR
	Sub-District:	
	Pincode:	758035
	Phone Number with Area Code:	
	Mobile Number:	91 9861094290
	Fax Number:	
	E-Mail:	mm@jsw.in
5.	**Details of Existing NOC issued by CGWA (enclose copy)**	

Government of India
Ministry of Jal Shakti
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Application Number : 21-4/203/OR/MIN/2009
Old Application Number : 21-4(203)/SER/CGWA/2009
Applied For Renewal : 3rd

	NOC Letter No:	CGWA/NOC/MIN/REN/2/2020/5639
	Date of Issuance:	23/01/2020
	Vailidity (Start):	10/12/2018
	Validity (End):	08/12/2023
	Reason for not applying for renewal before expiry of NOC Validity (Attach Affidavit):	
6.	**Change in Land Use Pattern after execution of Project and Surroundings (10 km Radius - Outside)**	
	The predominant land use in the study is forestland, which covers about 66.09% of the total study area, followed by mining area (9.30%), Current fallow (8.48%), cropland (8.25%), scrubland (4.03 %), water body (2.08 %) and minorly covered by barrenland (0.6%), build -up (0.82%)	

7. Land Use Detail of Project Area

	Land Use Details	Existing (sq meter)	Proposed (sq meter)	Grand Total (sq meter)
	Green Belt Area	387910.00	0.00	387910.00
	Open Land	3985370.00	0.00	3985370.00
	Road/ Paved Area	93030.00	0.00	93030.00
	Rooftop area of building/ sheds	2224460.00	0.00	2224460.00
	Total	6690770.00	0.00	6690770.00

8.	**Whether there is a change in Topography of the Area after the execution of the Project:**		Yes
	a)	**Regional**	Overall study area is comprising of cluster of small hillocks which brings variations in the slopes. The elevation of the study area ranges from 412 to 896 mamsl. The maximun elevation found in the south western part.
	b)	**Project Area**	The elevation in the lease area ranges from 461 to 646 mamsl. The ultimate mining depth will be 481 masl
9.	**Whether there is change in Drainage pattern of the area after the execution of the Project:**		No
	a)	**Regional**	
	b)	**Project Area**	
10.	**Present Townships / Villages within 10 km radius of the Project:-**		Jajang, Jadibahal, Palsa (Ka), Bandhuabeda, Gurudu, Kandhabanda, Jalahari

11.	**Whether the Groundwater Table will be Intersected by Activity :-**				Yes
	(a)	**At What Depth (m bgl)**	**Pre-monsoon**		**Post-monsoon**
		Minimum (m bgl)	4.89		2.50
		Maximum (m bgl)	7.19		5.25
	(b)	**Maximum Depth Proposed to Dewater (m bgl)**	48.00		
	(c)	**Groundwater Flow Direction (Attach Map)($)**	attached in CHR		
	(d)	**Any Other Information**	NA		
12.	**Total Water Requirment for various Purpose to be Mentioned**		**Existing(m3/day)**	**Addition**	**Existing(**	**Additional(**

Government of India
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Department of Water Resources, River Development and Ganga Rejuvenation
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			al (m3/day)	m3/year)	m3/year)
	Ground Water Required through Abstract Structure	1000.00	0.00	365000.00	0.00
	Ground Water Abstracted on account of Dewatering / Mining Seepage	0.00	764.00	0.00	278860.00
	Total Ground Water Withdrawal	1000.00	764.00	365000.00	278860.00

13. Details of De-Watering Structure

(a) De-Watering Existing Structure

Number of Existing Structures: 0

	S.No.	Type of Structure Name / Year of Construction	Depth(Meter) / Diameter(mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours(Day) / Days(Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA /If so Details Thereof

N

(b) De-Watering Requirement and Additional Structure Detail

Number of Proposed Structures: 2

	SNo.	Type of Structure Name / Year of Construction	Depth(Meter) / Diameter (mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours(Day) / Days(Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA/If so Details Thereof
	1	Mining Pits / -	- / -			- / -			Yes	Yes / -
	2	Mining Pits / -	- / -			- / -			Yes	Yes / -

14. Details of Utilization of Pumped Water (Please Attach Details) (m3/year) ($)

(a)	**Water Supply**	Yes	164250.00	About 450 m3/day rainwater accumulated in mine pits will be used for mobile water tanker
(b)	**Agriculture**	No		
(c)	**Green Belt Development**	No		
(d)	**Suppression of Dust**	Yes	114610.00	314 m3/day of mine seepage water will be used for dust suppression though fixed water sprinkler
(e)	**Recharge**	No		
(f)	**Any Other Item**	1000 m3/day will be from 7 existing borewells for domestic and drinking and other mining activities		

15. Monitoring of Ground Water Regime (Attach Map($))

(a)	**Location Details of the Wells / Piezometers (Latitute, Longitude, Reduced Level)**	No. of existing piezometer - 2 geotagged photos attached in CHR	

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

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Old Application Number : 21-4(203)/SER/CGWA/2009
Applied For Renewal : 3rd

	(b)	**Number of Wells / Piezometers**	No. of existing wells 7
	(c)	**Attach Details of GW Level of Observation Wells / Piezometers(At Least for One Year)($)**	attached in CHR
	(d)	**General Quality of GW in the Area & Surroundings ($)**	attached in CHR
	(e)	**Any Other Item**	NA

16.	**Give the details of change in groundwater regime and quality after execution of the project (Attach detailed report with Map showing GW flow direction($))**
	GW flow direction and GW regimes attached in CHR and GW modelling report

17. Proposed Pump / Pumping Groundwater Outside the Mine Pit for Domestic or Other Use (If so, give Details):

Number of Existing Structures: 0

SNo.	Type of Structure Name / Year of Construction	Depth(Meter) / Diameter(mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours(Day) / Days(Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA/If so Details Thereof
1	Borewell								Yes
2	Borewell								Yes
3	Borewell								Yes
4	Borewell								Yes
5	Borewell								Yes
6	Borewell								Yes
7	Borewell								Yes

Number of Additional Structures: 0

SNo.	Type of Structure Name / Year of Construction	Depth(Meter) / Diameter(mm)	Depth to Water Level (Meters below Ground Level)	Discharge (m3/Hour)	Operational Hours(Day) / Days(Year)	Mode of Lift Name	Horse Power of Pump	Whether fitted with Water Meter	Whether Permission Registered with CGWA/If so Details Thereof

18. (a). Compliance to the Condition prescribed in the NOC

SNo.	Conditions given in NOC	Compliance Conditions Applicable	Status of Compliance

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

Application Number : 21-4/203/OR/MIN/2009
Old Application Number : 21-4(203)/SER/CGWA/2009
Applied For Renewal : 3rd

	1	Area Specific Plantation	Yes	7.6 ha plantation area
	2	Domestic Water School Sanitation	No	
	3	Groundwater quality monitoring - Pre monsoon and Post monsoon	Yes	attached in CHR
	4	Maintenance of recharge structures	Yes	
	5	Number of Pizometers as per NOC and Water Level Record	Yes	2 piezometer as per NOC
	6	Number of Tubewells Borewales as per NOC	Yes	7 existing borewells as per NOC
	7	Pizometer fitted with AWLRs with telemetrry as per NOC	Yes	details attached in compliance form
	8	Quantum of Groundwater as per NOC	Yes	
	9	Recharge through ponds	Yes	2 settling ponds, artificial Recharge structure with 2 borewells constructed in the mine colony
	10	Recycle and reuse of water	Yes	
	11	RWH and AR structures implemented	Yes	1 Recharge Pit (Bores of 110 feet and 120 feet) 1 Rooftop Rain Water Harvesting Collection Chambers Details attached in CHR
	12	Submission of Compliance report to the Region	Yes	GW quarterly reports
	13	Water conservation measures	Yes	2 settling ponds with storage capacity of 57,280 m3
	14	Water Security Plan of villages	No	
	15	Well monitored around the plant premises	Yes	attached in CHR report
	16	Wells fitted with water meter and its Record	Yes	details attached in compliance form

(b). Compliance to the Condition prescribed in the NOC - Other

SNo.	Conditions given in NOC	Status of Compliance
No Record Found!		

19.	**Gainful utilization of pump water:-**
	Drinking and Domestic - 880 kld, ETP and Wheel washing - 45 kld, Plantation - 30 kld, Dry fog system - 29 kld, Mobile water Tanker- 450 kld, Fixed water Sprinkler - 314 kld
20.	**Details of Rainwater Harvesting and Artificial Recharge Measures for Groundwater Recharge in the Area:-**
	details attached in CHR

MINING USE- Self Declaration

☑ I hereby certify that the data and information furnished above are true to the best of my knowledge and belief and I am aware that if any part of the data / information submitted is found to be false or misleading at any stage, the application will be rejected outright.

I hereby declare that all the mandatory documents prescribed in the application form have been uploaded and no blank

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

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/irrelevant documents have been uploaded. I am also aware that any false/ wrong submission /uploading of document will lead to rejection of my application without any notice.

It is to certify that no case related to ground water withdrawal/ contamination is pending against the industry/ project/ unit as on date. Any such case filed against the company/ project/ unit in respect of ground water withdrawal/ contamination during the pendency of this application shall be immediately brought to the notice of CGWA.

I hereby undertake that in case any environmental compensation/ penalty is imposed on the firm by any statutory authority, I shall comply with the decision of such authority.

1. Application Proforma is subject to modification from time to time.

2. Application is submitted online on website http://cgwa-noc.gov.in to following office.

Regional Director,Central Ground Water Board South Eastern Region, Bhujal Bhawan, Khandagiri Square, NH-5, Bhubaneshwar, KHORDHA, ODISHA, 751030

3. Incomplete application will be summarily rejected.

Scanned copy of last page of application with signature and seal should be attached at presribed place before submission of application.

4. Reciept of Processing Fee of Rs. 5000.00/- (Rupees Five Thousand Only) submitted through NON TAX RECEIPT PORTAL (https://bharatkosh.gov.in) should be attached along with hard copy of application.

Processing Fee:-

Bharat Kosh Transaction Ref. No:-	
Bharat Kosh Transaction Date:-	

Note:- The Processing Fee is Non-Refundable. Applicant should ensure and Check Eligibility of Submission of Application and Required Documents before Submitting Online Application.

5.	Hard copy of application required:		No	
6.	Ground Water Quality Approved	Not Define	Ground Water Charge Required:	Not Define
	Ground Water Charge Recieve:	No	Ground Water Charge Amount:	
			Ground Water Arear Amount:	

Attached Files:

1). GroundWater flow Direction Map: (Refer:11-C)

S.No	Attachment Name	File Name
1	GW flow direction map	GW flow direction map.pdf

2). GW Level of Observation Wells / Piezometer : (Refer:15-C)

S.No	Attachment Name	File Name
1	observation well data	Observation well data.pdf

3). General Quality of Ground Water in the Area : (Refer:17-D)

S.No	Attachment Name	File Name

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

Application Number : 21-4/203/OR/MIN/2009
Old Application Number : 21-4(203)/SER/CGWA/2009
Applied For Renewal : 3rd

1	GW quality reports	Water quality reports.pdf

4). Changes in Topogpraphy : (Refer: 8)

No Attachment Found!

5). Changes in Drainage Pattern : (Refer: 9)

No Attachment Found!

6). Reason for Not Applying for Renewal before Expiring NOC : (Refer: 5)

No Attachment Found!

7). Existing NOC : (Refer: 5)

S.No	Attachment Name	File Name
1	Existing NOC	jswrevised noc (3).pdf

8). Compliance to the Condition prescribed in the NOC : (Refer: 17-a)

SNo.	Conditions given in NOC	Attachments		
		S.No.	Attachment Name	File Name
1	Area Specific Plantation	No Attachment Found!		
2	Domestic Water School Sanitation	No Attachment Found!		
3	Groundwater quality monitoring - Pre monsoon and Post monsoon	No Attachment Found!		
4	Maintenance of recharge structures	No Attachment Found!		
5	Number of Pizometers as per NOC and Water Level Record	No Attachment Found!		
6	Number of Tubewells Borewales as per NOC	No Attachment Found!		
7	Pizometer fitted with AWLRs with telemetrry as per NOC	No Attachment Found!		
8	Quantum of Groundwater as per NOC	No Attachment Found!		
9	Recharge through ponds	No Attachment Found!		
10	Recycle and reuse of water	No Attachment Found!		
11	RWH and AR structures implemented	No Attachment Found!		
12	Submission of Compliance report to the Region	No Attachment Found!		
13	Water conservation measures	No Attachment Found!		
14	Water Security Plan of villages	No Attachment Found!		

Application for Renewal of NOC to Dewater Ground Water for Mining Industry (Application for Renewal of NOC)

Application Number : 21-4/203/OR/MIN/2009
Old Application Number : 21-4(203)/SER/CGWA/2009
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	15	Well monitored around the plant premises	No Attachment Found!
	16	Wells fitted with water meter and its Record	No Attachment Found!

9). Compliance to the Condition prescribed in the NOC - Other : (Refer: 17-b)

	SNo.	Conditions given in NOC	Attachments		
			S.No.	Attachment Name	File Name

10). Extra Attachment :

S.No	Attachment Name	File Name
1	wetland certificate	wetland certifiate.pdf
2	GW modelling report	GWM_JSW_Jajang_OCM_20231206.pdf
3	CHR report	Final CHR of Jajang Iron Ore Mine_08122023_compressed.pdf

11). Bharat Kosh Reciept (Porcessing Fee):

No Attachment Found!

12). Application with Signature and Seal:

S.No	Attachment Name	File Name
1	Application with signature	Application for renewal of NOC.pdf

13). MSME certificate in case of MSME:

No Attachment Found!

Name & Signature of the applicant

Date : 03.04.2024

Place : BARBIL

Associated User : baswaraj1977
Submitted By User : baswaraj1977
Submission Date : 11/12/2023

* In case signed by any authorized signatory, the details of the signatory with the authorization shall be enclosed.

ANNEXURE IV

By Post/ e-mail

GOVERNMENT OF ODISHA

FOREST, ENVIRONMENT & CLIMATE CHANGE DEPARTMENT

*****

No.FE-DIV-FLD-0007-2022-5306/FE&CC, Date 14.03.22

10F (Cons) 106/2013

From

Sri Lingaraj Otta

OSD-cum-Special Secretary to Government

To

The Principal Chief Conservator of Forests & HoFF, Odisha,

Bhubaneswar.

Sub: Transfer of FC approval granted under the Forest (Conservation) Act, 1980 for mining lease from Old lessee M/s Rungta Mines Ltd to new Lessee M/s JSW Steel Ltd as per the provision of the Mines and Minerals (Development and Regulation) Amendment Act, 2021 in respect of Jajang Iron Ore Block under Keonjhar Forest Division, Barbil Tahasil, Dist-Keonjhar for diversion of 447.811 ha of forest land (including 44.70 ha Revenue forest land already diverted)-Compliance of Final approval Order regarding.

Sir,

I am directed to invite a reference to your letter No.1751/9F(MG)-75/2021 dtd.31.01.2022 seeking transfer of FC approval granted under the Forest (Conservation) Act, 1980 for mining lease from Old lessee M/s Rungta Mines Ltd to New lessee M/s JSW Steel Ltd as per the provision of the Mines and Minerals (Development and Regulation) Amendment Act, 2021 in respect of Jajang Iron Ore Block under Keonjhar Forest Division, Barbil Tahasil, Dist-Keonjhar for diversion of 447.811 ha of forest land (including 44.70 ha Revenue forest land already diverted) and with reference to letter File No.FC-11/112/2020-FC (Pt) dtd.07.07.2021 of Govt. of India, MoEF&CC, FC Division, New Delhi.

After careful consideration of the proposal of PCCF & HoFF, Odisha and in pursuance of the guidelines issued by Govt. of India, MoEF &CC vide File No. FC-11/112/2020-FC (Pt) Dated 7th July, 2021, the transfer of approval granted by Govt. of India, MoEF&CC under Section 2 of the Forest (Conservation) Act,

1980 vide F. No.8-88/98-FC (Vol) dtd.28.08.2014 from the erstwhile User Agency M/s Rungta Mines Ltd to M/s JSW Steel Ltd is hereby accorded by the State Govt. for non-forestry use of 447.811 ha of forest land for mining in Jajang Iron Ore Block under Keonjhar Forest Division, Barbil Tahasil, Dist-Keonjhar, Odisha subject to fulfilment of the following conditions.

i. DGPS Survey of 447.811 ha of diverted forest area is to be ensured by DFO, Keonjhar Forest Division in field before handing over the area.
ii. The DFO, Keonjhar Forest Division shall upload the KML files of the area under diversion and the accepted non-forest land for raising Compensatory Afforestation in the e-green watch portal of FSI before handing over forest land to the new lessee.
iii. Erstwhile lessee has deposited the NPV over 543.528 ha forest land which includes the diverted forest area of 447.811 ha. The amount deposited by the new lessee @ Rs.7.50 Lakh per ha is the lumpsum amount realized by State Government on issue of LoI (for the total forest area within the mining lease), which may be adjusted towards balance NPV and any compensatory levies payable in future.
iv. The new lessee shall furnish an undertaking to pay the additional NPV, if so determine, as per the decision of the Hon'ble Supreme Court of India.
v. The new lessee shall also comply the non-complied conditions and if any pointed out by the Govt. of India, MoEF &CC, IRO, Bhubaneswar after conducting the inspection of the area for the appraisal of compliance of approval granted under Forest (Conservation) Act, 1980.
vi. The new lessee, after ceasing mining operation, shall undertake re-grassing the mining area and any other areas which may have been disturbed due to their mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc.
vii. Forest Clearance over 102.938 ha forest land will be transferred to the new lessee after issue of FC transfer order and forest clearance over 344.873 ha will be transferred to the new lessee after acceptance of the CA land by the DFO, Keonjhar Forest Division as per the extant procedure for acceptance of CA land.
viii. The new lessee shall have to submit the fresh diversion proposal for the balance forest area of 96.105 ha (99.052 ha as per DGPS) for seeking approval under Section 2 (ii) of FC Act, 1980.
ix. Execution of project activities by the new lessee will be subject to availability of all other statutory clearances required under relevant Acts/Rules for this mining project and compliance of Court's order, if any.

Yours faithfully

14/12/2022

OSD-cum-Special Secretary to Government

FE-DIV-FLD-0007-2022/1/2022

Memo No. 5307 /FE&CC, Date 14-03-22

Copy forwarded to the Assistant Inspector General of Forests (FC), Government of India, Ministry of Environment, Forests & Climate Change (F.C. Division), Indira Paryavaran Bhawan, Alinganj, Jor Bagh Road, New Delhi-110003 for information and necessary action.

dt 14/3/2022
OSD-cum-Special Secretary to Government

Memo No. 5308 /FE&CC, Date 14-03-22

Copy forwarded to the Deputy Director General of Forests (Central), Govt. of India, MoEF&CC, IRO, A/3, Chandrasekharpur, Bhubaneswar for information and necessary action.

dt 14/3/2022
OSD-cum-Special Secretary to Government

Memo No. 5309 /FE&CC, Date 14-03-22

Copy forwarded to the Principal Chief Conservator of Forests (Wildlife), Chief Wildlife Warden, Odisha / Principal Chief Conservator of Forests (FD&NO), FC Act, O/o PCCF & HoFF, Odisha for information and necessary action.

dt 14/3/2022
OSD-cum-Special Secretary to Government

Memo No. 5310 /FE&CC, Date 14-03-22

Copy forwarded to the Regional Chief Conservator of Forests, Rourkela Circle / Divisional Forest Officer, Keonjhar Forest Division for information and necessary action.

dt 14/3/2022
OSD-cum-Special Secretary to Government

Memo No. 5311 /FE&CC, Date 14-03-22

Copy forwarded to Steel & Mines Department / R&DM Department/ Director Environment-cum-Special Secretary to Government, FE&CC Department / Director of Mines, Odisha / Member Secretary, SPCB, Odisha/ Collector, Keonjhar for information and necessary action.

dt 14/3/2022
OSD-cum-Special Secretary to Government

Memo No. 5312 /FE&CC, Date 14-03-22

Copy forwarded to the Authorized Signatory, M/s JSW Steel Ltd, Plot No.3, Forest Park, Sishu Bhawan Square, Bhubaneswar-751009 for information and

necessary action.

14/3/2022

OSD-cum-Special Secretary to Government

Memo No. 5313 /FE&CC, Date 14-03-22

Copy forwarded to M/s Rungta Mines Ltd, Chaibasa, Dist-West Singhbhum, Jharkhand-833201 / M/s Rungta Mines Ltd, Main Road, Barbil, Dist-Keonjhar, Pin-758035, Odisha for information and necessary action.

14/3/2022

OSD-cum-Special Secretary to Government

ANNEXURE V

JSW Steel Limited

Regd. Office: JSW Centre
Bandra Kurla Complex,
Bandra (East), Mumbai – 400 051
CIN : L27102MH1994PLC152925
Phone : +91 22 4286 1000
Fax : +91 22 4286 3000
Website : www.jsw.in

Letter No.- JSW/S/CO/2023/773 **Date-28.11.2023**

To,

The Principal Chief Conservator of Forests
(Forest Division & Nodal Officer, FC Act)
O/o the Principal Chief Conservator of Forests
Odisha, Bhubaneswar

Sub: Diversion of 46.757 ha of forest land (Including 2.721 ha Safety Zone) within the mining lease of 669.078 Ha in Jajang Iron Ore Block of M/s. JSW Steel Ltd. under Keonjhar Forest Division, District Keonjhar, Odisha (Single Window No. SW/152075/2023, Proposal No. FP/OR/MIN/QRY/452888/2023)

Sir,

In reference to the subject cited above, we would like to inform you that we have submitted the online application of diversion proposal over 46.757 ha forest land (Including 2.721 Ha Safety zone) in respect of Jajang Iron Ore Mines of M/s JSW Steel Ltd under Keonjhar Forest Division of Keonjhar District

Now, we are submitting herewith the hard copy of the said proposal for your kind information and necessary action.

Thanking You

Yours faithfully

FOR JSW STEEL LTD.

Manthrajaya Mahapatra

(Authorized Signatory)

Encl: Hard Copies of Forest Diversion proposal.

PRINCIPAL CHIEF CONSERVATOR OF FORESTS &
ODISHA, BHUBANESWAR
1 - DEC 2023 (2 nos D.B.)
Received No. 3
Sec.....JINDAL...Part of O.P.Jindal Group

ANNEXURE VI

SUMMARY

OF

ENVIRONMENTAL MONITORING REPORT

(OCTOBER 2023 TO MARCH 2024)

FOR

JAJANG IRON ORE MINE

DISTRICT—KEONJHAR, ODISHA

OF

M/S JSW STEEL LIMITED, ODISHA

ENV MONITORING CARRIED OUT

BY

ECOMEN MINING PVT.LTD

Ecomen Mining Pvt. Ltd.
(An approved Laboratory from MoEF & CC & NABL)
B-1/8, Sector-H, Aliganj, Lucknow 226 024 (U.P.)
Phone No.: (91-522) 2746282; Fax No.: (91-522) 2745726
E-mail: contactus@ecomen.in

Environmental Monitoring Report- Jajang Iron Ore Mines of M/s JSW Steel Limited, Odisha during the period (OCTOBER 2023 to MARCH 2024)

1. Ambient Air Quality Lease Area

Si. No.	Location	Month	Concentration	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3
1.	Near Mines Office	Oct'23	Maximum	68.1	26.8	18.6	19.6	0.66
			Minimum	54.2	18.4	12.5	13.2	0.51
			Average	**63.3**	**23.6**	15.5	15.8	0.6
		Nov'23	Maximum	71.9	21.9	16.9	18.8	0.55
			Minimum	67.0	18.0	14	15.3	0.52
			Average	69.4	20.2	15.4	16.8	0.5
		Dec'23	Maximum	71.9	21.9	16.8	19.8	0.56
			Minimum	67.1	18	14.1	15	0.52
			Average	68.98	19.55	15.15	17.01	0.54
		Jan'24	Maximum	76.9	18.3	16.1	15.1	0.55
			Minimum	70.10	21.69	17.50	16.65	0.59
			Average	73.81	21.59	17.52	16.61	0.59
		Feb'24	Maximum	76.9	24.9	19.0	19.0	0.64
			Minimum	69	18.2	16.0	15.1	0.55
			Average	72.75	21.00	17.54	16.95	0.60
		March'24	Maximum	77	24.7	18.9	18.7	0.64
			Minimum	69.1	18.1	16.0	15.2	0.55
			Average	72.43	21.25	17.36	16.99	0.60
		Oct'23	Maximum	66.6	25.4	15.9	19.2	0.92
			Minimum	57.8	17.8	11.7	15.1	0.53
			Average	61.6	21.1	13.8	17.1	0.7

Si. No.	Location	Month	Concentration	PIlio µg/m³	PM2.5 µg/m³	SO2 µg/m³	NO2 µg/m³	CO mg/m³
2.	Entry And Exit Gate	Nov'23	Maximum	71.5	21.7	16.9	19	0.55
			Minimum	67.1	18.0	14	15.5	0.52
			Average	69.5	19.8	15.4	17.7	0.5
		Dec'23	Maximum	71.5	21.7	16.9	19	0.55
			Minimum	67.1	18	14	15.5	0.52
			Average	69.60	19.73	15.39	17.75	0.53
		Jan'24	Maximum	76.8	25	19	18.9	0.64
			Minimum	69.4	18.1	16.1	15	0.55
			Average	72.55	21.10	17.57	17.35	0.60
		Feb'24	Maximum	76.7	24.6	19	19	0.64
			Minimum	69.3	18	16.1	15.4	0.55
			Average	72.59	21.16	17.66	17.26	0.59
		March'24	Maximum	76.9	25	18.9	19	0.63
			Minimum	69	18	16.1	15.3	0.55
			Average	73.27	20.87	17.66	16.83	0.59
3.	Guest House	Oct'23	Maximum	67.3	30.3	16.4	17.4	0.83
			Minimum	50.1	16.3	11.6	11.2	0.55
			Average	58.7	23.3	13.8	14.8	0.7
		Nov'23	Maximum	72.5	23.0	19	18.8	0.55
			Minimum	65.1	16.5	14	14	0.45
			Average	69.2	19.6	16.3	15.9	0.5
		Dec'23	Maximum	72.5	23	19	18.8	0.55
			Minimum	65.1	16.5	14.2	14	0.45
			Average	69.28	19.59	16.20	15.94	0.51
		Jan'24	Maximum	77	24.9	19	18.9	0.64
			Minimum	69.9	18.1	16.1	15.3	0.55
			Average	73.04	21.51	17.24	17.08	0.60

Sl. No.	Location	Month	Concentration	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3
		Feb'24	Maximum	76.7	24.6	18.7	18.7	0.63
			Minimum	69.1	18.2	16.2	15.1	0.55
			Average	73.00	21.26	17.50	17.24	0.59
		March'24	Maximum	76.8	24.8	18.7	19	0.64
			Minimum	69.3	18.4	16.1	15	0.55
			Average	73.14	21.46	17.41	16.96	0.59
4.	Near Work Shop	Oct'23	Maximum	62.4	28.8	18.1	20.2	0.62
			Minimum	55.9	23.8	11.6	11.7	0.5
			Average	58.2	26.1	14.6	16.2	0.6
		Nov'23	Maximum	71.9	22.0	17	18.8	0.55
			Minimum	67.3	18.0	14.1	15.1	0.52
			Average	69.8	19.9	15.7	16.7	0.5
		Dec'23	Maximum	71.9	22	17	18.8	0.55
			Minimum	67.3	18	14.1	15.1	0.52
			Average	69.75	19.85	15.75	16.74	0.54
		Jan'24	Maximum	76.3	24.9	18.9	18.9	0.64
			Minimum	69	18.1	16.1	15.1	0.55
			Average	73.19	20.68	17.33	16.93	0.60
		Feb'24	Maximum	76.2	24.6	18.9	18.9	0.64
			Minimum	69.2	18.1	16	15	0.55
			Average	72.74	20.94	17.57	16.83	0.59
		March'24	Maximum	75.80	24.80	19.00	18.70	0.63
			Minimum	69.2	18.1	16.1	15.4	0.56
			Average	72.02	21.17	17.42	17.26	0.60
CPCB Standard			**24 Hrly**	**100**	**60**	**80**	**80**	**4 (1Hrly)**
			Annual Average	**60**	**40**	**40**	**50**	**--**

2. Ambient Air Quality Buffer Area

Si. No.	Location	Month	Concentration	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3
1.	Jajang Village	Oct'23	Maximum	50.5	15.9	14.4	15.5	0.46
			Minimum	48.5	11.3	12.7	12.3	0.43
			Average	**49.3**	**13.1**	13.4	14.2	0.4
		Nov'23	Maximum	48.0	18.6	14.8	16.1	0.43
			Minimum	42.4	15.2	12.4	13.5	0.39
			Average	**45.6**	**17.4**	13.8	14.7	0.4
		Dec'23	Maximum	46.9	17.7	13.6	15.2	0.42
			Minimum	42.8	15.1	12	13.8	0.39
			Average	44.86	16.40	12.75	14.49	0.41
		Jan'24	Maximum	37.6	12.2	12.6	12.1	0.43
			Minimum	34.2	10.5	9.1	10.7	0.32
			Average	35.63	11.48	10.70	11.48	0.39
		Feb'24	Maximum	38.5	12.9	12.2	12.8	0.40
			Minimum	34.5	10.6	9.6	10.4	0.31
			Average	36.53	11.79	10.99	11.78	0.35
		March'24	Maximum	38.5	12.9	12.2	12.8	0.40
			Minimum	34.5	10.6	9.6	10.4	0.31
			Average	36.53	11.79	10.99	11.78	0.35
		Oct'23	Maximum	44.9	14.9	14.7	15.2	0.47
			Minimum	42.5	11.6	12.2	11.3	0.43
			Average	**43.7**	**13.7**	13.2	12.8	0.5

Si. No.	Location	Month	Concentration	PIlio µg/m³	PM2.5 µg/m³	SO2 µg/m³	NO2 µg/m³	CO mg/m³
2.	Jaribahal Village	Nov'23	Maximum	46.9	18.2	14.9	16.5	0.44
			Minimum	42.3	15.1	12	13.5	0.4
			Average	**45.1**	**16.5**	13.7	15.3	0.4
		Dec'23	Maximum	46.9	18.2	14.5	17	0.44
			Minimum	42.3	15.1	12.1	14.3	0.4
			Average	45.1	16.51	13.33	15.56	0.42
		Jan'24	Maximum	38.6	12.9	12.8	12.9	0.41
			Minimum	35	10.1	9.5	10.6	0.34
			Average	37.14	11.84	10.85	11.76	0.37
		Feb'24	Maximum	39.4	12.9	12.7	12.8	0.42
			Minimum	34.9	10.2	9.4	10.1	0.33
			Average	37.05	11.71	11.15	11.65	0.37
		March'24	Maximum	37.6	12.8	12.5	12.9	0.42
			Minimum	34.4	10.2	9.1	10.6	0.32
			Average	36.23	11.53	10.94	11.94	0.39
3.	Bandhabeda Village	Oct'23	Maximum	45.5	15.1	14.8	16	0.47
			Minimum	42.1	12.2	12.2	11.1	0.42
			Average	**43.7**	**13.7**	13.5	14.2	0.4
		Nov'23	Maximum	47.3	17.8	14.5	17	0.44
			Minimum	43.3	15.2	12.1	14.3	0.4
			Average	**44.9**	**16.9**	13.3	15.6	0.4
		Dec'23	Maximum	47.3	17.8	14.9	16.5	0.44
			Minimum	43.3	15.2	12	13.5	0.4
			Average	44.94	16.93	13.66	15.33	0.42
		Jan'24	Maximum	38.1	12.6	12.7	12.8	0.43
			Minimum	34.2	10	9.4	10.2	0.33
			Average	36.08	11.19	10.69	11.18	0.39

Sl. No.	Location	Month	Concentration	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO mg/m^3
		Feb'24	Maximum	39.9	12.2	12.4	12.9	0.43
			Minimum	34.4	10	9.3	11.3	0.31
			Average	36.56	10.69	11.08	12.25	0.37
		March'24	Maximum	38.9	12.4	12.4	12.7	0.42
			Minimum	35.3	10.5	9.8	10.1	0.31
			Average	37.31	11.50	10.90	11.10	0.37
4.	Kamalpur Village	Oct'23	Maximum	43.7	15.6	15.1	15.6	0.47
			Minimum	40.1	12.7	12.2	12.2	0.42
			Average	**41.6**	**14.2**	13.5	13.8	0.4
		Nov'23	Maximum	47.9	18.9	14.8	16.9	0.44
			Minimum	42.7	15.7	12.8	13.5	0.4
			Average	**45.5**	**17.5**	14.0	14.9	0.4
		Dec'23	Maximum	47.9	18.9	14.8	16.9	0.44
			Minimum	42.7	15.7	12.6	13.5	0.41
			Average	45.40	17.40	13.95	14.89	0.43
		Jan'24	Maximum	39.9	12.8	12.2	12.9	0.4
			Minimum	35.4	10.4	10	10.3	0.31
			Average	37.33	11.64	10.96	11.71	0.37
		Feb'24	Maximum	39.9	12.9	12.3	12.3	0.4
			Minimum	34.7	10.1	9.4	10.1	0.31
			Average	37.48	11.21	10.63	11.01	0.38
		March'24	Maximum	37.4	12.7	12.6	12.4	0.42
			Minimum	34.7	10.1	9.7	10.3	0.31
			Average	35.95	11.29	10.59	11.34	0.37

3. Fugitive Emission Monitoring (µg/m³)

Sl. No.	Month	Screen Plant/Smita Plant		Waste Dump/Hatipit area		Mines Face Bench	
1.	Oct'23	Max	Min	Max	Min	Max	Min
		684.9	612.2	693.2	635.1	695.2	622.5
2.	Nov'23	776.9	709.3	766.7	711.3	773.5	701.1
3.	Dec'23	744.5	671.9	766.7	711.3	759.3	653.2
4.	Jan'24	727.1	646.3	722.8	643.5	715.2	672.9
5.	Feb'24	720.7	643.4	720.6	658.1	718.5	645.2
6.	March'24	687.8	642.7	722.1	642	726.7	648.2
Six Month Average		**723.65**	**654.3**	**732.02**	**666.9**	**731.4**	**657.2**

Sl. No.	Month	Crusher Plant		Ore storage & Loading Point		Mines Haulage Road/Road no-2	
1.	Oct'23	Max	Min	Max	Min	Max	Min
		687.6	635.8	576.3	531.2	587.5	524.8
2.	Nov'23	774.2	692.2	774.2	692.2	587.5	524.8

3.	Dec'23	745.2	674.9	749.1	650.4	742.3	670.4
4.	Jan'24	721.8	641.6	724.3	659	707.7	650.8
5.	Feb'24	716.2	646.2	710.6	655	722.9	650.6
6.	March'24	716.4	641.9	725.8	642.6	722	644.4
Six Month Average		**726.9**	**655.4**	**710.1**	**638.4**	**678.3**	**611.0**

4. ILLUMINATION MONITORING (Lux)

	Oct 23		Nov 23		Dec 23	
LOCATION	**Horizontal**	**Vertical**	**Horizontal**	**Vertical**	**Horizontal**	**Vertical**
Workshop Area	97.0	102.0	120.0	93.0	119.4	91.0
Screen Plant	90.1	157.8	90.1	86.8	94.1	76.8
Haul Road	97.4	122.0	97.4	86.0	87.4	86.2
Loading Point	50.2	85.9	64.2	87.9	62.2	87.9
Crusher Plant	135.3	158.4	124.3	154.4	114.3	124.4
Parking Yard	74.0	82.0	78.0	85.0	75.0	85.7
Permanent Path	48.6	89.0	58.6	95.0	68.6	91.0
Electric Substation	102.5	117.7	122.5	112.7	112.5	122.7
Rest Shelter	97.0	117.0	87.0	107.0	87.0	117.0
Mines Bench Foot Path	35.4	55.8	55.4	75.8	65.4	75.4
	Jan 24		**Feb 24**		**March 24**	
LOCATION	**Horizontal**	**Vertical**	**Horizontal**	**Vertical**	**Horizontal**	**Vertical**
Workshop Area	128.0	110.0	128.0	120.0	138.0	115.0
Screen Plant	132.1	110.8	132.1	110.8	122.1	108.8
Haul Road	61.3	48.9	61.3	48.9	65.3	58.9
Loading Point	58.5	43.9	58.5	53.9	68.5	43.9
Crusher Plant	109.3	105.4	110.3	105.4	115.3	105.4
Parking Yard	85.0	96.0	75.0	94.0	90.0	96.0
Permanent Path	48.6	85..0	48.6	85..0	61.6	88..0
Electric Substation	102.5	153.7	120.5	153.7	112.5	156.7
Rest Shelter	35.0	40.0	35.0	41.0	40.0	43.0
Mines Bench Foot Path	54.4	48.8	52.4	45.2	62.4	53.8

5. Noise Level {dB(A)}

A. Ambient Noise Monitoring

Location	Oct 23		Nov 23		Dec 23		Standards	
	Leq Day	Leq Night	Leq Day	Leq Night	Leq Day	Leq Night	Leq Day	Leq Night
GUEST HOUSE AREA	52.6	45.8	53.3	42.6	69.2	70.5	55 dB(A)	45 dB(A)
EAST BOUNDARY	58.2	47.4	71.5	64.6	71.3	71.6	75 dB(A)	70 dB(A)
WEST BOUNDARY	66.8	57.8	71.9	62.8	70.5	68.4	75 dB(A)	70 dB(A)
NORTH BOUNDARY	59.4	63.2	68.5	67.0	72.7	66.4	75 dB(A)	70 dB(A)
SOUTH BOUNDARY	58.3	56.5	68.8	68.0	72.8	68.4	75 dB(A)	70 dB(A)
Location	**Jan 24**		**Feb 24**		**March 24**		**Standards**	
	Leq Day	**Leq Night**	**Leq Day**	**Leq Night**	**Leq Day**	**Leq Night**	**Leq Day**	**Leq Night**
GUEST HOUSE AREA	62.1	66.7	66.3	69	66	65.1	55 dB(A)	45 dB(A)
EAST BOUNDARY	66.7	63.8	64.4	69.9	64.1	62.4	75 dB(A)	70 dB(A)
WEST BOUNDARY	61	64.8	68	61.6	61.7	70	75 dB(A)	70 dB(A)
NORTH BOUNDARY	68.2	65.2	61.4	61.5	62.9	61.4	75 dB(A)	70 dB(A)
SOUTH BOUNDARY	72.7	65.1	65.8	67.8	62.2	68.8	75 dB(A)	70 dB(A)

B. Source Noise Monitoring

CORE ZONE	Oct 23				Nov 23			
	Week-1	Week-2	Week-3	Week-4	Week-1	Week-2	Week-3	Week-4
	Leq				Leq			
DUMPER	70.2	67.4	70.6	70.6	68.0	71.2	71.6	70.7
LOADER	59.3	70.2	69.2	71.2	68.1	70.1	70.7	72.1
CRUSHER PLANT	68.5	69.3	67.4	71.2	69.1	70.1	71.1	69.7
SCREEN PLANT	62.8	71.4	71.6	68.5	71.0	70.6	71.1	72.1
MINES OFFICE	69.7	63.2	69.3	73.2	71.5	71.5	69.2	71.8
EXCAVOTAR	74.2	73.2	74.6	74.6	71.2	68.8	69.4	72.9
DOZER	71.6	72.6	70.4	72.4	71.4	72.7	71.3	70.2

CORE ZONE	Dec 23				Jan 24			
	Week-1	Week-2	Week-3	Week-4	Week-1	Week-2	Week-3	Week-4
	Leg				Leg			
DUMPER	69.1	71.2	71.6	70.7	72.7	67.8	68.5	67.7
LOADER	73.4	70.1	70.7	72.1	70	71.7	70.9	69.9
CRUSHER PLANT	67.3	70.1	71.1	69.7	72	72.1	69	67.4
SCREEN PLANT	70.1	70.6	71.1	72.1	72.2	68.9	71.4	68.8
MINES OFFICE	69.9	71.5	69.2	71.8	69.5	67.4	71.4	69.6
EXCAVOTAR	67.7	68.8	69.4	72.9	73.3	73.2	72.3	73.5
DOZER	68.1	72.7	71.3	70.2	71.7	69.7	68.3	67.6
CORE ZONE	**Feb 24**				**March 24**			
	Week-1	Week-2	Week-3	Week-4	Week-1	Week-2	Week-3	Week-4
	Leg				Leg			
DUMPER	70.7	67.9	73.9	70.6	71.2	72.6	73.9	69.4
LOADER	70.7	72.2	73.7	72.8	67.2	67	73.7	68.3
CRUSHER PLANT	73.6	69.3	67.9	72.4	70	73.2	67.9	68.3
SCREEN PLANT	68.8	69.5	69.5	71.3	67.7	71.7	69.5	68.1
MINES OFFICE	72.7	73.4	67.1	73.8	73.6	67.8	67.1	69.1
EXCAVOTAR	68.3	69.5	70.2	74	72.3	72.4	70.2	68.6
DOZER	67.5	72.1	68.3	68.5	69.9	69.3	68.3	71.9

6. Surface Water Quality

JAJANG IRON ORE MINE								
Baitarini River UpStream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	6.88	6.95	6.91	6.81	6.84	6.82	**6.5-8.5**
Total Dissolved Solids	**mg/l**	224	236	240	248	244	244	**1500**
BOD	**mg/l**	6.8	6.5	4.5	6.6	6.8	6.2	**3**
DO	**mg/l**	7.1	6.9	6	6.5	6.7	6.7	**4**
Chlorides	**mg/l**	28	24	22	28	28	20	**600**
Fluorides	**mg/l**	0.28	0.3	0.28	0.28	0.35	0.28	**1.5**
Iron	**mg/l**	0.16	0.14	0.12	0.16	0.16	0..21	**50**
Baitarini River DownStream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**

PH	**-**	7.29	7.35	7.38	7.2	7.49	7.49	**6.5-8.5**
Total Dissolved Solids	**mg/l**	248	260	269	272	278	272	**1500**
BOD	**mg/l**	5.4	5.7	5	5.5	5.9	6	**3**
DO	**mg/l**	7.5	7.5	6.5	7.2	8	7.3	**4**
Chlorides	**mg/l**	36	40	36	44	44	44	**600**
Fluorides	**mg/l**	0.46	0.48	0.42	0.45	0.45	0.45	**1.5**
Iron	**mg/l**	0.27	0.25	0.22	0.23	0.22	0.27	**50**
Suna River Upstream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	6.78	6.86	6.91	6.95	6.95	6.94	**6.5-8.5**
Total Dissolved Solids	**mg/l**	184	210	222	224	224	224	**1500**
BOD	**mg/l**	4.6	4.4	3.1	4.6	4.6	4.8	**3**
DO	**mg/l**	6.8	6.9	5.7	6.8	6.7	6.8	**4**
Chlorides	**mg/l**	24	28	20	24	32	32	**600**
Fluorides	**mg/l**	0.46	0.42	0.34	0.45	0.45	0.44	**1.5**
Iron	**mg/l**	0.19	0.21	0.23	0.23	0.24	0.23	**50**
Suna River Downstream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	7.18	7.29	7.05	7.35	7.54	7.37	**6.5-8.5**
Total Dissolved Solids	**mg/l**	256	270	256	280	282	280	**1500**
BOD	**mg/l**	8	8.5	3.9	8.2	9	8.2	**3**
DO	**mg/l**	6.5	6.8	5.4	6.6	6.9	6.5	**4**
Chlorides	**mg/l**	40	44	18	48	48	46	**600**
Fluorides	**mg/l**	0.45	0.48	0.3	0.44	0.47	0.44	**1.5**
Iron	**mg/l**	0.19	0.22	0.21	0.25	0.24	0.25	**50**
Kakarpani River UpStream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	6.87	6.95	6.91	6.85	6.88	6.86	**6.5-8.5**
Total Dissolved Solids	**mg/l**	188	196	178	210	188	188	**1500**
BOD	**mg/l**	5.2	5.4	3.2	5.3	5.6	5.6	**3**
DO	**mg/l**	6.2	6.5	6.1	6.7	6.7	6.3	**4**
Chlorides	**mg/l**	22	26	28	28	30	24	**600**
Fluorides	**mg/l**	0.26	0.29	0.25	0.31	0.27	0.3	**1.5**
Iron	**mg/l**	0.18	0.21	0.16	0.22	0.23	0.24	**50**
Kakarpani River DownStream								

JAJANG IRON ORE MINE

Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Limits for Stream Water Standards
PH	**-**	6.89	7.15	7.11	7.24	7.23	7.25	**6.5-8.5**
Total Dissolved Solids	**mg/l**	321	344	210	358	360	356	**1500**
BOD	**mg/l**	6.9	6.7	5.2	6.9	6.9	6.4	**3**
DO	**mg/l**	6.3	6.6	5.4	6.8	6.8	6.4	**4**
Chlorides	**mg/l**	26	30	34	34	34	28	**600**
Fluorides	**mg/l**	0.48	0.45	0.29	0.42	0.47	0.42	**1.5**
Iron	**mg/l**	0.36	0.32	0.19	0.35	0.35	0.36	**50**
Jalpa River Upstream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	6.96	6.8	6.87	6.97	6.95	6.9	**6.5-8.5**
Total Dissolved Solids	**mg/l**	160	175	182	188	184	184	**1500**
BOD	**mg/l**	3.9	4	3.6	4.4	4.4	4.3	**3**
DO	**mg/l**	5.7	5.9	6.2	5.7	6.1	6.1	**4**
Chlorides	**mg/l**	18	22	26	26	26	18	**600**
Fluorides	**mg/l**	0.3	0.34	0.32	0.36	0.32	0.32	**1.5**
Iron	**mg/l**	0.15	0.19	0.11	0.22	0.21	0.18	**50**
Jalpa River Downstream								
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Limits for Stream Water Standards**
PH	**-**	7.24	7.46	6.98	7.38	7.38	7.38	**6.5-8.5**
Total Dissolved Solids	**mg/l**	228	242	234	254	248	256	**1500**
BOD	**mg/l**	5.8	5.5	5.2	5.7	5.7	5.2	**3**
DO	**mg/l**	BDL	BDL	6	BDL	BDL	BDL	**4**
Chlorides	**mg/l**	42	36	32	40	40	32	**600**
Fluorides	**mg/l**	0.39	0.37	0.38	0.39	0.39	0.39	**1.5**
Iron	**mg/l**	0.26	0.24	0.14	0.22	0.26	0.22	**50**

7. Surface Water Flow Rate

LOCATION NAME	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24
Baitarani River	1.32	0.43	0.56	0.70	0.72	0.75
Kakarpani River	0.88	0.50	0.38	0.49	0.50	0.62
Sona River	0.98	0.57	0.51	0.70	0.70	0.68
Jalpa River	0.75	0.83	0.75	0.48	0.47	0.57

8. ETP

Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Detection Range
ETP Inlet								
pH	-	6.85	6.12	6.81	6.85	6.98	6.85	2.0 -12
Total Suspended Solid as TSS	mg/l	72.5	51.5	65.0	64.0	70.0	64.0	5 - 5000
Total Dissolved Solids as TDS	mg/l	862.0	719.0	850.0	880.0	876.0	856.0	10-10000
Biochemical Oxygen Demand as BOD 3days at 27^0C	mg/l	43.5	48.0	41.5	42.0	48.5	42.0	5-10000
Chemical Oxygen Demand as COD	mg/l	284.0	255.0	276.0	284.0	296.0	296.0	5-50000
Oil & Grease as O & G	mg/l	7.10	7.1	6.6	7.10	6.84	6.45	5-600
Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Acceptable Limits
ETP Outlet								
pH	-	7.16	7.23	7.21	7.36	7.38	7.54	6.5-9.0
Total Suspended Solid as TSS	mg/l	24.5	35.0	23.0	25.0	24.5	24.0	100.0
Total Dissolved Solids as TDS	mg/l	540.0	518.0	510.0	548.0	548.0	544.0	-
Biochemical Oxygen Demand as BOD 3days at 27^0C	mg/l	15.0	11.2	15.0	13.0	16.0	13.0	30.0
Chemical Oxygen Demand as COD	mg/l	120.0	121.0	118.0	120.0	120.0	120.0	250.0
Oil & Grease as O & G	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	10.0

9. Ground Water Quality

Sl. No.	TESTS	Units	Oct- 2023					
			Dugwell Near Bil Siding	Kamalpur Village	Jajang Village	Jurudi Village	Jalahari Village	Tap Water Near Jajang Mine
1.	pH	-	6.81	7.18	6.96	6.88	6.76	7.18
2.	Total Dissolved Solids as TDS	mg/l	128	152	160	162	124	144
3.	Total Hardness as CaCO3	mg/l	68	64	88	68	52	56
4.	Chloride as Cl	mg/l	20	18	18	22	16	22
5.	Fluorides as F	mg/l	0.21	0.22	0.21	0.24	0.24	0.24
6.	Iron as Fe	mg/l	0.15	0.17	0.16	0.19	0.12	0.19
Sl. No.	TESTS	Units	Nov-2023					
			Dugwell Near Bil Siding	Kamalpur Village	Jajang Village	Jurudi Village	Jalahari Village	Tap Water Near Jajang Mine
1.	pH	-	7.25	6.9	6.72	7.15	6.89	6.73
2.	Total Dissolved Solids as TDS	mg/l	151	130	113	160	112	132
3.	Total Hardness as CaCO3	mg/l	60	40	52	64	48	52
4.	Chloride as Cl	mg/l	14	8	14	18	14	12
5.	Fluorides as F	mg/l	0.2	0.13	0.19	0.33	0.23	0.11
6.	Iron as Fe	mg/l	0.11	0.09	BDL	0.12	0.2	0.07

10. Drinking Water Quality

Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Acceptable Limits	Permissible Limits
pH	-	6.94	6.88	6.84	7.23	6.8	7.36	6.5-8.5	No Relaxation
Total Dissolved Solids as TDS	mg/l	158	170	177	220	188	240	500	2000
Total Hardness as CaCO3	mg/l	60	60	68	80	64	88	200	600
Sulfate as SO4	mg/l	14	15.6	12.6	21.5	16.5	19.5	200	400
Chloride as Cl	mg/l	22	18	14	26	22	22	250	1000
Fluorides as F	mg/l	0.2	0.24	0.2	0.12	0.26	0.14	1	1.5
Iron as Fe	mg/l	0.13	0.17	0.12	0.14	0.14	0.1	0.3	No Relax
Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Acceptable Limits	Permissible Limits
pH	-	6.96	7.1	7.14	7.21	7.25	7.15	6.5-8.5	No Relaxation
Total Dissolved Solids as TDS	mg/l	172	184	209	190	196	180	500	2000
Total Hardness as CaCO3	mg/l	68	72	76	84	80	80	200	600
Sulfate as SO4	mg/l	26	24.5	23.4	21.5	26.5	18	200	400
Chloride as Cl	mg/l	24	20	24	16	24	20	250	1000
Fluorides as F	mg/l	0.15	0.18	0.15	0.24	0.15	0.2	1	1.5
Iron as Fe	mg/l	0.12	0.1	0.12	0.12	0.13	0.1	0.3	No Relax
Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Acceptable Limits	Permissible Limits
pH	-	7.38	7.56	7.34	7.21	7.11	7.15	6.5-8.5	No Relaxation
Total Dissolved Solids as TDS	mg/l	220	230	237	172	174	160	500	2000
Total Hardness as CaCO3	mg/l	64	68	80	72	72	60	200	600
Sulfate as SO4	mg/l	28.5	26.75	25.4	18.5	18.5	14.5	200	400
Chloride as Cl	mg/l	22	24	20	14	14	10	250	1000
Fluorides as F	mg/l	0.23	0.21	0.26	0.22	0.22	0.18	1	1.5
Iron as Fe	mg/l	0.21	0.15	0.1	0.08	0.09	0.09	0.3	No Relax

11. STP

Parameter	Units	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	March-24	Detection Range
STP Inlet								
pH	-	7.26	7.45	7.56	7.35	7.56	7.60	2.0 -12
Total Suspended Solid as TSS	mg/l	76.0	72.0	97.0	76.0	64.0	80.0	5 - 5000
Total Dissolved Solids as TDS	mg/l	752.0	764.0	755.0	780.0	752.0	780.0	10-10000
Biochemical Oxygen Demand as BOD 3days at 27^0C	mg/l	37.5	39.0	36.0	41.0	36.0	44.0	5-10000
Chemical Oxygen Demand as COD	mg/l	296.0	312.0	298.0	324.0	328.0	328.0	5-50000
Oil & Grease as O & G	mg/l	6.90	5.90	5.2	5.70	6.40	6.45	5-600
Parameter	**Units**	**Oct-23**	**Nov-23**	**Dec-23**	**Jan-24**	**Feb-24**	**March-24**	**Acceptable Limits**
STP Outlet								
pH	-	7.80	7.69	7.66	7.60	7.54	7.85	6.5-9.0
Total Suspended Solid as TSS	mg/l	26.0	22.0	16.0	26.0	26.0	24.5	100.0
Total Dissolved Solids as TDS	mg/l	524.0	536.0	522.0	544.0	544.0	548.0	-
Biochemical Oxygen Demand as BOD 3days at 27^0C	mg/l	12.0	13.5	11.0	12.5	14.0	12.0	30.0
Chemical Oxygen Demand as COD	mg/l	72.0	80.0	88.0	88.0	88.0	88.0	250.0
Oil & Grease as O & G	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	10.0

12. Vibration Monitoring

Station no.	Station Name	Instrument location	Season (Summer/Winter/Monsoon/ post monsoon	Peak particle velocity	Air Over pressure	Frequency	Remark
1	Zone-1	Old Mines office(250 m away from the blasting area)	Winter	7.46 mm/s	126.8dbl @10.4Hz/ .044kpa	7.5 Hz	Within permissible Limit
2	Zone-1	Old Mines office Back side(250m away from the blasting area	Winter	5.96 mm/s	136.7dbl@2 1.3 Hz/.1362kp a	9.0 Hz	Within permissible Limit
3	Zone-2	Zone-2 Near Mines office(25 0 m away from the blasting site)	Winter	2.16 mm/s	145.6dbl@8 5.3 Hz/.3818kp a	6.7 Hz	Within permissible Limit
4	Zone-2	Zone-2 Workshop back side(250m away from the blasting area	Winter	8.19 mm/s	127.8dbl@5 .6 Hz/.049kpa	3.5 Hz	Within permissible Limit

Verified By

Technical Manager

Authorized By

Quality Manager

ANNEXURE VII







ANNEXURE VIII









50 KL Water Tanker



16 KL Water Tanker

DUST SUPPRESSION USING CHEMICAL SURFACTANTS





DUST CONTROL MEASURES AT THE EXIT GATES AND PUBLIC ROADS

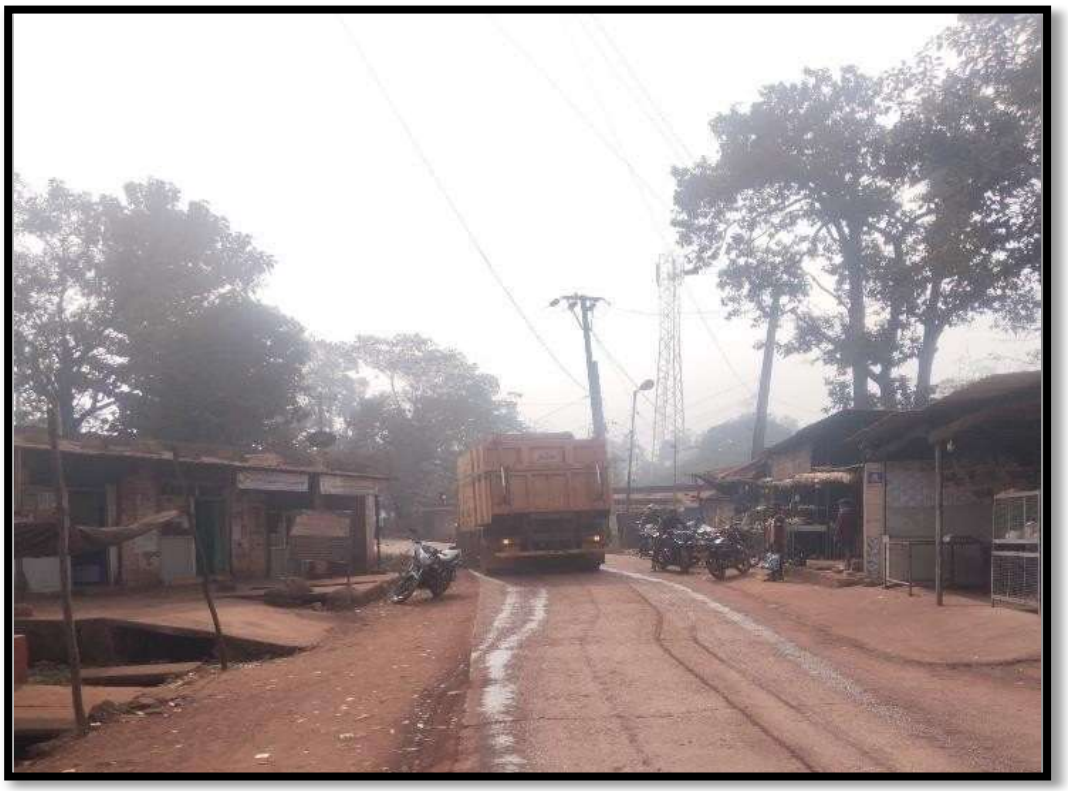






WHEEL WASHING POINT NEAR THE EXIT GATE

DUST CONTROL MEASURES AT THE EXIT GATES AND PUBLIC ROADS







CHECK DAM, 40000 cum CAPACITY

ANNEXURE XI

Comprehensive Hydrogeological Report along with Groundwater Modelling Study

for

Jajang Iron Ore Mine

of

M/s JSW Steel Limited

Address

JSW Steel Limited
Singhania tower, Bhadrasahi,
Po- Barbil, Dist- Keonjhar, Odisha-758035

Prepared By

Geo Climate Risk Solutions Pvt. Ltd.
Accredited by CGWA and ISO 9001:2015 Certified Company
APIS, Sunrise Incubation Tower, Hill No.3, Madhurawada,
Visakhapatnam, 530048
Website: www.gcrs.co.in
Email: business@gcrs.co.in

September 2023

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1 SALIENT FEATURES OF THE PROPOSAL

S. No.	Particulars	Information
1	Application No.	21-4/203/OR/MIN/2009
2	Submission Date	
3	Fresh or Renewal	Renewal
4	Existing or New/Proposed	Existing
5	If Renewal, date of validity of existing /last NOC	10.12.2018 to 08.12.2023
6	CTE issue Date	13.12.2016
7	Name of the Project with Address	Jajang Iron Ore Mine of M/s JSW Steel Limited Jajang, Joribhal, Palsa (Ka), Bandhuabera Barbil Tahashil, Keonjhar, Odisha
8	State	Odisha
9	District	Keonjhar
10	Block/Taluka	Joda
11	Category of Block/Taluka (as per Prevailing GWRE	Joda block comes under the " safe" Category
12	Quantum of GW Applied (KLD)	1764 m^3/day (Mine seepage: 314, Borewell: 1000 and Rainwater: 450)
13	Quantum of GW Applied (m^3/year)	643860 m^3/year
14	Alluvium/ Non-alluvium	Non-Alluvium
15	Groundwater Modelling Required (Yes/No)	Yes
16	Name of Authorized Signatory of the Project and Designation	Mr. Baswaraj Dalgade, General Manager Administration
17	Consultant Details with Name of Authorized Signatory (If Institution)	Geo Climate Risk Solutions Pvt. Ltd. Mr. G Prasad Babu (Founder & CEO)
18	In case the report is prepared jointly by accredited Institute and Individual consultant, name details of chapters prepared by the Individual consultant	NA
19	Accreditation Certificate No. and Date/ Validity (In case jointly as per Point No. 18, No. and validity of both institution and individual are to be given)	CGWB Accreditation number & Validity: CGWB/RGI/005 & 14.02.2026

Mr. G. Prasad Babu (Founder & CEO)
Signature with Name

2 ABOUT THE PROJECT

Jajang Iron Ore mine initially owned by M/s Rungta Mines Limited and the lease validity of the mine was till 31.03.2020. Then Government of Odisha invited tender dated 6th December, 2019 for commencement of the auction process to grant the mining lease under non-captive category in respect of the said mine in pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 and the Mineral (Auction) Rules, 2015. E-auction process was conducted and M/s JSW Steel Ltd was declared as the preferred bidder according to the Mineral auction Rule, 2015 for Jajang Iron Ore Block and issued the notice for grant of Mining Lease (ML) vide letter no 3007/S&M/Bhubaneshwar/IV(Misc)SM-66/2016 dated 18th March 2020 for for Jajang Iron Ore Block over an area of 666.15 ha as per ROR (669.078 ha as per DGPS computation) in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar district, Odisha for a mineable reserve size of about 34.87 Million tonnes (Mt). Now, all the valid rights, approvals, clearances, licenses in respect of the aforementioned mining block are deemed to have vested in favour of JSW Steel Ltd as well.

JSW Steel Limited proposed to produce 12.80 million TPA (ROM) of Iron ore with maximum waste of 28.589 MTPA (OB) along with screening, crushing by fully mechanized method in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar district, Odisha state. The total mineable reserves are 34.87 Million tonnes as on 01.04.2020 as per approved mining plan in the name of M/s JSW Steel Limited vide letter no. MP/A/13-ORI/BHU/2020-21 dated: 19.08.2020.

Jajang Iron Ore Mine of M/s JSW Steel Ltd granted lease area of 669.078 Ha (as per DGPS Survey)/666.150 Ha (as per ROR) land in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda, Tehsil Barbil, District Keonjhar, Odisha by Government of Odisha, District Keonjhar which comes under toposheet no. 73 G/5 with Lat: $21^0$54’44.23926" to $21^0$56’33.49374"N & Long: $85^0$24’49.65672" to $85^0$26’50.70226"E (Figure 2.1 and Figure 2.2). It is approachable by the Joda-Bambebari-Keonjhar road, which is well connected with NH-215 at Kalapahar at distance of 11 km from the lease. The railway line connecting Daitari-Keonjhar-Banspani is passing through the Eastern side of the lease hold. The nearest railway station is Jaroli & Banspani, which are situated at a distance of 2 kms & 7 kms respectively, there are two railway sidings RMJC and BIL present within the lease hold area. The salient features of the project is given in Table 2.1. The area coverage of the project site is given in Table 2.2.

Table 2.1: Salient Feature.

Name of the Lease holder	M/S. JSW Steel Limited
Rule 45 Registration No.	IBM/432/2011
Address	JSW Centre, Bandra Kurla Complex, Bandra East, Mumbai - 400051
DGPS coordinates of boundary pillars	Lat: $21^0$54’44.23926" to $21^0$56’33.49374"N Long: $85^0$24’49.65672" to $85^0$26’50.70226"E
Mineral(s) which is/are included in the letter of intent/lease deed	Only one Mineral included in the lease deed i.e., Hematite (Iron Ore).
Mineral(s) which is/are the applicant/lessee intends to mine.	Hematite (Iron Ore)
Lease Details (Existing Mine)	18.03.2020 -26.06.2070
Name of Mine	Jajang Iron Ore Mine
Date of grant of lease	18.03.2020
Period / Expiry date	26.06.2070
District & State	Keonjhar &Odisha
Taluka	Barbil
Villages	Jajang, Jadibahal, Palsa (Ka), Bandhuabeda
Weather the area falls under (CRZ),if yes details there of	No

(Source: Mining Plan)

Table 2.2: District wise and Block wise area coverage.

STATE	DISTRICT	Block name	Block area	Percentages
Odisha	Keonjhar	Champua	550.8827798	1.274226472
Odisha	Keonjhar	Jhumpura	2373.229619	5.489429179
Odisha	Keonjhar	Joda	37826.18968	87.4943527
Odisha	Sundargarh	Koira	2482.419249	5.74199165

The existing NOC of Jajang Iron Ore Mine has been granted from CGWA vide no. CGWA/NOC/MIN/REN/2/2020/5639 for groundwater abstraction/ dewatering quantum of 1000 m3/day from 7 existing and 2 proposed borewells with a validity from 10.12.2018 to 08.12.2023. Presently, it is applying for the changing dewatering quantum of 1764 m3/day which includes 314 m3/day of mine seepage, 1000 m3/day from 7 borewells and 450 m3/day of rainwater for the issue of groundwater NOC from the authority.

OBJECTIVE

The study's overall objective is to carry out a detailed hydrogeological study for the preparation of a comprehensive hydrogeological report on the groundwater conditions in the core and buffer zones within the radius of 2, and 10 km, respectively, from the project boundary to obtain approval from the Central Ground Water Authority (CGWA) as per the SOP notified in May 2023.

APPROACH AND METHODOLOGY

In order to achieve the objectives hand in hand with the scope of work outlined above, a multidisciplinary approach has been adopted, dovetailing the domain skills of hydrogeological and groundwater modelling, giving equal opportunities to arrive at an optimal strategy addressing the issues holistically. The methodology encompasses detailed hydrogeological investigation in and around the mine lease area, establishing an aquifer extent and an optimal groundwater monitoring network to monitor water quantity and quality changes. Estimating mine seepage in time and space has been attempted, evaluating the influence on ground water in terms of space and quantifying contribution from ground water. Further, an attempt has been made to arrive at technically viable engineering interventions for water harvesting and groundwater recharge following standard norms and guidelines within the statutory framework of various regulatory authorities (like CGWB, Department of Water Resources, and others).

To carry out the hydrogeological study for the project, core zone of 2 km and a buffer zone of 10 km from the mine lease boundary have been assigned as per the statutory guidelines stipulated by the Central Ground Water Authority (CGWA).The toposheet map and the google image map of the project area are represented as Figure 2.2 & Figure 2.3 .

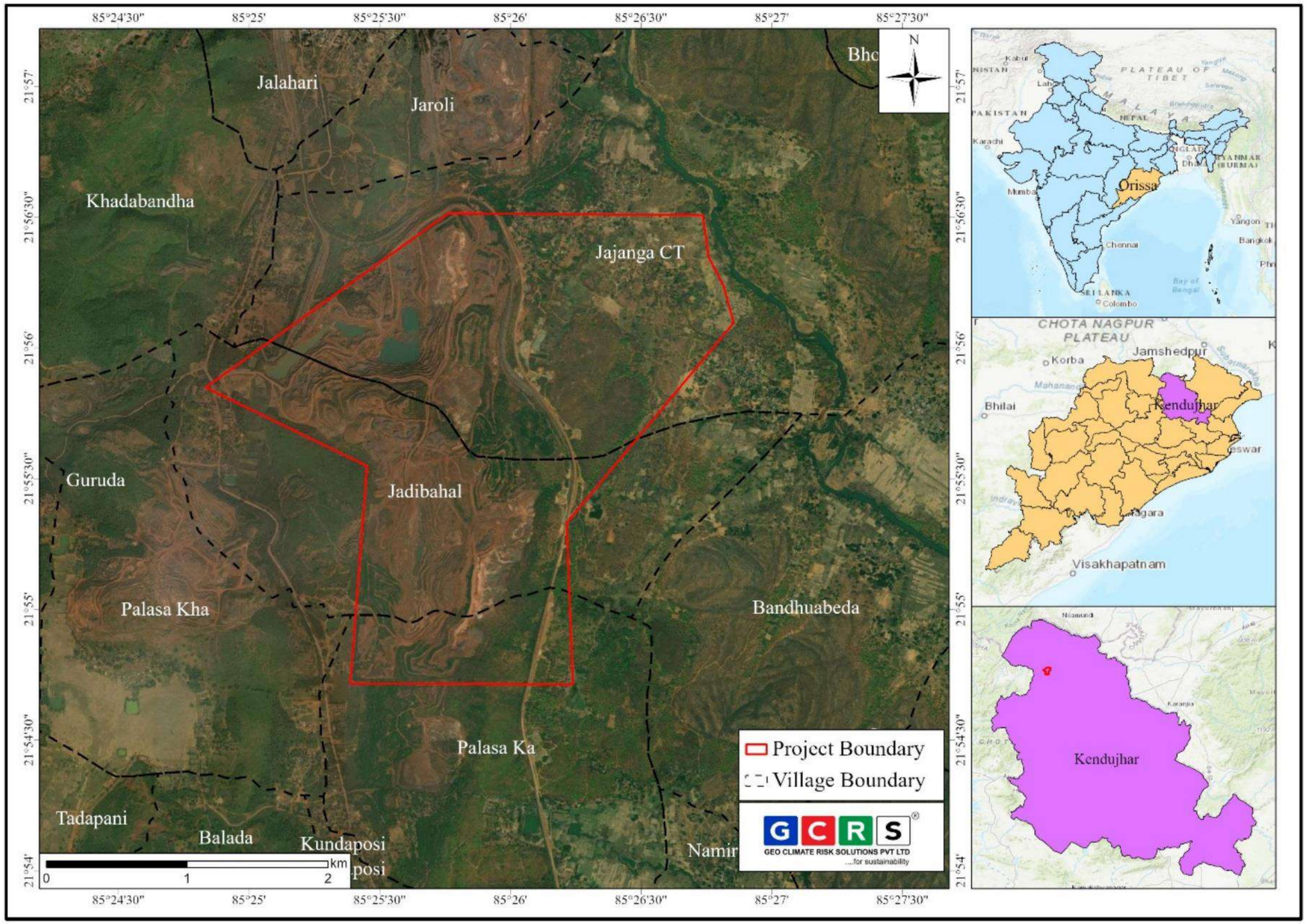


Figure 2.1: Location map of the Project Site.

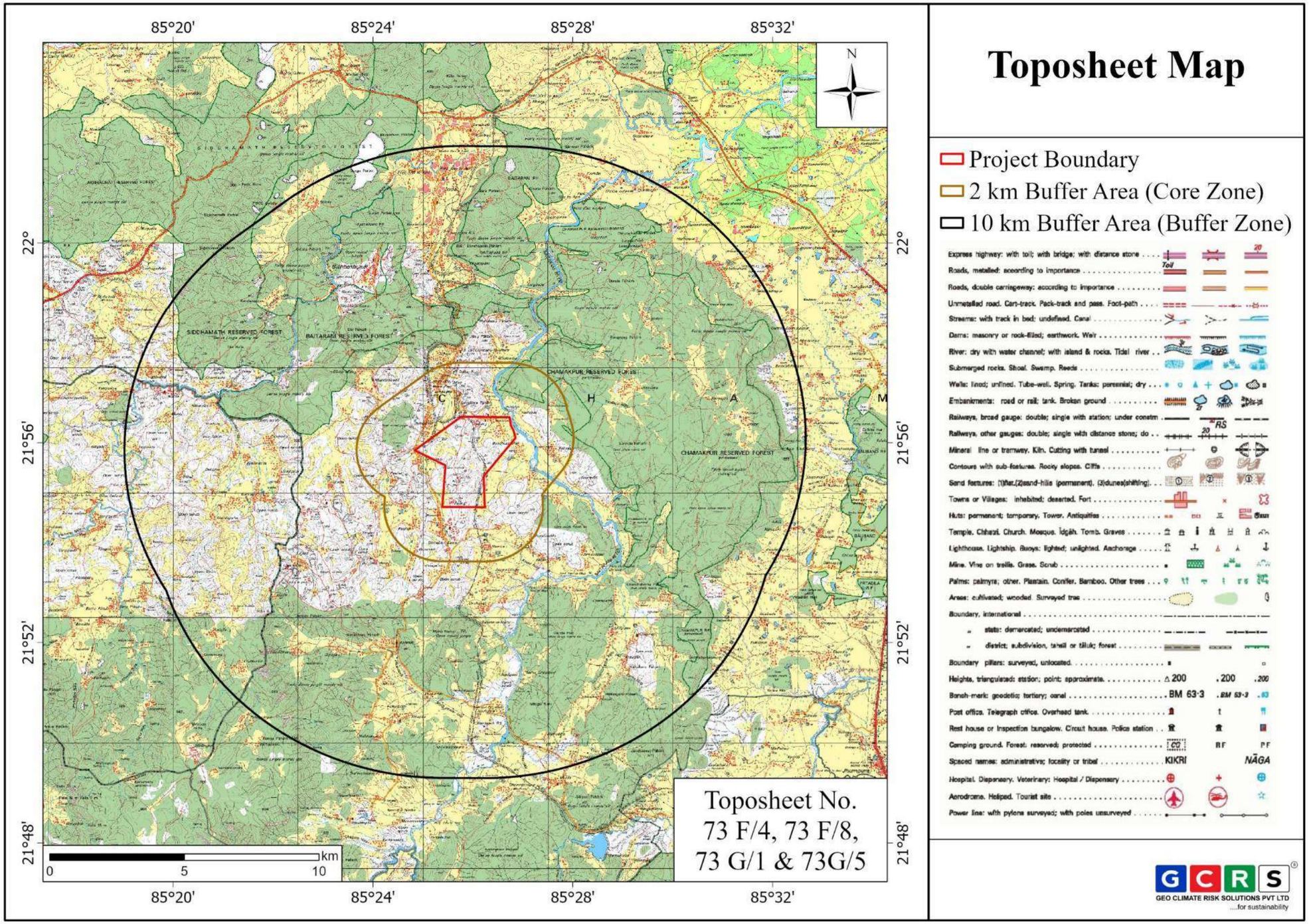


Figure 2.2: Toposheet map of the study and project area.

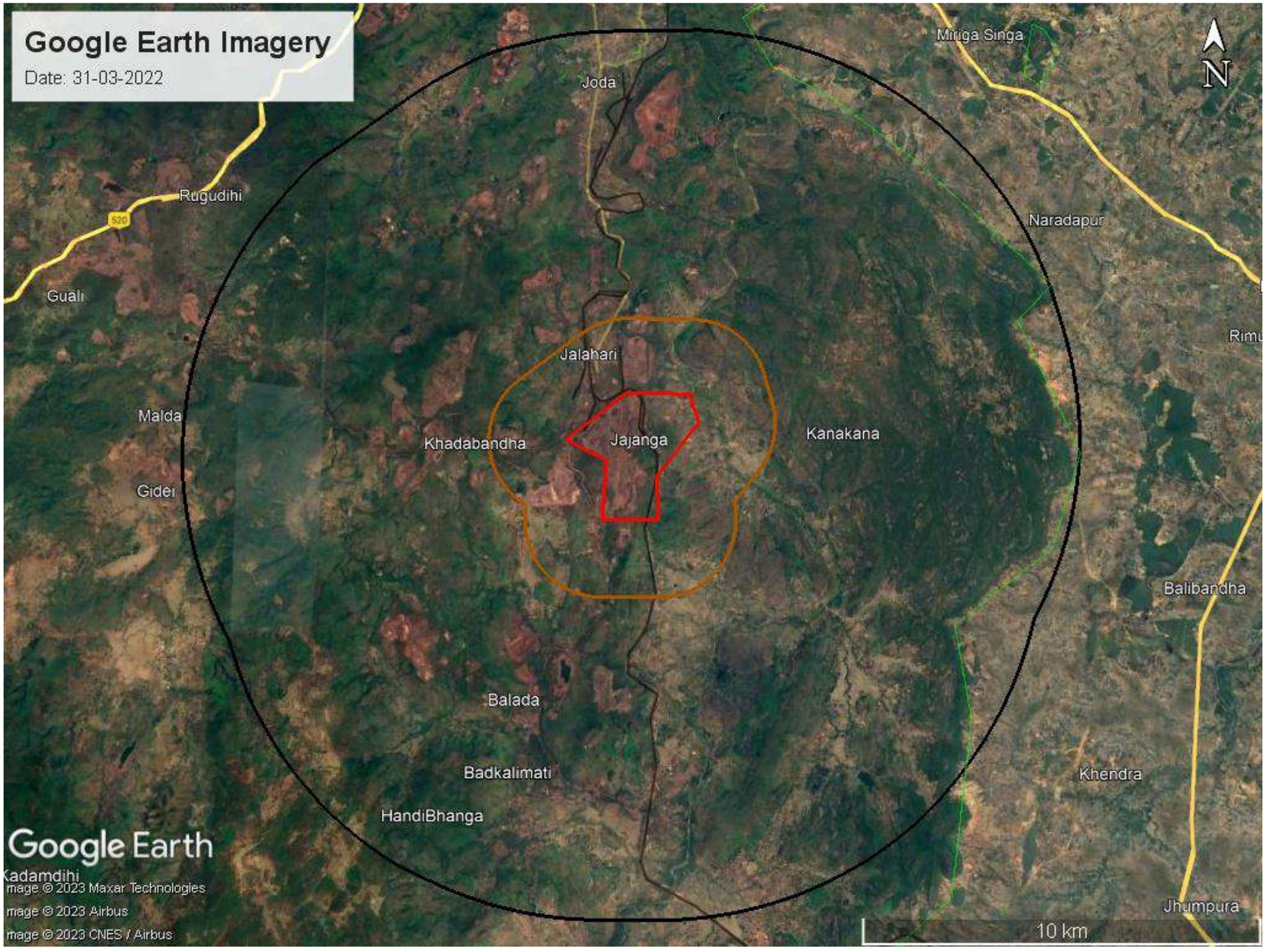


Figure 2.3 : Google Earth imagery of the study area. The red colour shows the project boundary, the yellow boundary shows the core area (2 km), and the white colour indicates the buffer area (10 km).

2.1 LANDUSE / LAND COVER OF THE SURROUNDING AREA

The land use and landcover (LULC) maps are the fundamental data source for land management and planning. The accurate mapping of LULC classes is a valuable tool for understanding the relationship between humans and the environment (Pratico et al., 2021; Schulz et al., 2021; Viana et al., 2019; Qian and Zhang, 2022). The LULC maps for the present study were prepared using Sentinel-2 data on Google Earth Engine (GEE) platform. The GEE platform is widely used to shorten the processing time, which helps the user store decades of data and removes the need to download satellite imagery. The spatial resolution of LULC classes in the present study area is mainly related to the topographic factors/conditions. In the present study, a map has been prepared with 9 LULC classes for November, 2023 (Figure 2.4). The predominant land use in the study is forestland, which covers about 66.09% of the total study area, followed by mining area (9.30%), Current fallow (8.48%), cropland (8.25%), scrubland (4.03) and so on (Table 2.3).

Table 2.3: Land Use Pattern of the study area.

Sl. No.	LULC Classes	Area (%)
1	Forest	66.09
2	Mining	9.30
3	Current Fallow	8.48
4	Cropland	8.25
5	Scrubland	4.03
6	River	2.08
7	Builtup	0.82
8	Barrenland	0.60
9	Water bodies	0.35
	Total	**100**

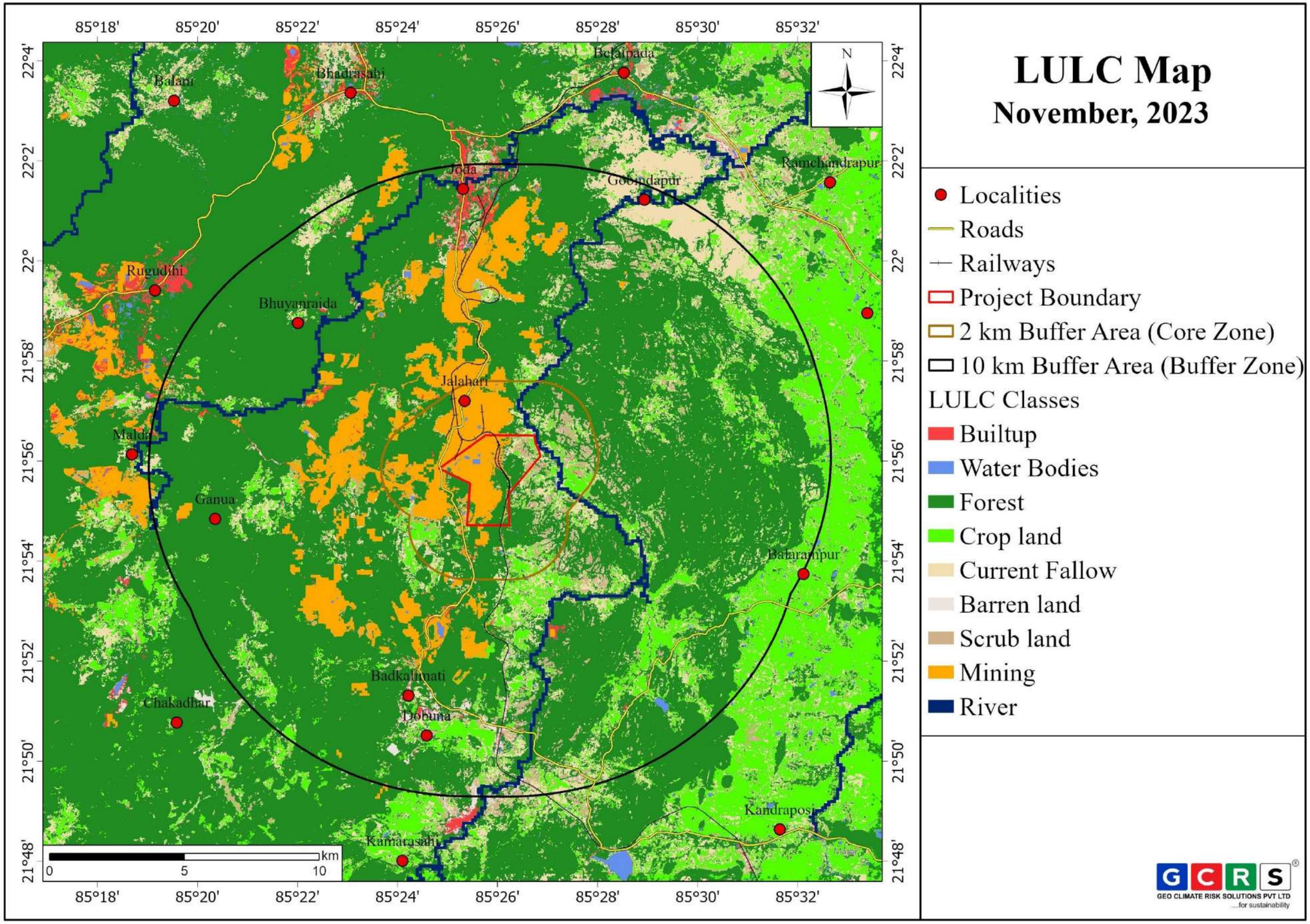


Figure 2.4: Land use map of the study area (November, 2023).

2.2 DEM / TOPOGRAPHY

Digital Elevation Model (DEM) is the digital representation of the land surface elevation with respect to any reference datum. It reflects the physical surface of the earth and helps us to understand the nature of terrain using interpreting the landscape using modern techniques and high-resolution images. It is profitable to comprehend the nature of the topography, address the practical problems and fix them by applying new insights, upcoming high resolutions, satellite images, and techniques. In contrast, the topography is land surface's physical and natural features. A topographic map shows natural and manmade features (Balasubramanian, 2017).

The surface topography/DEM map is prepared using ArcGIS Pro software from SRTM-DEM of 30 m spatial resolution data. The study area is characterised by vast undulating terrain with flat topped low ridges. These ridges situated in the south western part of the study area treding towards north. Overall study area is comprises of cluster of small hillocks which brings variations in the slopes. The elevation of the study area ranges from 412 to 896 mamsl. The maximun elevation found in the south western part. The elevation in the lease area ranges from 461 to 646 mamsl. The Topographic map of the study area is given as Figure 2.5.

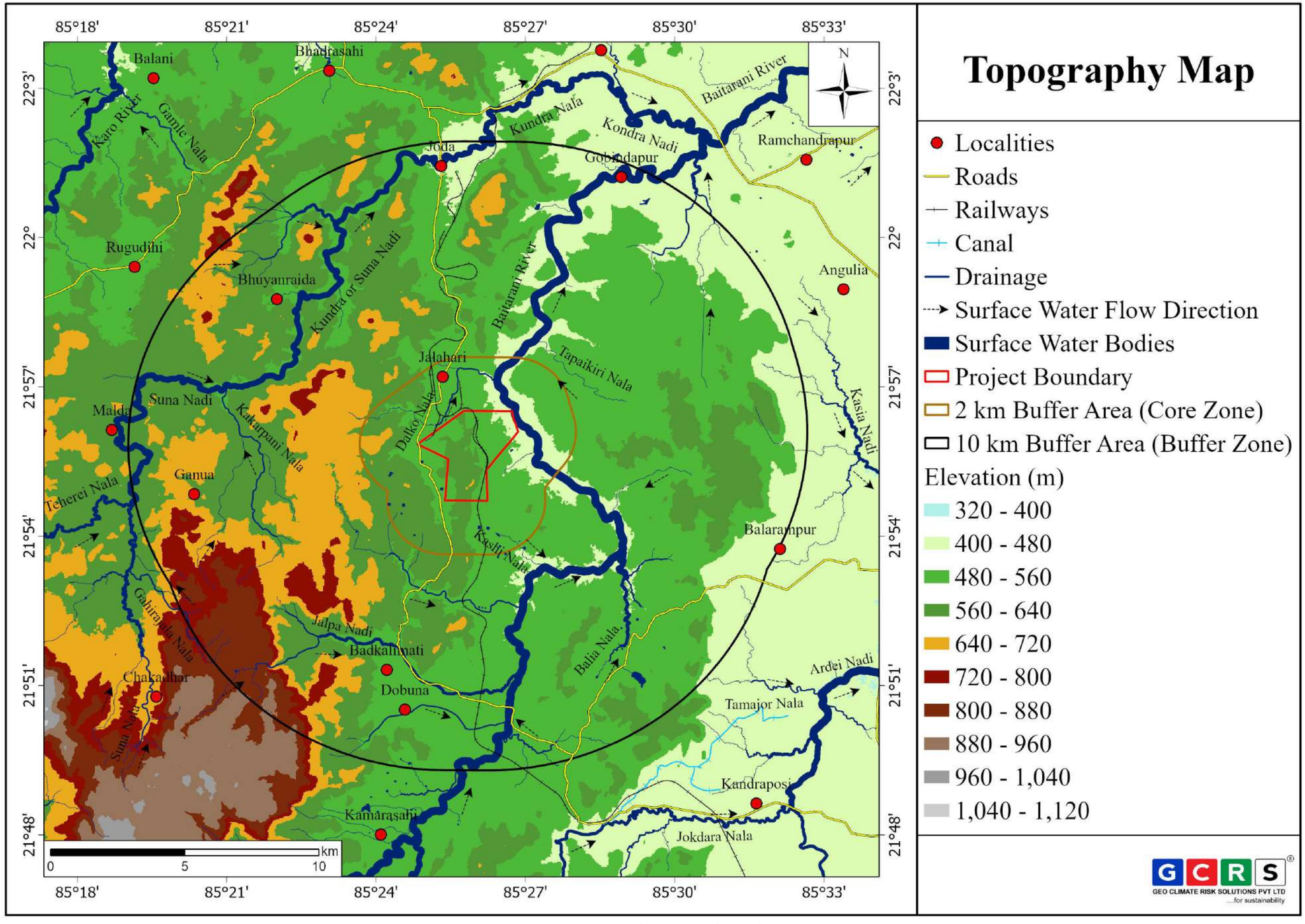


Figure 2.5: Topography map of the study area.

2.3 GEOMORPHOLOGY AND DRAINAGE

The geomorphological units of the study area shows structural, denudational, fluvial and anthropogenic origins (Figure 2.6). The predominant geomorphological features of the region are Moderately Dissected Hills and Valleys of structural origin, followed by pediment, pediplain, active quarry, highly dissected hills and valleys of structural origin, hill, intermontane valley etc.

The drainage network of the study area is extracted from SRTM-DEM of 30 m spatial resolution (USGS website) using the Hydrology tool of ArcGIS Pro software. The Baitarani River constitutes the principal drainage system in the study area. The River Baitarani flows in the eastern part of the lease boundary. Some small seasonal nallas flowing in the study area and meet ultimately to Baitarani River. The study area's drainage system is predominantly dendritic (Figure 2.7). The Suna Nadi & Kundra Nala flows in the northeast direction and drains the north western part of the study area. The southern and south eastern part of the study area is drained by Jalpa Nadi, Kashi nala, Balia Nala & Barha Nala. Other than these perennial water courses, some small seasonal channels can be observed in the study area which finally get merge into the River Baitarani.

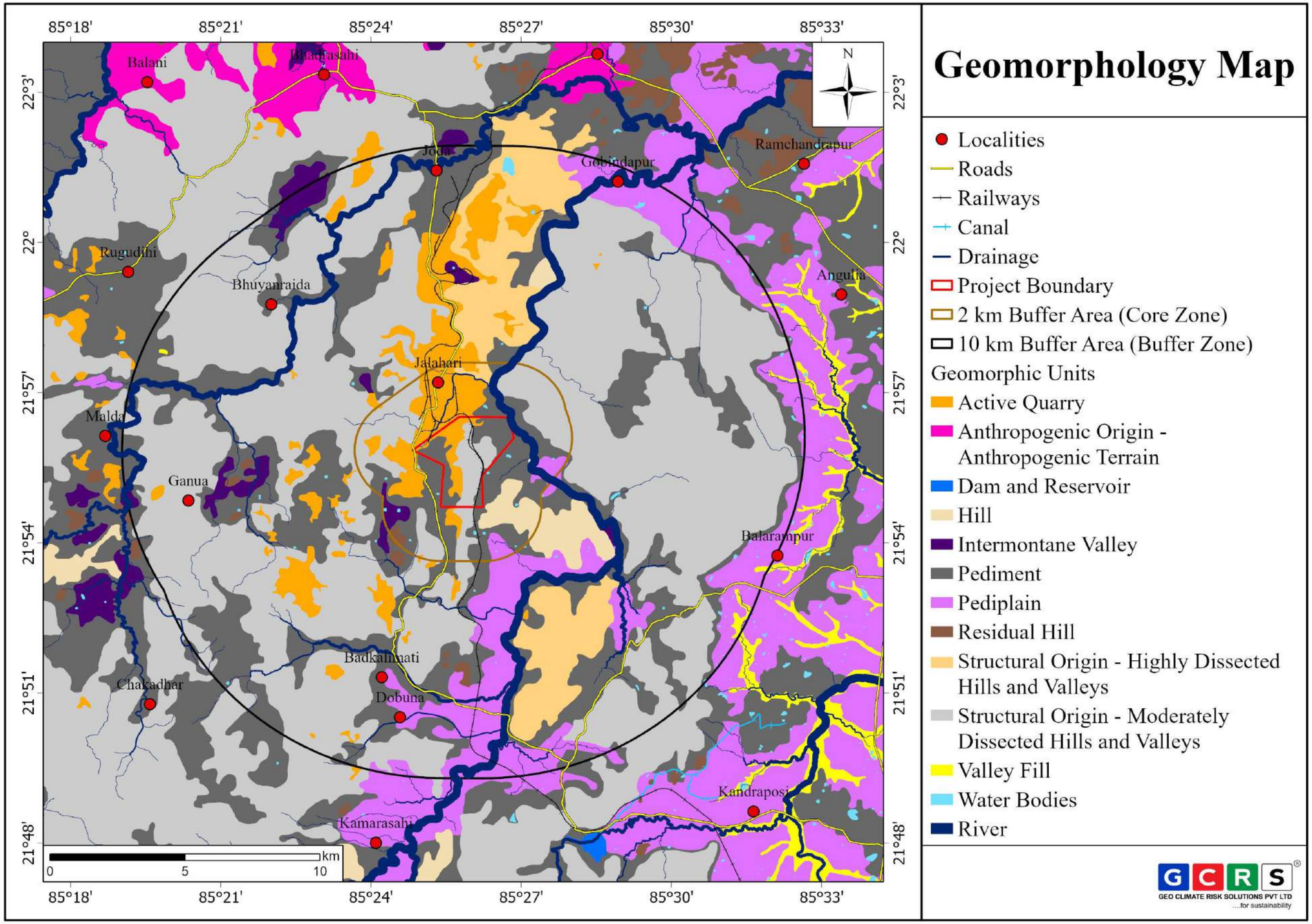


Figure 2.6: Geomorphology map of the study area (Source: Bhukosh, GSI, https://bhukosh.gsi.gov.in/Bhukosh/MapViewer.aspx).

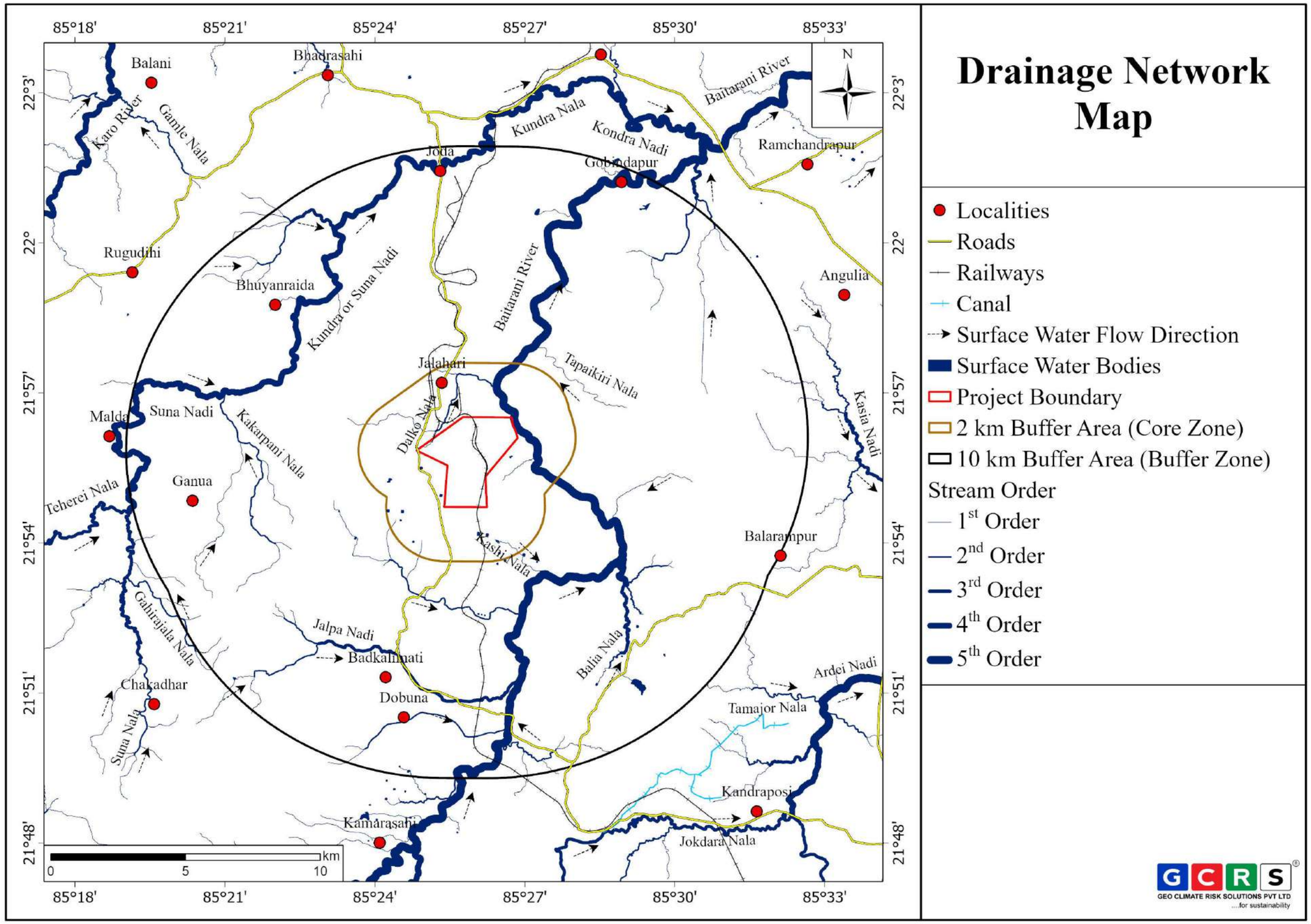
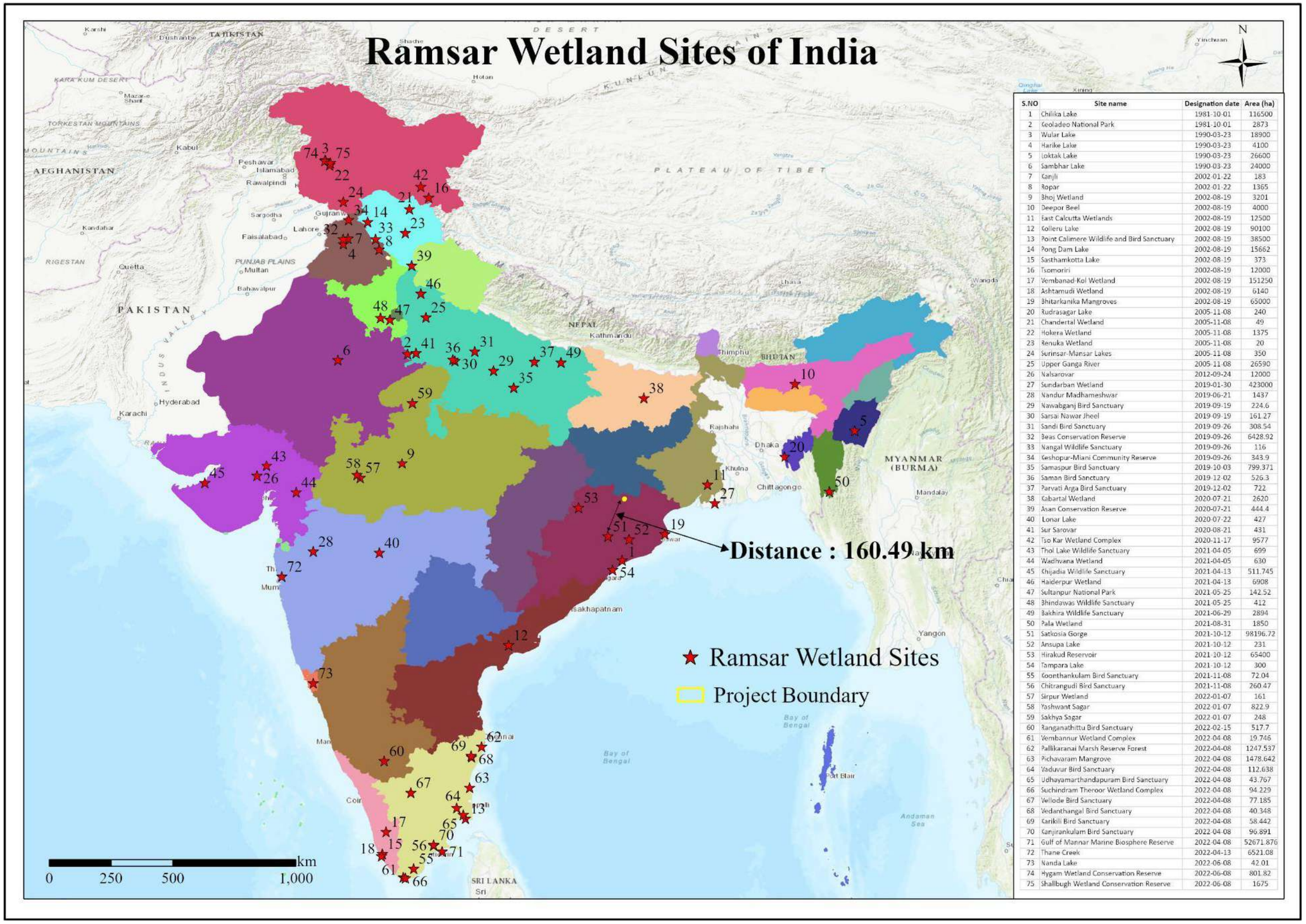


Figure 2.7: Drainage map of the study area.

2.4 DETAILS OF WETLANDS / MAJOR WATER BODIES

A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen-free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Any wetland site which has been listed under the Ramsar Convention that aims to conserve it and promote sustainable use of its natural resources is called a Ramsar Site. There are a total of 75 Ramsar wetland sites present in India as on August, 2022. (https://rsis.ramsar.org)(Figure 2.8).

The nearest Ramsar Wetland Site to the project boundary is Satkosia Gorge, Odisha situated at an aerial distance of about 160.49 km in the Southwest direction. Hence, no Ramsar sites are present in the vicinity of 500 m from the mine lease or within the study area. A certificate regarding the same is not applicable for the particular proposal.



S.NO	Site name	Designation date	Area (ha)
1	Chilika Lake	1981-10-01	116500
2	Keoladeo National Park	1981-10-01	2873
3	Wular Lake	1990-03-23	18900
4	Harike Lake	1990-03-23	4100
5	Loktak Lake	1990-03-23	26600
6	Sambhar Lake	1990-03-23	24000
7	Kanjli	2002-01-22	183
8	Ropar	2002-01-22	1365
9	Bhoj Wetland	2002-08-19	3201
10	Deepor Beel	2002-08-19	4000
11	East Calcutta Wetlands	2002-08-19	12500
12	Kolleru Lake	2002-08-19	90100
13	Point Calimere Wildlife and Bird Sanctuary	2002-08-19	38500
14	Pong Dam Lake	2002-08-19	15662
15	Sasthamkotta Lake	2002-08-19	373
16	Tsomoriri	2002-08-19	12000
17	Vembanad-Kol Wetland	2002-08-19	151250
18	Ashtamudi Wetland	2002-08-19	6140
19	Bhitarkanika Mangroves	2002-08-19	65000
20	Rudrasagar Lake	2005-11-08	240
21	Chandertal Wetland	2005-11-08	49
22	Hokera Wetland	2005-11-08	1375
23	Renuka Wetland	2005-11-08	20
24	Surinsar-Mansar Lakes	2005-11-08	350
25	Upper Ganga River	2005-11-08	26590
26	Nalsarovar	2012-09-24	12000
27	Sundarban Wetland	2019-01-30	423000
28	Nandur Madhameshwar	2019-06-21	1437
29	Nawabganj Bird Sanctuary	2019-09-19	224.6
30	Sarsai Nawar Jheel	2019-09-19	161.27
31	Sandi Bird Sanctuary	2019-09-26	308.54
32	Beas Conservation Reserve	2019-09-26	6428.92
33	Nangal Wildlife Sanctuary	2019-09-26	116
34	Keshopur-Miani Community Reserve	2019-09-26	343.9
35	Samaspur Bird Sanctuary	2019-10-03	799.371
36	Saman Bird Sanctuary	2019-12-02	526.3
37	Parvati Arga Bird Sanctuary	2019-12-02	722
38	Kabartal Wetland	2020-07-21	2620
39	Asan Conservation Reserve	2020-07-21	444.4
40	Lonar Lake	2020-07-22	427
41	Sur Sarovar	2020-08-21	431
42	Tso Kar Wetland Complex	2020-11-17	9577
43	Thol Lake Wildlife Sanctuary	2021-04-05	699
44	Wadhvana Wetland	2021-04-05	630
45	Khijadia Wildlife Sanctuary	2021-04-13	511.745
46	Haiderpur Wetland	2021-04-13	6908
47	Sultanpur National Park	2021-05-25	142.52
48	Bhindawas Wildlife Sanctuary	2021-05-25	412
49	Bakhira Wildlife Sanctuary	2021-06-29	2894
50	Pala Wetland	2021-08-31	1850
51	Satkosia Gorge	2021-10-12	98196.72
52	Ansupa Lake	2021-10-12	231
53	Hirakud Reservoir	2021-10-12	65400
54	Tampara Lake	2021-10-12	300
55	Koonthankulam Bird Sanctuary	2021-11-08	72.04
56	Chitrangudi Bird Sanctuary	2021-11-08	260.47
57	Sirpur Wetland	2022-01-07	161
58	Yashwant Sagar	2022-01-07	822.9
59	Sakhya Sagar	2022-01-07	248
60	Ranganathittu Bird Sanctuary	2022-02-15	517.7
61	Vembannur Wetland Complex	2022-04-08	19.746
62	Pallikaranai Marsh Reserve Forest	2022-04-08	1247.537
63	Pichavaram Mangrove	2022-04-08	1478.642
64	Vaduvur Bird Sanctuary	2022-04-08	112.638
65	Udhayamarthandapuram Bird Sanctuary	2022-04-08	43.767
66	Suchindram Theroor Wetland Complex	2022-04-08	94.229
67	Vellode Bird Sanctuary	2022-04-08	77.185
68	Vedanthangal Bird Sanctuary	2022-04-08	40.348
69	Karikili Bird Sanctuary	2022-04-08	58.442
70	Kanjirankulam Bird Sanctuary	2022-04-08	96.891
71	Gulf of Mannar Marine Biosphere Reserve	2022-04-08	52671.876
72	Thane Creek	2022-04-13	6521.08
73	Nanda Lake	2022-06-08	42.01
74	Hygam Wetland Conservation Reserve	2022-06-08	801.82
75	Shallbugh Wetland Conservation Reserve	2022-06-08	1675

Figure 2.8: Nearest ramsar wetland site from the project boundary.(Source- https://rsis.ramsar.org)

3 HYDROGEOLOGY

Details pertaining to the ground water scenario in the core and buffer zones of the study area, brief of the regional and local geology, hydrogeological set up, water level trends, fluctuations and quality data including relative maps have been discussed in the underlying sections.

3.1 GEOLOGICAL SET UP

The Singhbhum cratonic block comprises two Archean greenstone belts, viz. Jamda-Koira belt along with Noamundi basin on the west and Gorumahisani-Badampahar-Daitari belt on the east. The Joda area with Mn-mineralized zones belongs to the Jamda-Koira belt and is located in the eastern limb of the Noamundi synclinorium. Manganese and iron ores are closely associated with Banded Iron Formation (BIF), metamorphosed volcanic and sedimentary rocks of the Iron Ore Group (IOG). The basement rock of the IOG basin is dominantly Singhbhum Granite (Type-A). The Mesoarchaean succession in the Singhbhum crustal province begins with the Iron Ore Group (IOG), characterized by Banded Iron Formations (BIF), clastic sedimentary rocks and minor carbonates (Chakraborty & Majumder, 1986; Saha, 1994; Bhattacharya et al., 2007; Mukhopadhyay et al., 2008). IOG rocks are low-grade metamorphosed and intruded by younger Singhbhum Granite (Type-B). Bonai-Keonjhar iron-manganese belt (Lat: 21°40’ and 22°15’ N and Long: 85°00’ and 85°35’ E) in the IOG forms a 60 km long & 25 km wide synclinorium (Noamundi synclinorium), referred to as “Iron-Ore horse shoe” plunging variously to north and northeast. The corresponding anticlinal core in the western part of the Noamundi synclinorium is mainly occupied by the 3.3 Ga Bonai granite (Saha, 1994). BIF, an important volcano-sedimentary rock formation of the Archean Greenstone belt, broadly defines the outline of the synclinorium, which are almost continuously exposed along the margin. At the same time, manganese ore-bearing shales occur within the core region of the fold. The entire region displays the effect of superposed folding on two near perpendicular axes, the generalized trends being NNE-SSW & WNW-ESE to NW-SE (Table 3.1).

Table 3.1: The Generalized Chrono Stratigraphic Succession of the Singbhum-Orissa Iron OreCraton (after Saha et al., 1988).

Newer Dolerite dykes and sills		c. 1600-950 Ma	
Mayurbhanj Granite		c. 2100 Ma	
Gabbro-anorthosite ultramafics		c.2100-2200 Ma	
Kolhan Group			
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Jagannathpur Lava	Dhanjori-Simlipal lavas	c. 2300 Ma	
Malangtoli Lava	Quartzite-conglomerate		Dhanjori group
Pelitic and arenaceous metasediments with mafic sills		c. 2300-2400 Ma	Singhbhum Group
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Singhbhum Granite (Type B) (Phase III)		c. 3.1 Ga	
Mafic Lava, tuff, acid volcanics, tuffaceous shale Manganiferous shale and Mn-ores (Noamundi Group of Banerji, 1977)			Iron Ore Group
Banded hematite jasper, banded hematite quartzite with iron ores			
Ferruginous chert, local dolomite and quartzite sandstone			Nilgiri Granite
Singhbhum Granite (Type A) (Phase I and II)		c. 3.3 Ga	
Folding and metamorphism of OMG and OMTG			Bonai Granite
Older Metamorphic Tonalitic Gneiss (OMTG)		c. 3.775 Ga	
Older Metamorphic Group (OMG): Pelitic schist, quartzite, para-amphibolite, ortho-amphibolite		c. 4.0 Ga	

(Note :- Ma- Mega annum, Ga-Giga annum)

Local Geology

Banded Iron Formation (BIF) hosted iron ores with their variants are occurred comprises the economic ore deposits in this region. Banded Hematite Jasper (BHJ), Banded Hematite Quartzite (BHQ), Banded Hematite Shale (BHS), Ferruginous shale are major BIF members. Hematite ore is found bedded, laminated, massive, & in powdery form and associated with this BIF formation. Sandstone, volcanic formation, laterite, soil and alluvium is also observed in the study area. Sandstone is conspicuously well developed and are interbedded with lenticular bands of conglomerate. These sandstones are made of white and grey quartz grains, rounded to well-rounded in shape and with a matrix of clayey nature. The conglomerate is made of grey, smoky and white quartz. Banded Hematite Jasper is conspicuously well developed on almost all the ridges in this area. Iron ore in this area occurs usually on the hill top and is flanked by Banded Hematite Jasper, Intercalated bands of shale are locally found within the ore.The ore bodies are frequently covered by laterite, soil & debris and occurs as blankets over the BIF. Hematite is the major constituent mineral, biscuity/friable in nature found in between BHJ/BHQ and laminated ore. Massive ores are fine-grained, dense and compact in nature. The gradational leaching and enrichment to give rise to iron ore bodies are very well observed. The geology map is presented as Figure **3**.**1**.

[Behera, R., & Beura, D (2019)]

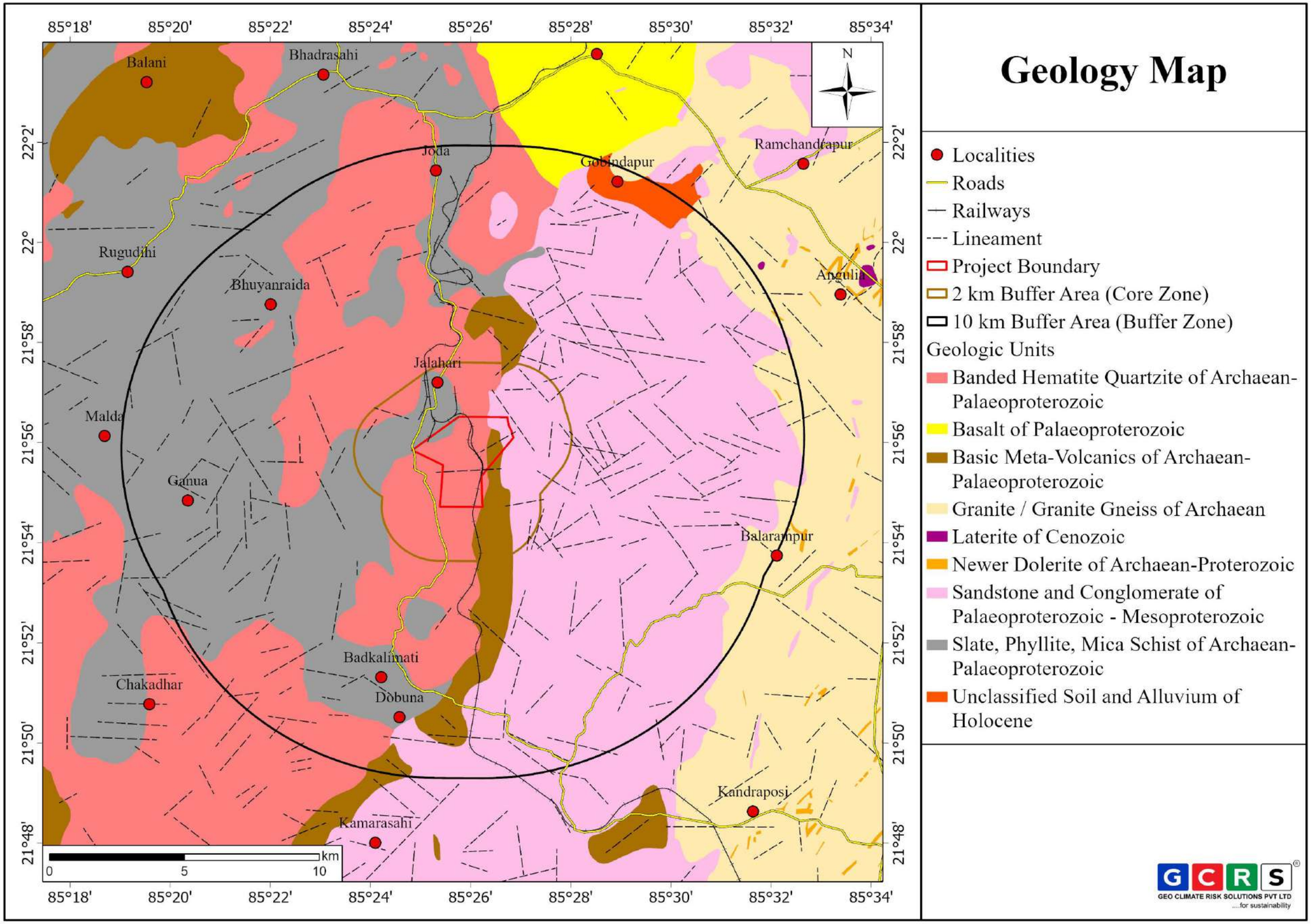


Figure 3.1: Geology map of the study area. (Source: Bhukosh, GSI, https://bhukosh.gsi.gov.in/Bhukosh/MapViewer.aspx).

3.2 GEOPHYSICAL STUDIES

Using Ohm's law electrical resistivity of sub-surface geologic formation is determined through artificially energizing the subsurface and carrying measurements on the ground surface. The contrast in resistivity value of an individual layer with the surrounding or effective presence (dependent of its relative resistivity and thickness) makes it detectable.

In the electrical resistivity method, a known amount of electrical current (I) is sent into the ground through a pair of electrodes (called current electrodes) and the potential (δV) developed because of the resistance offered by the subsurface due to the passage of this current is measured across another pair of electrodes (potential electrodes) planted into the ground. The ratio between the potential measured and the corresponding current sent into the ground yields the resistance 'R' of the ground to a depth depending upon the spacing between the two current electrodes. By multiplying this value of `R' by a geometric factor, a parameter called the apparent resistivity "ρ_a" is computed. Both the parameters, apparent resistivity 'ρ_a' and the resistance 'R' contain the information on the geo-electric characteristics of the subsurface. In practice, several configurations exist, but the Wenner and Schlumberger configurations are the most used.

In this survey, a microprocessor-based resistivity meter CRM-500 was used. Vertical Electrical Sounding (VES) has been carried out for the present study using Schlumberger configuration. Maximum spreads were 300 m (AB) for sounding.

Vertical Electrical Sounding (VES)

VES is a process by which a depth investigation is made. In this, the center is fixed and the measurements are made by increasing the electrode spacing. The apparent resistivity values obtained with increasing values of electrode separations are used to estimate the thickness and resistivity's of the subsurface formations. In Schlumberger sounding arrangement (Figure 3.2), all the four electrodes are kept in a line symmetrically over a point '0', with inner (Potential) electrodes kept closer. To increase the depth of investigation, the current electrodes C_1 and C_2 are moved apart symmetrically from the center point `0', keeping the potential electrodes fixed. The separation between the potential electrodes is changed only when the potential between them drops to allow value during sounding. The apparent resistivity for each electrode separation is calculated by multiplying the resistance `R' with Schlumberger configuration factor 'K' (a geometrical factor). We have the formula is

$\rho_a = \pi R\{(C_1C_2/2)^2 - (P_1P_2/2)^2\} / P_1P_2$ or $\rho_a = KR$

Where 'K' is the geometric factor for Schlumberger configuration,

C_1C_2 is current electrode spacing

P_1P_2 is potential electrode spacing

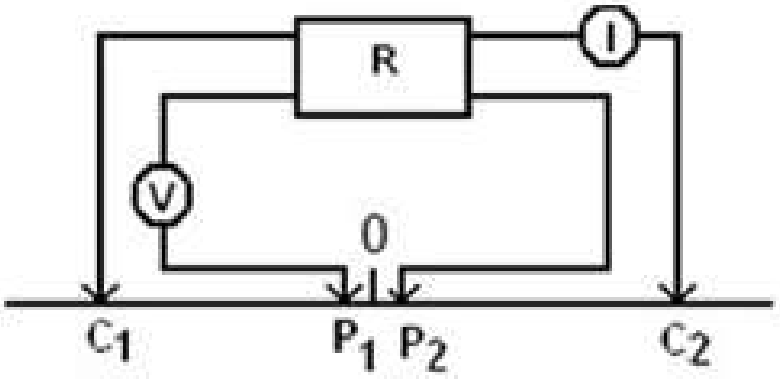


Figure 3.2: Schlumberger electrode configuration.

Data analysis and interpretation

The surface geophysical survey of tVertical Electrical Sounding (VES) have been conducted at two locations in the study area to identify the subsurface condition. The observed resistance values from the instrument have been multiplied with geometric factor (K) to get the apparent resistivity values for each electrode spacing. The apparent resistivity values for different potential dipoles were brought to a single common potential dipole. The field apparent resistivity data were plotted on log-log graph paper against the half current electrode separation to get the VES curves (X-axis-$C_1C_2/2$ value and Y-axis apparent resistivity value).

These data of $C_1C_2/2$ and apparent resistivity were interpreted with the help of a two-layer master curve by curve matching technique and further checked with the help of IPI2WIN software. The final results corroborated with the known hydrogeological conditions in the area. The geoelectric layer parameters (resistivity and thickness) were obtained for each VES. The resistivity measurements obtained from the field and the Inferred results of the geophysical survey are given in Table 3.2 and Table 3.3.

Table 3.2: Field data of VES survey.

VES1		VES2

SI. No.	AB/2 in meter (C.E.)	MN in meter (P.E.)	Resistivity (ohm-m)	SI. No.	AB/2 in meter (C.E.)	MN in meter (P.E.)	Resistivity (ohm-m)
1	2	2	210	1	2	2	257
2	5	2	310	2	5	2	297
3	10	2	300	3	10	2	271
4	20	20	234	4	20	20	157
5	30	20	137	5	30	20	125
6	40	20	101	6	40	20	121
7	50	20	94	7	50	20	123
8	60	20	84	8	60	20	124
9	70	20	97	9	70	20	119
10	80	20	105	10	80	20	125
11	90	20	114	11	90	20	125
12	100	20	120	12	100	20	131
13	120	40	132	13	120	40	136
14	140	40	150	14	140	40	146
15	150	40	159	15	150	40	156

Discussion of result

A total 02 numbers of VES have been carried out at different points. Aquameter CRM 500 Resistivity meter has been used for conducting the VES. Schlumberger and half Schlumberger configurations have been used for conducting the VES survey. The maximum current electrode spread for conducting VES was 300 m (AB). The data is plotted on double logarithmic graph paper and matched with standard curves to determine the resistivity and thickness of various layers. The data is also interpreted by a Computer using IPI2WIN software to verify the results of partial curve matching from interpreted results of VES, the resistivity and thickness of different layers in VES 1 and 2.

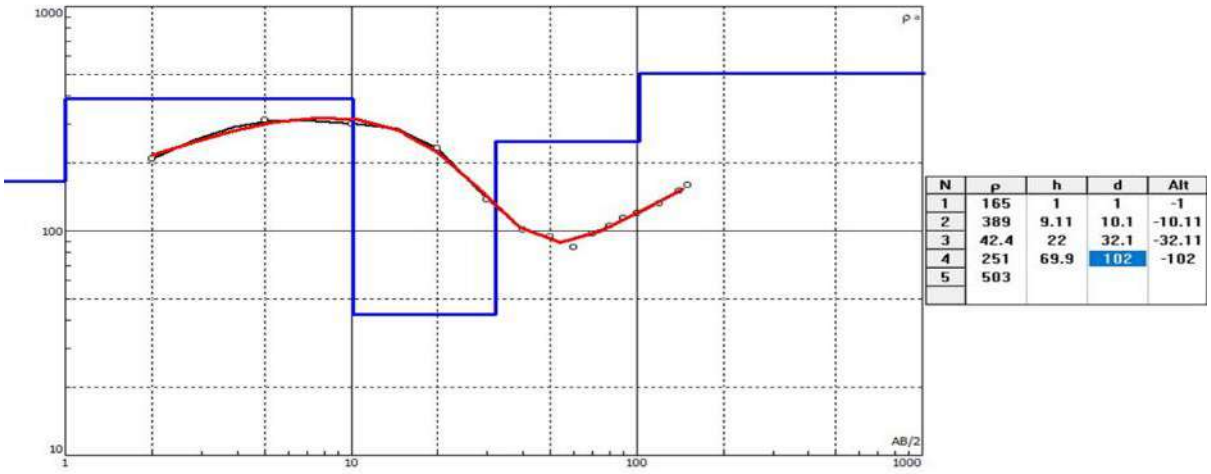


Figure 3.3: Electrode spacing (AB/2) vs resistivity for VES1.

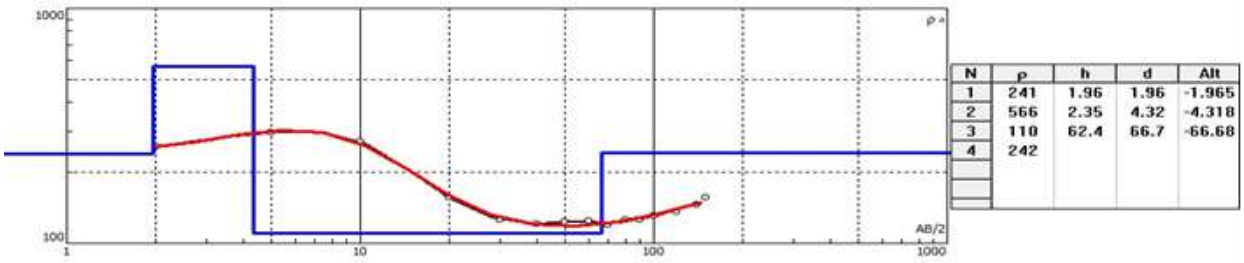


Figure 3.4: Electrode spacing (AB/2) vs. resistivity for VES2.

Table 3.3: Inferred results of the geophysical survey.

VES	Layer No	Rho (Ohm-m)	Thickness (m)	Depth (m)	Interpreted Lithology	Expected geology
1	1	165	1	1	Topsoil	
	2	389	9.11	10.1	Weathered Zone	Precambrian
	3	42.4	22	32.1	Highly Fractured Rock	(Singhbhum Formation)
	4	251	69.9	102	Fractured Rock	
	5	503		Infinity	Hard Rock	
2	**Layer No**	**Rho (Ohm-m)**	**Thickness (m)**	**Depth (m)**	**Interpreted Lithology**	**Expected geology**
	1	241	1.96	1.96	Topsoil	
	2	566	2.35	4.32	Weathered Zone	Precambrian
	3	110	62.4	66.7	Fractured Rock	(Singhbhum Formation)
	4	242		Infinity	Hard Rock	

3.3 HYDROGEOLOGICAL SET UP

The hydrogeological framework is mainly determined by the geological setup, rainfall distribution and the degree of secondary and primary porosities in the geological formations for storage and movement of groundwater. The geological formations of the study area have diverse lithological compositions and structures. Hence the hydrogeological condition too shows wide variations. Two major hydrogeological units have been identified depending on geology, water-bearing and yielding properties.

1. Consolidated formations.
2. Unconsolidated formations.

Consolidated formations, mainly crystalline rocks, lack primary porosity. Groundwater occurs mainly in the weathered zones at shallow depths like joints, shears, foliation planes and fractures at deeper depths. In the latter, groundwater occurs in the inter-granular pore spaces. Other factors affecting groundwater's potential are rainfall and climate, topography, soil conditions and land use of the study area. In the hard crystalline rock, water recharge from precipitation or seepage from surface water bodies percolates into the weathered zone. In this zone, groundwater generally occurs under the unconfined condition, whereas in the fractured bedrock aquifers, it occurs under semi-confined to confined conditions. The younger Proterozoic volcanic do not form potentials aquifers, weathered basement and fractured fresh basement rock horizons in the limited areas of good recharge. Sedimentaries, too occurring in valley areas, have good potential up to 60 m depth wherever truncated by dolerite dykes. The iron ore group of rocks has high yield potentials in the upper 75 m depth.

The unconsolidated formations mainly consist of laterite and alluvium. Laterites at places are highly consolidated and used as building stones. The laterites have a high degree of effective porosity and form potential aquifers commonly tapped in dug wells. The alluvium comprises an admixture of varying proportions of clay, silt, sand, and calcareous concretions. Ground water occurs under the phreatic condition at shallow depth. The thickness of the alluvium varies from 15 m to the maximum of 95 m bgl, with an average of around 40 m. The thickness of granular zones varies from 12 m to 25 m. The aquifer characteristics of the lateritic aquifers indicate high development potential.

Quartzite is the predominant aquifer that spreads over the study area . Shale is found in the southwestern portion of the study area. Basement gneiss covers in the edge of study area and

in eastern & southeastern region of the study area. Sandstones occupy the northeastern section of the study area (Figure 3.6).

To study the change in ground water regime in and around study area, 17 monitoring wells were selected at different locations for regular monitoring of groundwater levels (Core zone - 2 wells, Buffer zone - 10 wells & outside buffer zone - 5 wells). The monitoring schedule undertaken in and around the mine area has been categorized into 2km core and 10 km buffer zone to better understand the changes observed in the groundwater regime. Based on the water level of monitoring wells, a hydrogeology map has been prepared as Figure 3.6. The details of these well inventory monitoring wells and location map are presented in Table 3.4 and Figure 3.5.

Table 3.4: Well inventory details collected in and around the study area.

Well Id	Latitude	Longitude	Elevation (m)	Water Level (mbgl)		Fluctuation (m)	Water Table (mamsl)	
				October 2023	May 2023		May 2023	October 2023
WL1	21.95341	85.35306	560	5.62	8.02	2.4	551.98	554.38
WL2	21.96459	85.3314	594	5.21	7.48	2.27	586.52	588.79
WL3	21.99168	85.4223	508	6.79	8.12	1.33	499.88	501.21
WL4	21.89318	85.40508	563	1.83	3.49	1.66	559.51	561.17
WL5	21.91146	85.4135	586	4.83	6.79	1.96	579.21	581.17
WL6	21.92028	85.38568	639	1.03	3.08	2.05	635.92	637.97
WL7	21.87043	85.43573	502	1.83	3.79	1.96	498.21	500.17
WL8	21.89578	85.4526	487	6.25	8.24	1.99	478.76	480.75
WL9	21.84316	85.44125	499	6.09	7.98	1.89	491.02	492.91
WL10	21.9512	85.42577	488	2.50	4.89	2.39	483.11	485.5
WL11	21.91581	85.36132	593	3.24	5.12	1.88	587.88	589.76
WL12	22.01194	85.37808	534	1.77	3.68	1.91	530.32	532.23
WL13	21.82046	85.46206	504	5.25	7.19	1.94	496.81	498.75
WL14	22.03837	85.49196	433	3.45	6.01	2.56	426.99	429.55
WL15	21.89806	85.57278	414	5.21	7.07	1.86	406.93	408.79
WL16	21.87426	85.31084	627	3.58	5.19	1.61	621.81	623.42
WL17	21.99009	85.31931	550	2.82	5.28	2.46	544.72	547.18

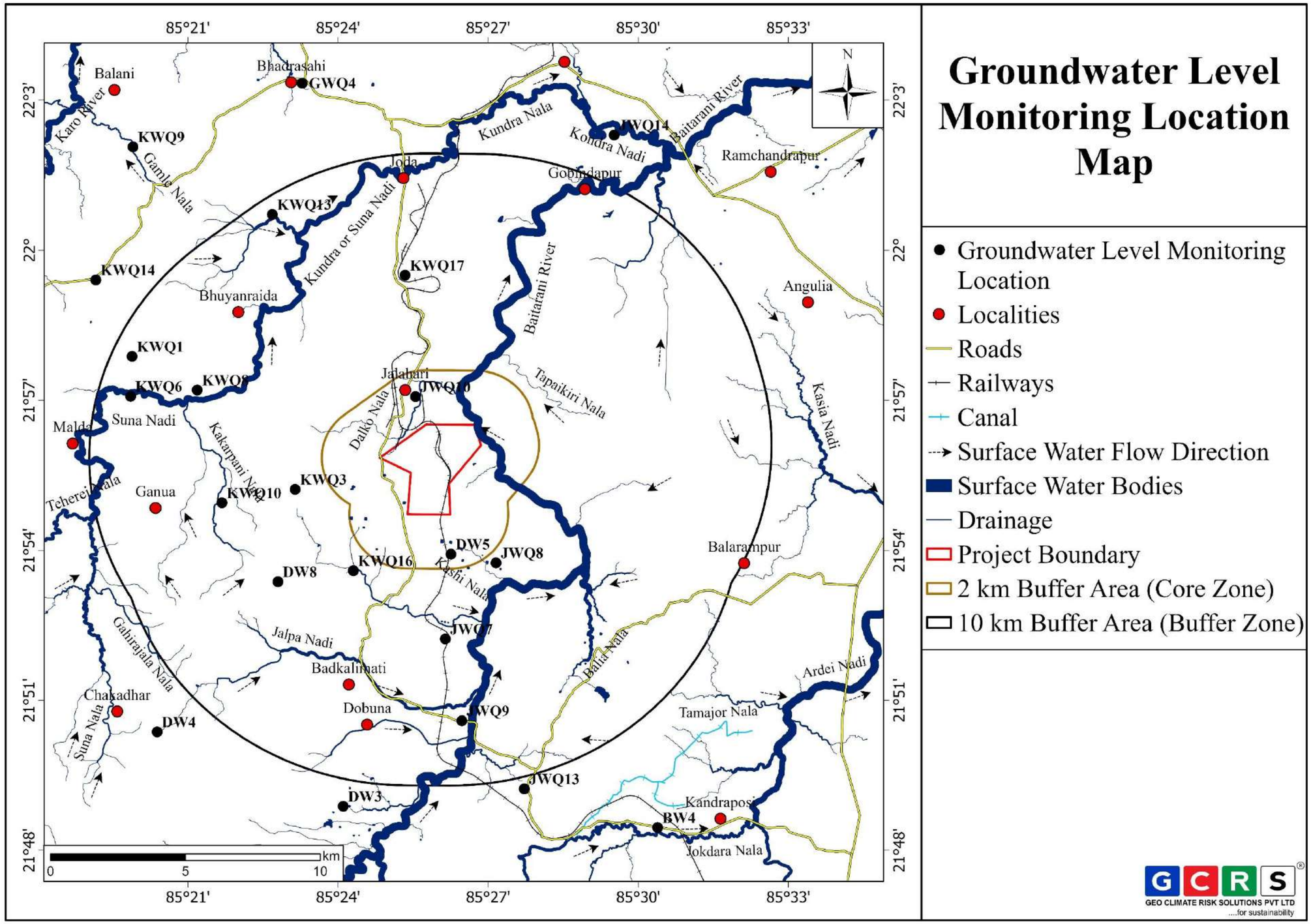


Figure 3.5: Location map of groundwater monitoring stations in and around the study area.

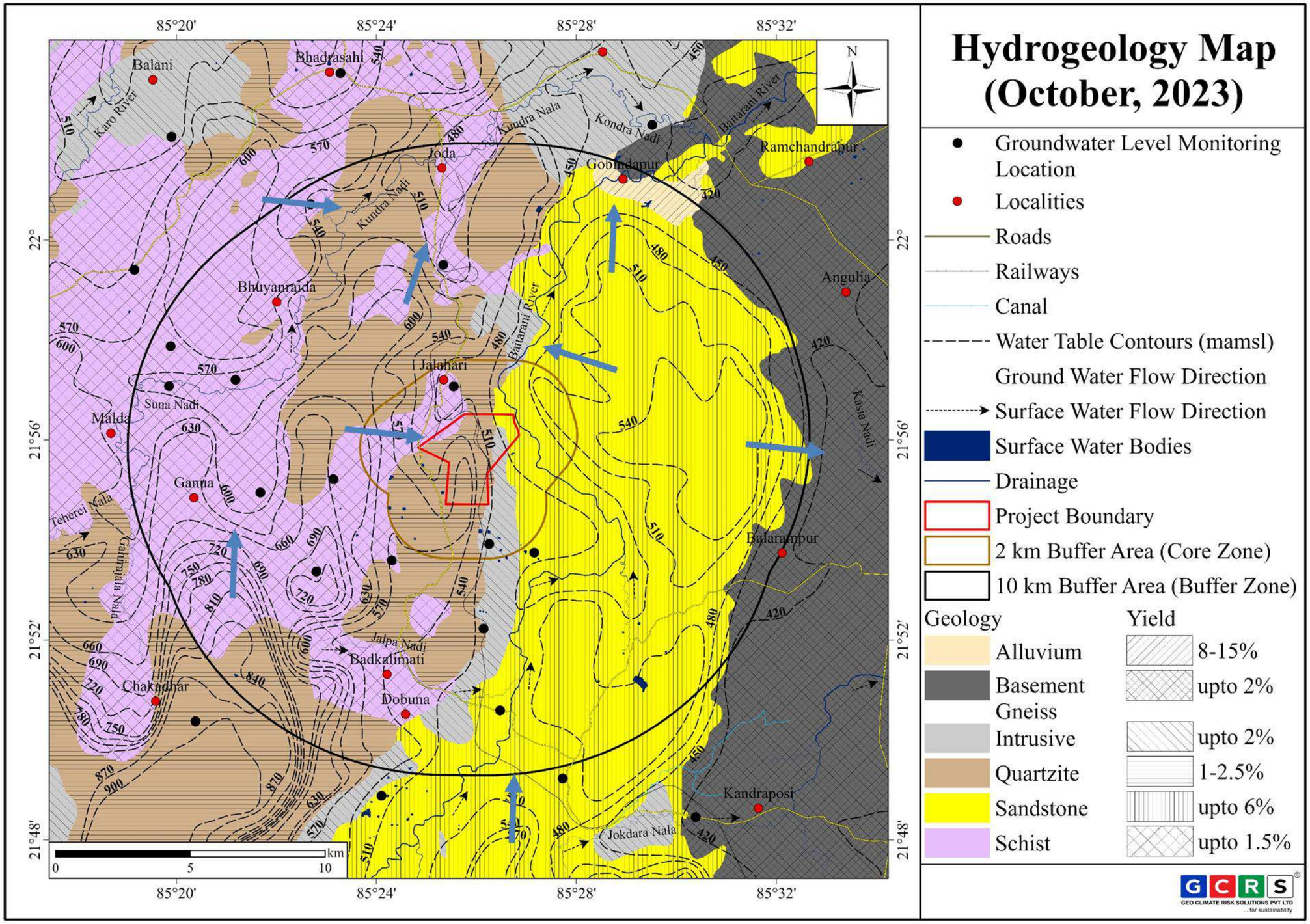


Figure 3.6: Hydrogeology map of the study area.

3.3.1 Aquifer Characteristics

The aquifer parameters are essentially required for the estimation of mine seepage as well as planning the groundwater withdrawal for open cast mining. The aquifers of the study area, are mainly composed of quartzite, which covers the maximum area, and have a yield capacity of 1 to 2.5 %. The sandstone has maximum water yielding up to 6%, followed by the shale, basement gneiss and intrusive that yield water up to 3%, 3%, & 2%, respectively (Figure 3.5).

Accordingly, a short-term pumping test has been carried out for determination of aquifer parameters accurately in the mine area. The details of the data pertaining to the pumping test is furnished in Table 3.5. The drawdown values obtained from the pumping test is plotted and analyzed by Jacob's straight line method.

Table 3.5: Details of pumping test conducted at Jajang.

Pumping Well			**Observation Well**			
Height of measuring point (agl)		0.32 m	0.40 m			
Latitude		21.93804 N	21.97679 N			
Longitude		85.43682 E	85.29636 E			
Depth of Well Drilled (bgl)		200 m	200 m			
diameter		0.1524m (6 inches)	0.1524m (6 inches)			
30.48 cm (12 inches) diameter drilling depth (bgl)			30.48 cm (12 inches) diameter drilling depth (bgl)			
20.32 cm (8 inches) diameter MS pipe casing lowered (bgl)			20.32 cm (8 inches) diameter PVC pipe casing lowered (bgl)			
19.05cm (7.5 inches) diameter drilling depth (bgl)			19.05cm (7.5 inches) diameter drilling depth (bgl)			
			10.16 cm (4 inches) diameter slotted pipe lowered (bgl)			
Initial Depth to WL (bmp)		2.41 m	1.82 m			
Elevation (amsl)		487 m	488 m			
Discharge rate		**7.2 m3/hr**				
Pump Capacity		**3 HP**				
Distance between pumping well and observation well = 29m						
		Pumping Well		Observation well		
SN	**Time since pumping started (min)**	**Water Level (mbmp)**	**Drawdown (m)**	**Water Level (mbmp)**	**Drawdown (m)**	Remarks
1	1	17.86	15.45	1.82	0	
2	2	17.89	15.48	1.83	0.01	

3	3	17.9	15.49	1.85	0.03	
4	4	17.92	15.51	1.86	0.04	
5	5	17.94	15.53	1.88	0.06	
6	6	17.96	15.55	1.9	0.08	
7	7	17.98	15.57	1.92	0.10	
8	8	18.00	15.59	1.93	0.11	
9	9	18.00	15.59	1.94	0.12	
10	10	18.01	15.6	1.96	0.14	
11	11	18.02	15.61	1.97	0.15	
12	12	18.05	15.64	1.98	0.16	
13	13	18.08	15.67	1.99	0.17	
14	14	18.10	15.69	2.00	0.18	
15	15	18.08	15.67	2.00	0.18	
16	20	18.10	15.69	2.01	0.19	
17	25	18.11	15.70	2.04	0.22	
18	30	18.14	15.73	2.06	0.24	
19	35	18.16	15.75	2.07	0.25	
20	40	18.21	15.80	2.08	0.26	
21	45	18.22	15.81	2.09	0.27	
22	50	18.21	15.80	2.10	0.28	
23	55	18.22	15.81	2.11	0.29	
24	60	18.23	15.82	2.11	0.29	
25	65	18.24	15.83	2.11	0.29	
26	70	18.28	15.87	2.12	0.30	
27	75	18.30	15.89	2.12	0.30	
28	80	18.32	15.91	2.125	0.31	
29	85	18.32	15.91	2.13	0.31	
30	90	18.33	15.92	2.13	0.31	
31	95	18.34	15.93	2.13	0.32	
32	100	18.35	15.94	2.13	0.32	
33	105	18.38	15.97	2.14	0.32	
34	110	18.38	15.97	2.14	0.32	
35	115	18.38	15.97	2.15	0.32	
36	120	18.38	15.97	2.15	0.33	
37	125	18.39	15.98	2.15	0.33	
38	130	18.39	15.98	2.15	0.33	
39	135	18.39	15.98	2.15	0.33	
40	140	18.40	15.99	2.15	0.33	
41	145	18.40	15.99	2.15	0.33	
42	150	18.40	15.99	2.15	0.33	
43	155	18.41	15.99	2.15	0.337	
44	160	18.41	16.00	2.159	0.339	

45	165	18.41	16.00	2.16	0.34	
46	170	18.41	16.00	2.16	0.34	
47	175	18.42	16.00	2.16	0.34	
48	180	18.42	16.00	2.159	0.339	
49	190	18.42	16.01	2.16	0.34	
50	200	18.42	16.01	2.16	0.34	
51	210	18.42	16.01	2.16	0.34	
52	220	18.43	16.02	2.16	0.34	
53	230	18.43	16.02	2.17	0.35	

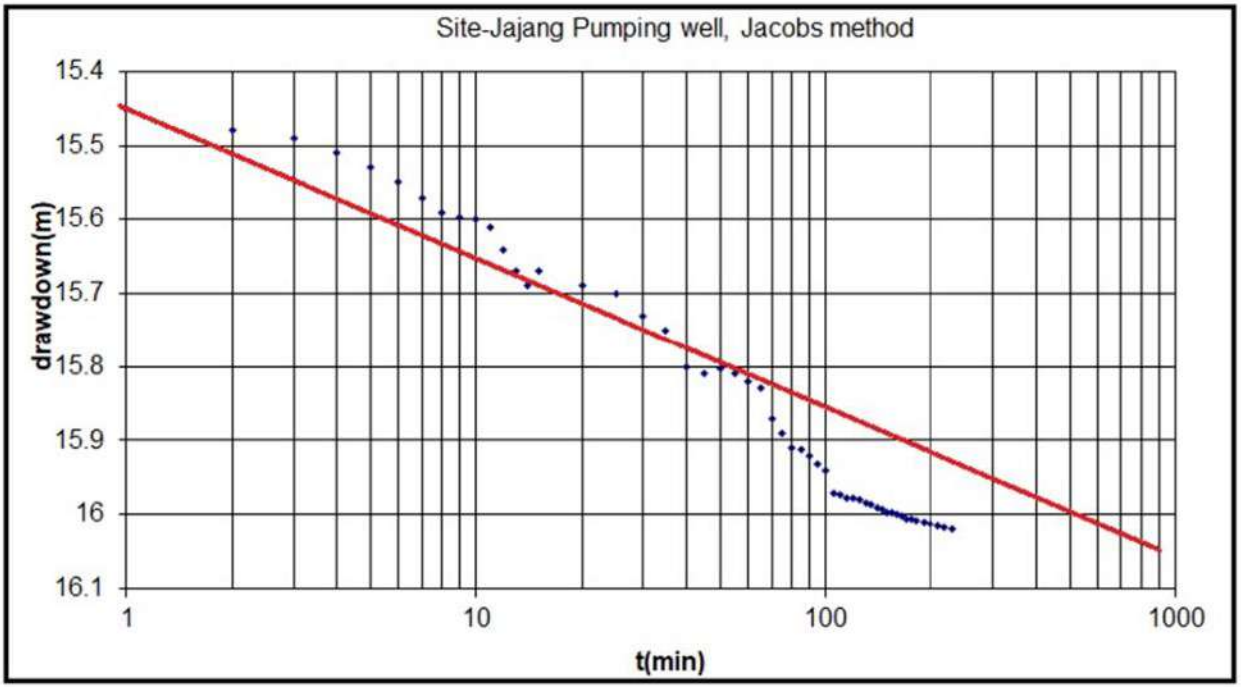


Figure 3.7: Pumping test data interpretation using Jacob's method.

The pumping test data has been analyzed by Jacob's straight-line method of the pumping data of the observation well. The calculation is given below.

Formulae: $T= 2.3Q/4\pi\Delta s$ &$S= 2.25\ T\ t_o/r^2$

Where,

T =kD = Transmissivity, m^2/day

Q = Discharge m^3/day=172.8 m^3/day

r = Distance (m) between PW & OW 29m

Δs = Slope of straight line per log cycle of time=0.2

S = Storage coefficient

t_o= time in days at zero drawdown

On the basis of above formulae, the calculated parameters are as follows.

T= 158.21 m^2/day

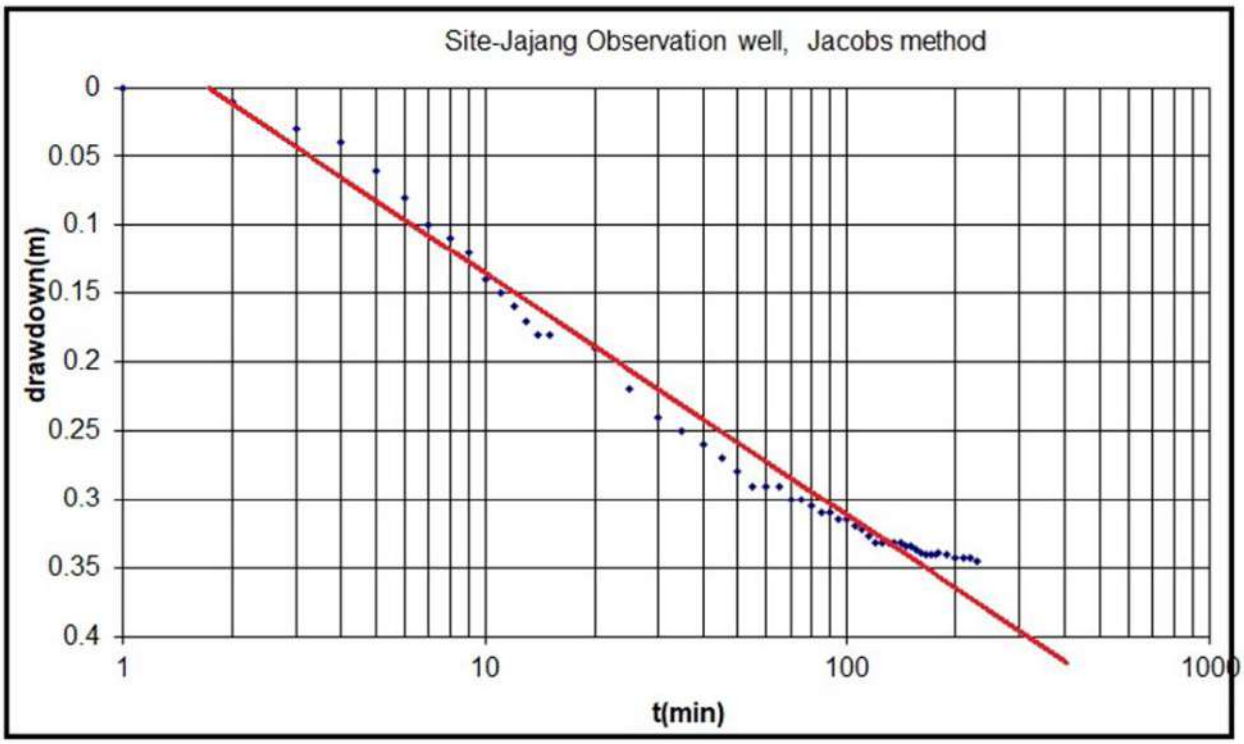


Figure 3.8: Residual drawdown vs. t/t'.

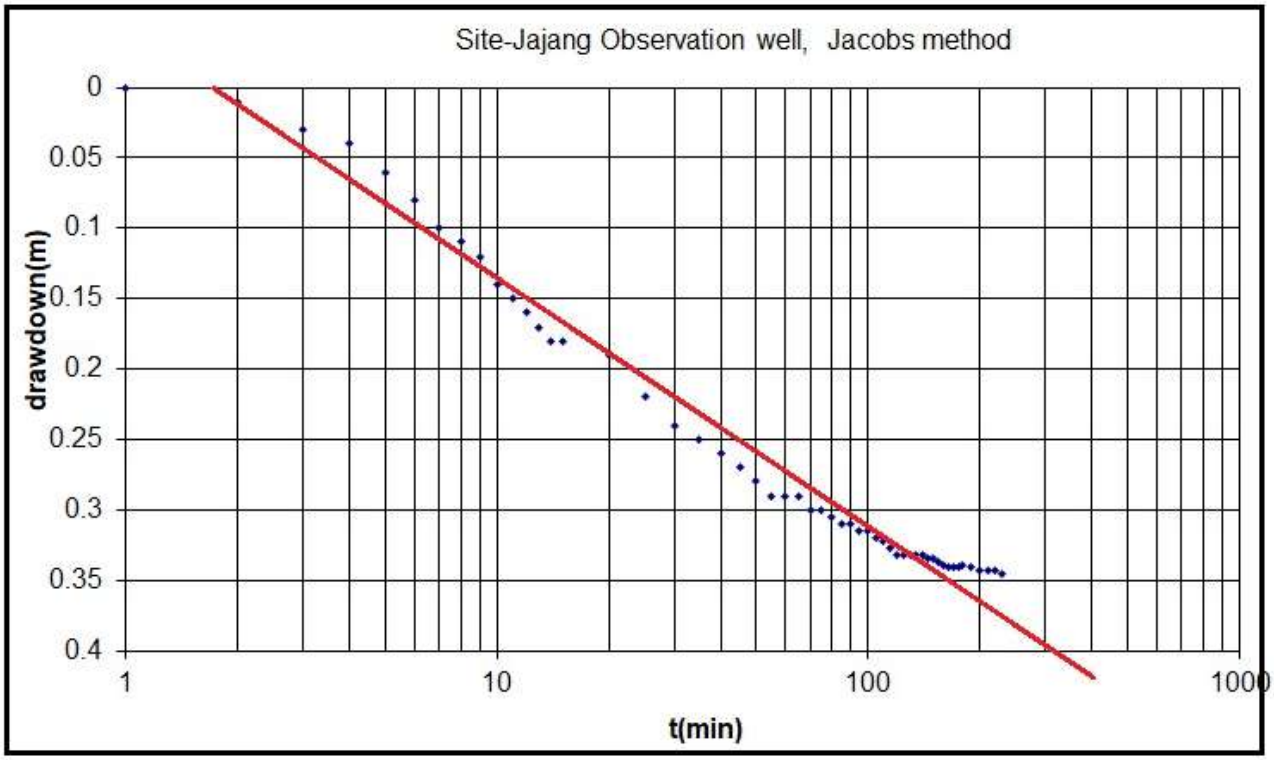


Figure 3.9: Drawdown vs. time.

Formulae: $T= 2.3Q/4\pi\Delta s$ &$S= 2.25\ T\ t_o/r^2$
Where,

T =kD = Transmissivity, m^2/day

Q = Discharge m^3/day=172.8 m^3/day

r = Distance (m) between PW & OW 29m

Δs = Slope of straight line per log cycle of time=0.26

S = Storage coefficient

t_o= time in days at zero drawdown

On the basis of above formulae, the calculated parameters are as follows.

T= 121.705 m^2/day

Table 3.6: Recuperation data.

SN	Time	Time since pumping started in min(t)	Time since pumping stopped in min (t')	t/t'	Recuperation data Pumping well		Recuperation data Observation well	
					Water Level (mbmp)	RDD (m)	Water Level (mbmp)	RDD (m)
1	12:01:00 AM	231	1	231.00	5.10	0.60	2.07	2.11
2	12:02:00 AM	232	2	116.00	3.46	0.55	2.04	2.09
3	12:03:00 AM	233	3	77.67	3.25	0.50	2.03	2.05
4	12:04:00 AM	234	4	58.50	3.09	0.47	2.03	2.03
5	12:05:00 AM	235	5	47.00	3.00	0.42	2.02	2.02
6	12:06:00 AM	236	6	39.33	2.96	0.40	2.02	2.02
7	12:07:00 AM	237	7	33.86	2.92	0.39	2.01	2.01
8	12:08:00 AM	238	8	29.75	2.84	0.39	2.00	2.00
9	12:09:00 AM	239	9	26.56	2.79	0.38	1.98	1.98
10	12:10:00 AM	240	10	24.00	2.77	0.36	1.97	1.97
11	12:11:00 AM	241	11	21.91	2.76	0.35	1.97	1.97
12	12:12:00 AM	242	12	20.17	2.75	0.34	1.96	1.96
13	12:13:00 AM	243	13	18.69	2.73	0.32	1.96	1.96
14	12:14:00 AM	244	14	17.43	2.72	0.31	1.95	1.95
15	12:15:00 AM	245	15	16.33	2.70	0.29	1.95	1.95
16	12:20:00 AM	250	20	12.50	2.66	0.25	1.93	1.93
17	12:25:00 AM	255	25	10.20	2.64	0.23	1.92	1.92
18	12:30:00 AM	260	30	8.67	2.61	0.20	1.92	1.92
19	12:35:00 AM	265	35	7.57	2.60	0.19	1.91	1.91
20	12:40:00 AM	270	40	6.75	2.58	0.17	1.91	1.91
21	12:45:00 AM	275	45	6.11	2.57	0.16	1.90	1.90
22	12:50:00 AM	280	50	5.60	2.56	0.15	1.90	1.90
23	12:55:00 AM	285	55	5.18	2.56	0.15	1.90	1.90
24	1:00:00 AM	290	60	4.83	2.55	0.14	1.89	1.89
25	1:05:00 AM	295	65	4.54	2.55	0.14	1.89	1.89
26	1:10:00 AM	300	70	4.29	2.54	0.13	1.88	1.88
27	1:15:00 AM	305	75	4.07	2.53	0.12	1.88	1.88
28	1:20:00 AM	310	80	3.88	2.53	0.12	1.88	1.88

29	1:25:00 AM	315	85	3.71	2.52	0.11	1.87	1.87
30	1:30:00 AM	320	90	3.56	2.51	0.10	1.87	1.87
31	1:35:00 AM	325	95	3.42	2.51	0.10	1.87	1.87
32	1:40:00 AM	330	100	3.30	2.51	0.10	1.87	1.87
33	1:45:00 AM	335	105	3.19	2.50	0.09	1.87	1.87
34	1:50:00 AM	340	110	3.09	2.50	0.09	1.87	1.87
35	1:55:00 AM	345	115	3.00	2.50	0.09	1.87	1.87
36	2:00:00 AM	350	120	2.92	2.50	0.09	1.87	1.87
37	2:20:00 AM	370	140	2.64	2.49	0.08	1.87	1.87
38	2:40:00 AM	390	160	2.44	2.49	0.07	1.86	1.86
39	3:00:00 AM	410	180	2.28	2.48	0.06	1.86	1.86
40	3:30:00 AM	440	210	2.10	2.47	0.05	1.85	1.85
41	4:00:00 AM	470	240	1.96	2.46	0.05	1.85	1.85
42	4:30:00 AM	500	270	1.85	2.46	0.04	1.85	1.85
43	5:00:00 AM	530	300	1.77	2.45	0.04	1.84	1.84

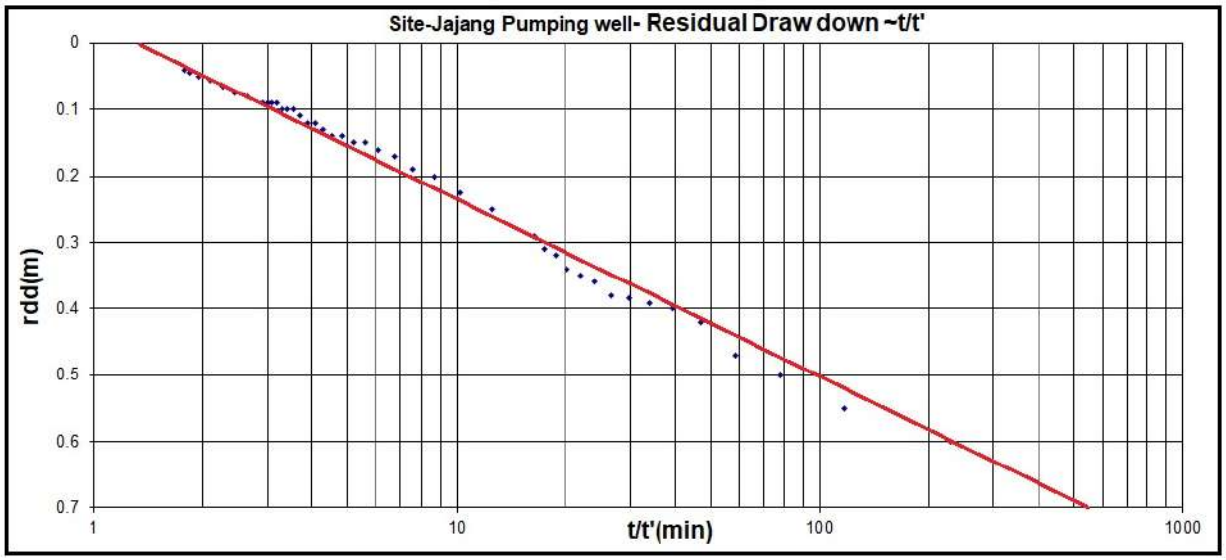


Figure 3.10: Residual drawdown vs. t/t'.

Formulae: $T= 2.3Q/4\pi\Delta s$ &$S= 2.25\ T\ t_o/r^2$

Where,

T =kD = Transmissivity, m^2/day

Q = Discharge m^3/day=172.8 m^3/day

r = Distance (m) between PW & OW 29m

Δs = Slope of straight line per log cycle of time=0.21

S = Storage coefficient

t_o= time in days at zero drawdown

On the basis of above formulae, the calculated parameters are as follows.

T= 121.705 m^2/day S=1.13X10^{-4}

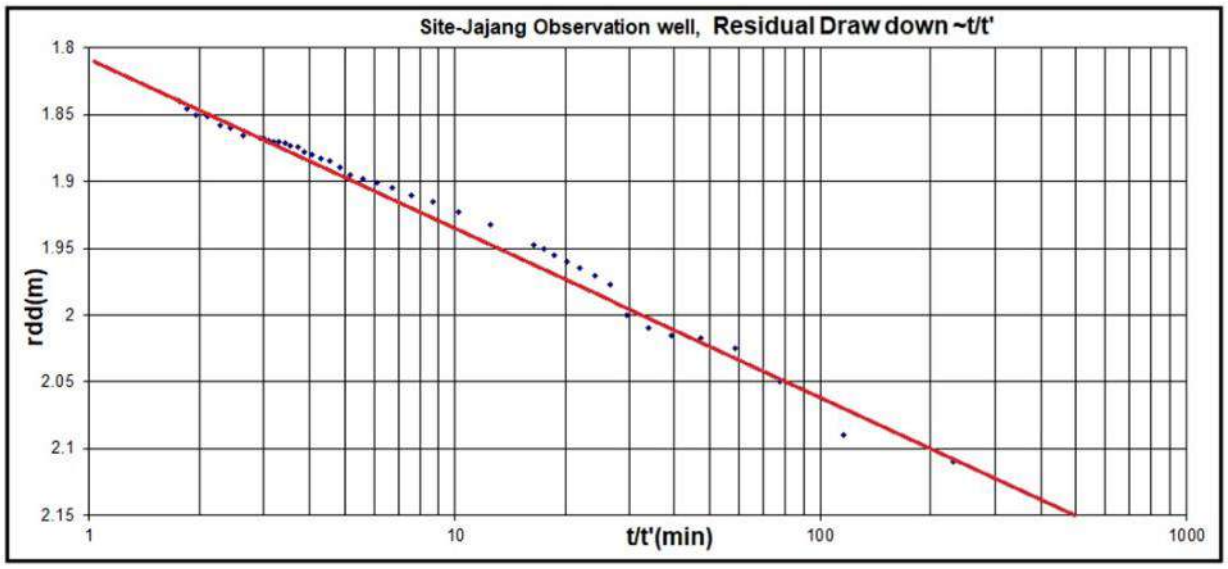


Figure 3.11: Residual drawdown vs. t/t'.

Formulae: $T = 2.3Q/4\pi\Delta s$

On the basis of above formulae, the calculated parameters are as follows.

T= 175.796 m^2/day

Table 3.7: Summarized details of pumping tests.

Village	**Type of test**	**Duration of test(min)**	**Q (m3/day)**	**Max D/D (m)**	r2 (m)	t0 (Day)
JAJANG(PW)	Pumping	230	172.8	16.02		
	Recovery	300	172.8			
JAJANG (OW)	Pumping	230	172.8	0.345	841	0.00035
	Recovery	300	172.8			

Village	**Type of test**	ΔS	Transmissivity (m2/day)	Thickness of the aquifer (m)	Storativity	Permeability (m/day)
JAJANG(PW)	Pumping	0.2	158.2166	50		3.16
	Recovery	0.21	150.6824	50		3.01
JAJANG (OW)	Pumping	0.26	121.705	50	0.000113963	2.43
	Recovery	0.18	175.7962	50		3.52
			151.6001		**Average**	**3.03**

3.3.2 Ground water flow and aquifer interaction with surface water bodies

To know the ground water flow regime in the study area, water table contours have been drawn based on water level and SRTM elevation data. The flow direction has been drawn & presented in as Hydrogeological map (Figure 3.6). The water table elevation in the study area ranges between 478.76 to 635.92 mamsl during May, 2023 and ranges between 480.75 to 637.97 mamsl during October, 2023 (Table 3.4). Variation in the groundwater flow direction can be observed, locally. The regional trend of groundwater flow direction in the overall study area is generally towards north. The study area is an undulating terrain with number of hills. The groundwater flow direction is generally follows the surface topography. The local groundwater flow direction is from south to north (Figure 3.12 and Figure 3.13).

The groundwater recharge process is mainly governed by surface water and groundwater interaction. Several natural (hydrometeorological and hydrological) and anthropogenic processes play an important role in understanding the groundwater recharge processes and surface water and groundwater interaction (Winter et al., 1998; Mayer et al., 2014). These interactions play an important role in determining water's hydrogeochemical composition, quality, and quantity at regional and local scales (Bhattacharya et al., 1985). Therefore, a proper understanding of surface water and groundwater interaction is essential for calculating water budget and effective water resources management.

Several methods, such as water balance, hydro-geochemical approach, water table fluctuation method, rainfall-runoff modelling, and isotopic approach, are widely used to identify the surface water and groundwater interaction (Healy and Cook, 2002). The present study uses a water table fluctuation approach to identify surface water and groundwater interaction.

The water table fluctuation approach is widely used for the unconfined aquifers that display a sharp change in groundwater levels (Healy and Cook, 2002; Joshi et al., 2021a & b; Tiwari et al., 2021). The water table fluctuation approach calculates the rise in groundwater level in response to given precipitation. In the water table fluctuation approach, groundwater recharge is estimated from the position of the water table during or after a precipitation event multiplied by the specific yield.

$$R = S_y \frac{\Delta h}{\Delta t}$$

where R is the groundwater recharge, Δh is the water level increase during Δt time, S_y = 0.08% Specific yield of an unconfined aquifer system (CGWB, 2009).

The results obtained using the water table fluctuation approach indicate active recharge conditions in and around the study area. The average rate of groundwater recharge is about 60 mm/year.

3.3.3 Depth to Water Level

Monitoring of groundwater regime will be of immense help in the management of the water resources as well as in protecting groundwater storage. Such a study envisages regular monitoring of water levels at selected locations to observe the variation of the groundwater level concerning groundwater withdrawal over time. It is pertinent to say that any groundwater development of a particular area would bring changes near it. The water level monitoring details are given in Table **3.4** and the summarized results are in Table 3.8. The depth to water level maps are given in

Table 3.8: Summarised results of water level data

	Water level (mbgl)					
	May, 2023			**October, 2023**		
	Minimum	Maximum	Standard Deviation	Minimum	Maximum	Standard Deviation
Core zone	4.89	6.79	0.95	2.50	4.83	1.17
Buffer zone (Study area)	3.08	8.24	2.13	1.03	6.79	2.12
Outside buffer zone	5.19	7.19	0.85	2.82	5.25	0.99
	Water table (mamsl)					
	Minimum	Maximum	Standard Deviation	Minimum	Maximum	Standard Deviation
Core zone	483.11	579.21	48.05	485.5	581.17	47.84
Buffer zone (Study area)	478.76	635.92	48.72	480.75	637.97	48.82
Outside buffer zone	406.93	621.81	78.53	408.79	623.42	78.40

The depth to water level in the study area varied from 3.08 to 8.24 mbgl during May, 2023 whereas it varied from 1.03 to 6.79 mbgl during October, 2022. It ranged from 4.89 to 6.79 mbgl during May, 2023 and ranged from 2.50 to 4.83 mbgl during October, 2023 in the core zone. Outside the buffer zone, it varied from 5.19 to 7.19 mbgl during May, 2023 and 2.82 to 5.25 mbgl during October, 2023. The water level fluctuation in the study area varied from 1.33 to 2.56 m.

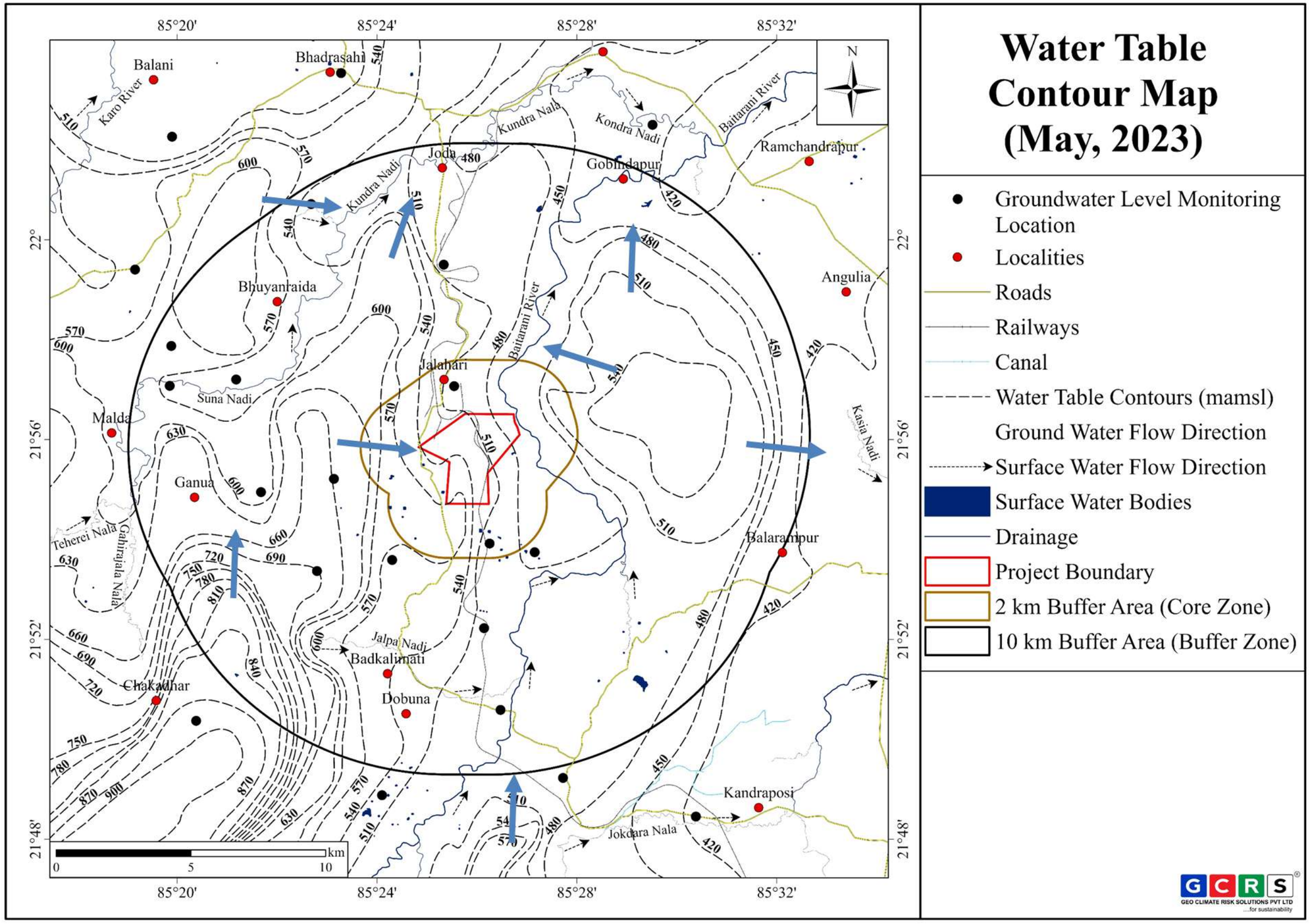


Figure 3.12: Water table contour map for May, 2023.

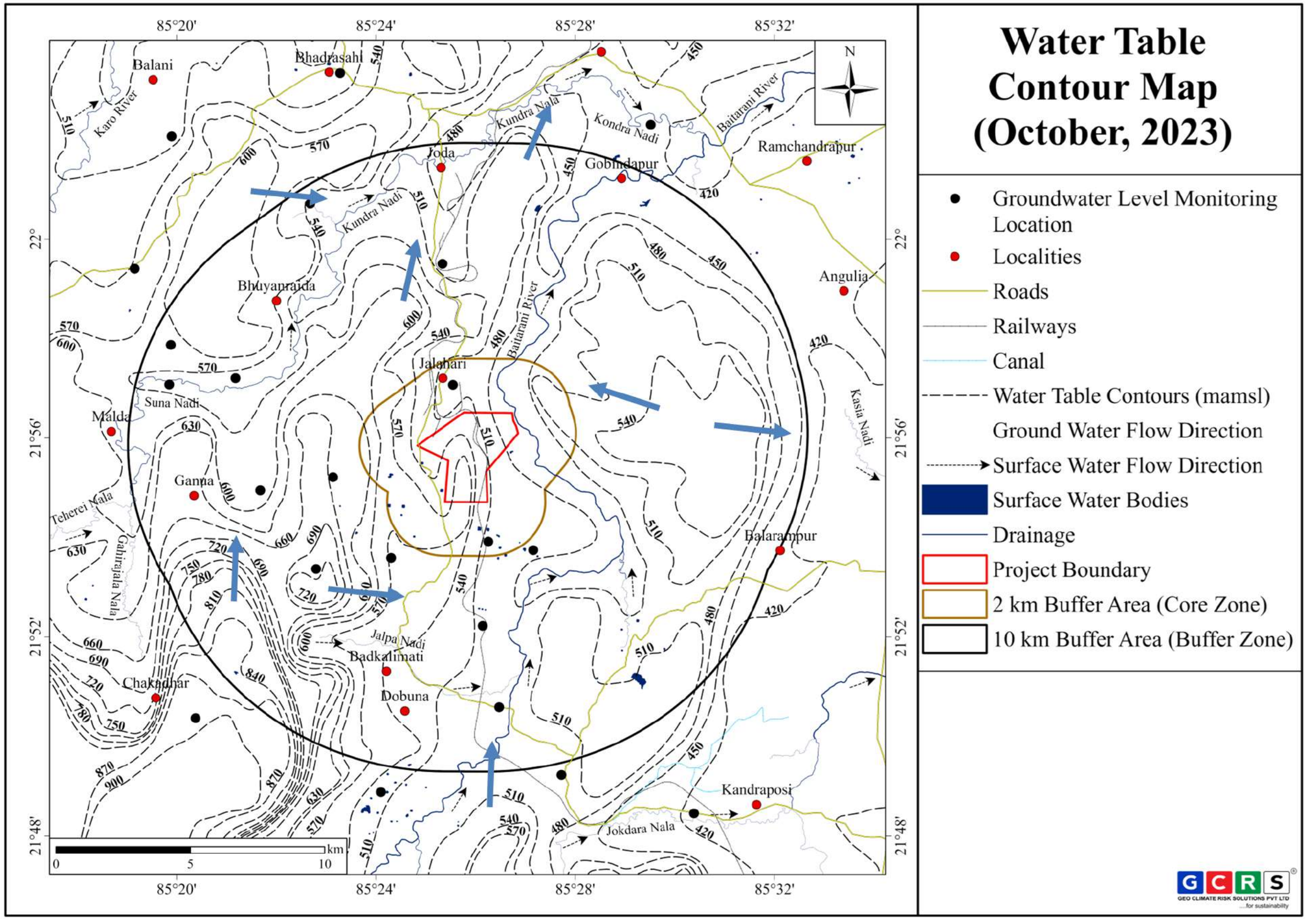


Figure 3.13: Water table contour map for October, 2023.

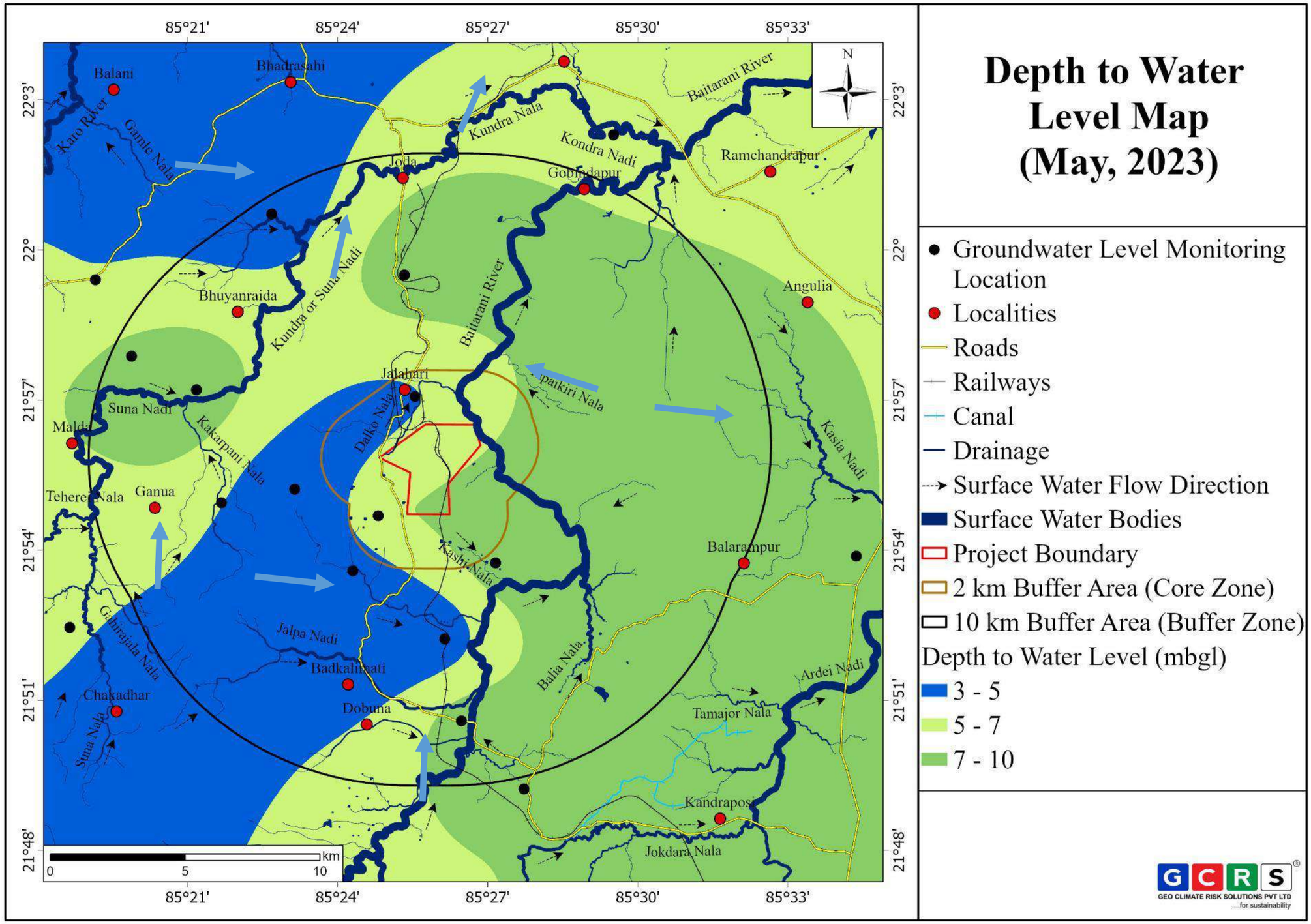


Figure 3.14: Depth to water level map of May, 2023.

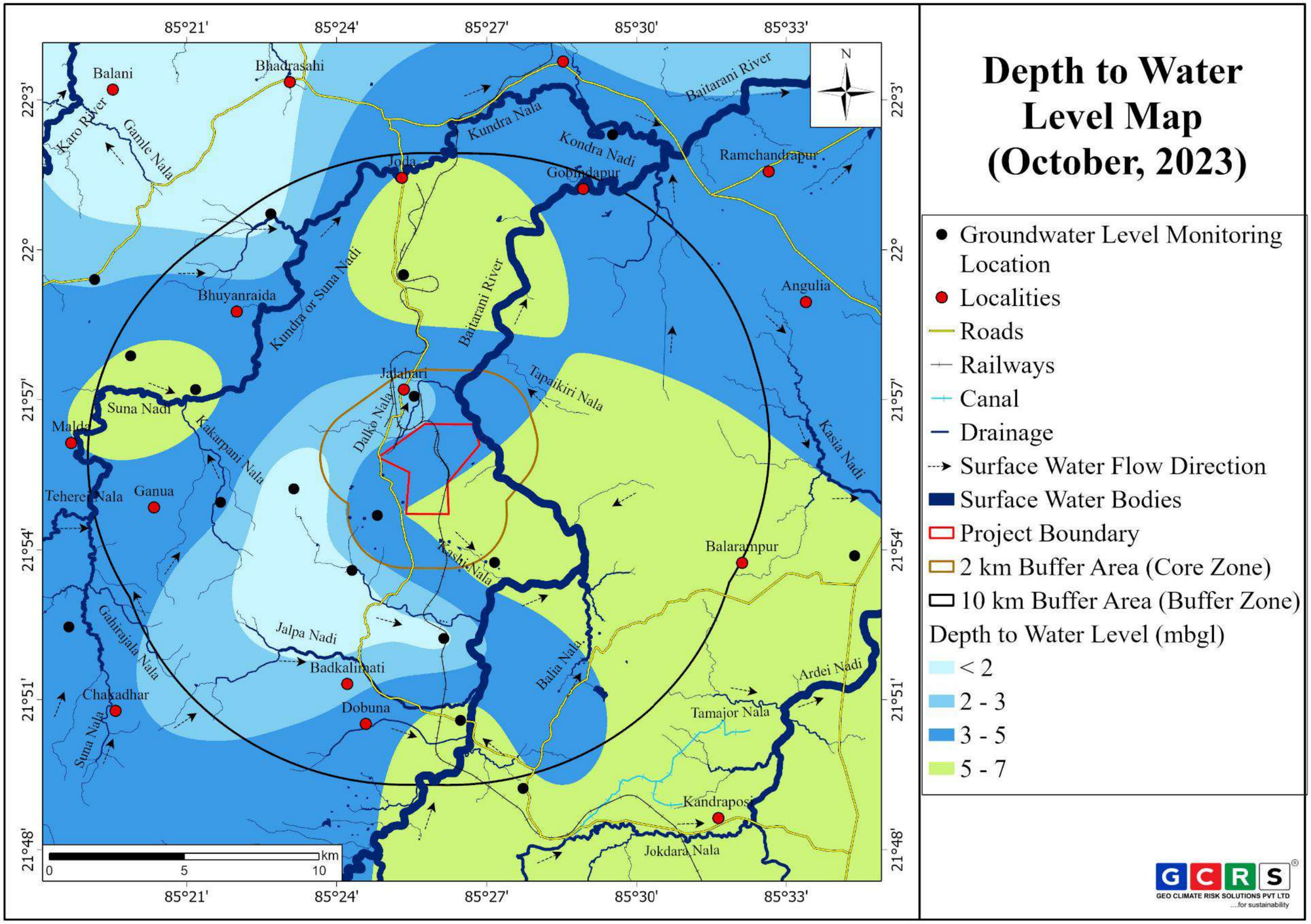


Figure 3.15: Depth to water level map of October, 2023.

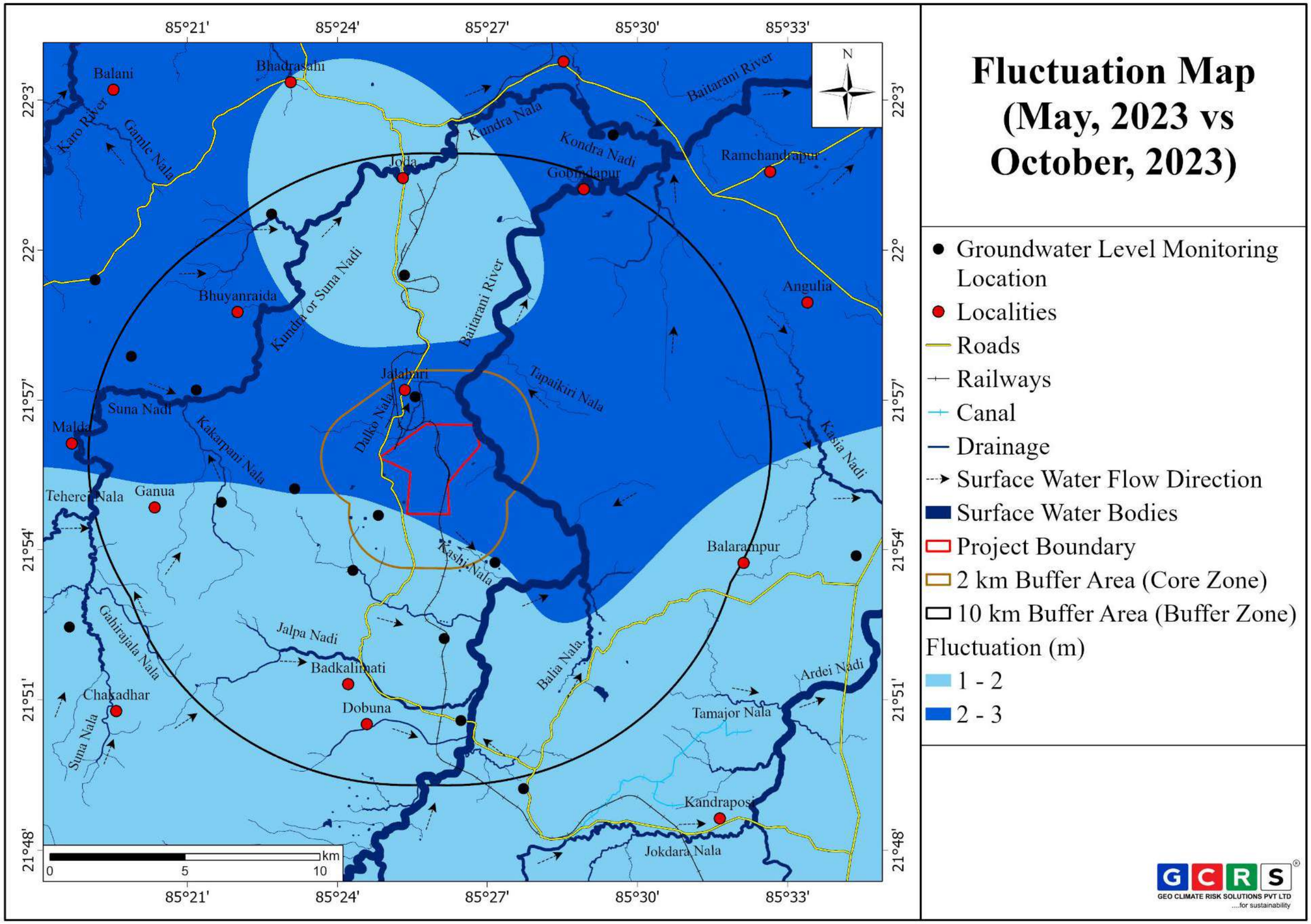


Figure 3.16: Water Level fluctuation map (May, 2023 vs October, 2023).

3.3.4 Long term water level data analysis

In order to study the changes in ground water level with respect to time, data were analyzed from 2010 to 2022 through the monitoring network wells of CGWA that lie in and around the study area. The variation in ground water level recorded systematically for a longer period in the monitoring location of "Joda", which is situated at an aerial distance of 8.33 km in the north direction from the project boundary (Figure 3.17). The long term montoring data also represented by the hydrograph and some seasonal fluctuations are observed. Only seasonal fluctuation with cyclic and sinusoidal changes representing the recharge and discharge of ground water during the different period has been observed which can be due to variations in rainfall patterns and no significant decline in water level is identical during observation period.

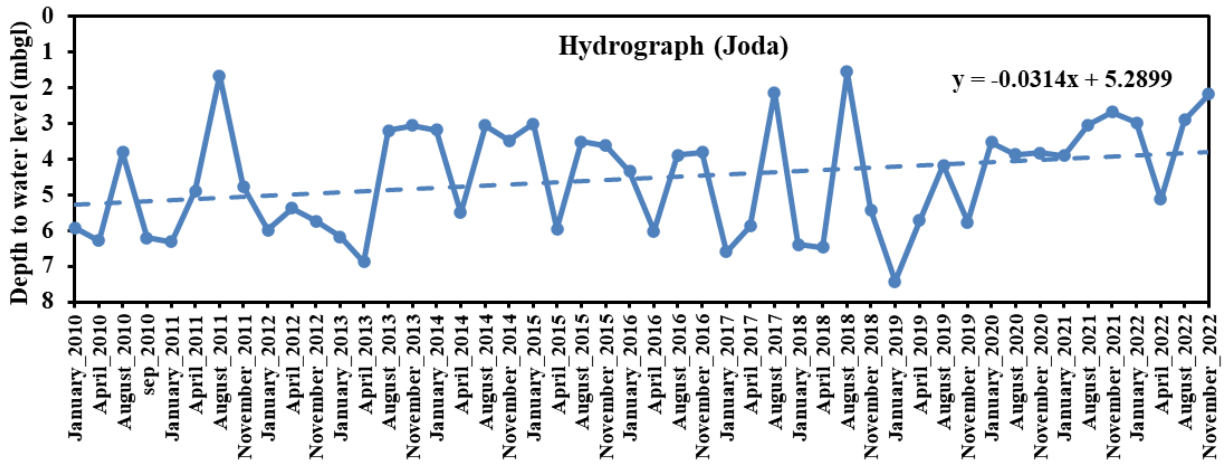


Figure 3.17: Hydrograph

3.3.5 Ground water quality

The water quality of the mine lease area and surrounding may be altered due to nearby quarry and mining activities. Hence, to understand the groundwater quality in and around the mine lease area, groundwater samples were collected in and around the study area (Figure 3.18). The water sample analysis report is attached as Annexure-I. It shows that all the quality parameters lie within the permissible limits as per IS: 10500:2012.

The suitability of groundwater for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water on the growth of human beings, animals, and various plants and the industrial requirement. However, many ions

are essential for the growth of plants and the human body, but when present in excess, they have an adverse effect on health and growth.

The water samples have been collected from the core zone, buffer zone, and outside of the buffer zone for the qualitative analysis of groundwater (Table 3.9). The water quality monitoring location maps is shown as Figure 3.18. It is observed that all the water quality parameters are within the permissible limits as per the BIS standard.

The values for the Electrical Conductivity varied from 150 to 650 µS/cm in the study area (Figure 3.19). The chloride concentration in the study area mainly varied from 17.4 to 190.2 mg/L (Figure 3.20). The reported nitrate concentration ranges from 2.9 to 24.3 mg/L in and around the study area (Figure 3.21). The fluoride concentration varies from 0.10 to 0.50 mg/L (Figure 3.22).

Table 3.9: Water quality analysis results.

Sl. No	Well Id	Latitude	Longitude	pH	EC	HCO3	Ca	Mg	Na	K	Fe	Cl	SO4	NO3	F	Mn
1	KWQ6	21.95129	85.33089	7.90	650	205	58.1	18.3	31.5	36.0	0.18	171.5	17.1	19.6	0.17	BDL
2	KWQ10	21.91581	85.36132	8.00	550	150	30.2	11.0	53.1	32.0	0.23	190.2	27.2	16.5	0.11	BDL
3	JWQ10	21.9512	85.42577	7.90	500	145	52.1	11.0	33.5	2.9	0.23	64.2	8.5	11.9	0.15	BDL
4	KWQ2	21.98669	85.2906	8.00	420	180	36.2	19.5	18.3	0.8	0.14	18.4	5.2	15.4	0.29	BDL
5	JWQ8	21.89578	85.4526	8.00	400	130	38.5	13.0	23.2	0.1	0.1	46.2	14.2	22.3	0.10	BDL
6	JWQ9	21.84316	85.44125	7.61	390	30	38.6	5.2	35.4	5.6	0.22	99.1	21.6	12.1	0.40	BDL
7	KWQ16	21.89318	85.40508	8.00	380	145	34.1	7.1	32.3	1.5	0.14	25.5	7.9	11.9	0.50	BDL
8	DWQ4	21.8395	85.3397	7.99	380	95	34.2	9.0	24.2	4.1	0.15	43.6	31.2	7.8	0.30	BDL
9	DWQ5	21.8987	85.4376	8.08	370	120	28.5	15.1	24.2	3.2	0.16	39.2	3.5	15.8	0.20	BDL
10	KWQ4	21.87426	85.31084	7.75	360	100	34.5	9.0	25.2	6.2	0.16	50.2	8.25	12.5	0.30	BDL
11	KWQ3	21.92028	85.38568	7.90	350	150	14.3	24.3	18.5	0.3	0.03	17.6	8.5	10.6	0.26	BDL
12	KWQ17	21.99168	85.4223	7.80	350	110	40.2	3.7	26.1	2.8	ND	92.5	8.5	6.5	0.19	BDL
13	KWQ8	21.95341	85.35306	7.90	300	100	36.5	3.7	16.4	0.6	0.08	120.7	6.3	24.3	0.25	BDL
14	KWQ13	22.01194	85.37808	8.00	300	135	24.6	7.3	22.4	0.3	ND	170.2	8.9	15.6	0.34	BDL
15	JWQ14	22.03837	85.49196	8.03	300	90	24.3	9.0	22.7	2.5	0.11	35.5	3.6	3.9	0.40	BDL
16	DWQ8	21.8895	85.38	7.80	300	110	30.4	7.3	17.3	0.6	0.17	59.7	8.2	21.2	0.23	BDL
17	JWQ7	21.87043	85.43573	7.76	260	60	20.2	3.9	27.4	4.1	ND	46.6	13.6	9.5	0.30	BDL
18	KWQ1	21.96459	85.3314	8.10	250	95	22.1	5.2	19.1	0.6	0.21	18.2	3.2	11.2	0.10	BDL
19	DWQ3	21.8147	85.4017	8.10	250	95	24.1	4.9	21.4	0.2	0.14	17.4	5.9	6.9	0.25	BDL
20	GWQ4	22.05562	85.38806	8.00	200	50	28.1	2.1	8.2	0.2	0.19	32.6	5.2	2.9	0.10	BDL
21	BWQ4	21.8076	85.5064	8.23	150	45	12.3	2.5	15.5	3.1	0.14	17.7	25.3	6.2	0.17	BDL

Note: All the units are in mg/L except for pH (no unit) and EC in µS/cm.

ND: Not Detected

BDL: Below Detection Limit

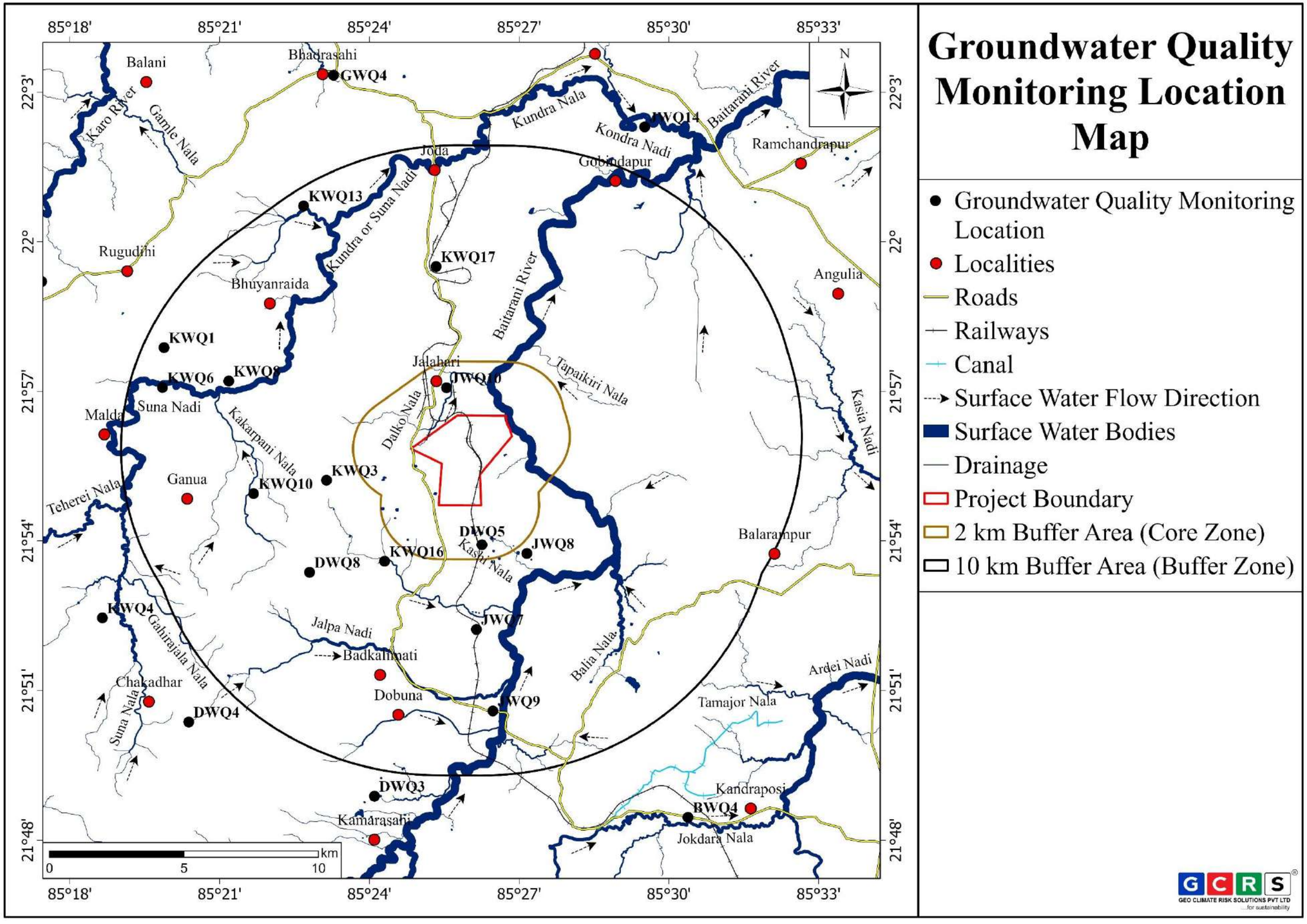


Figure 3.18: Location map of groundwater quality monitoring locations in and around the study area.

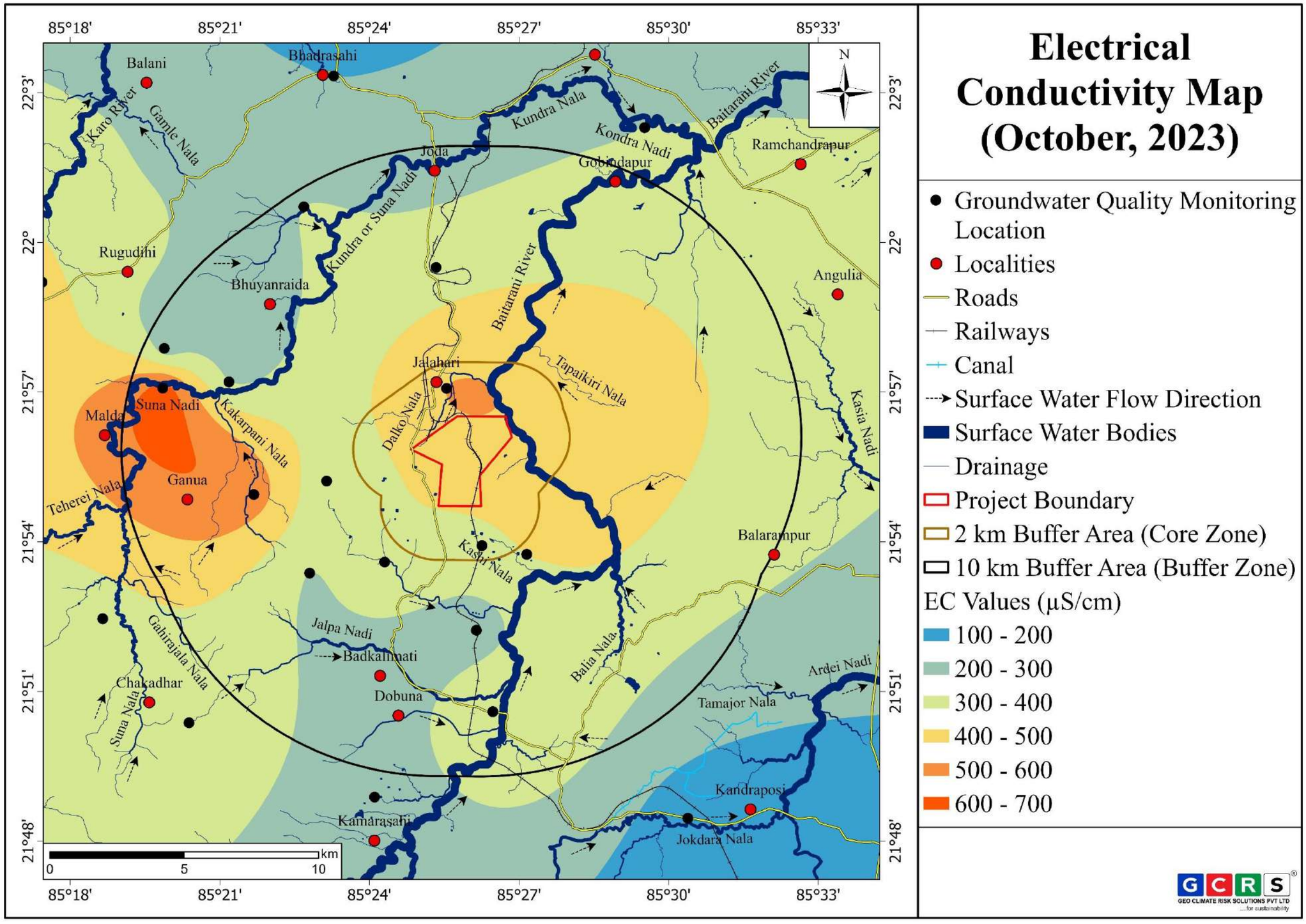


Figure 3.19: EC contour map in and around the study area (Source: Field data).

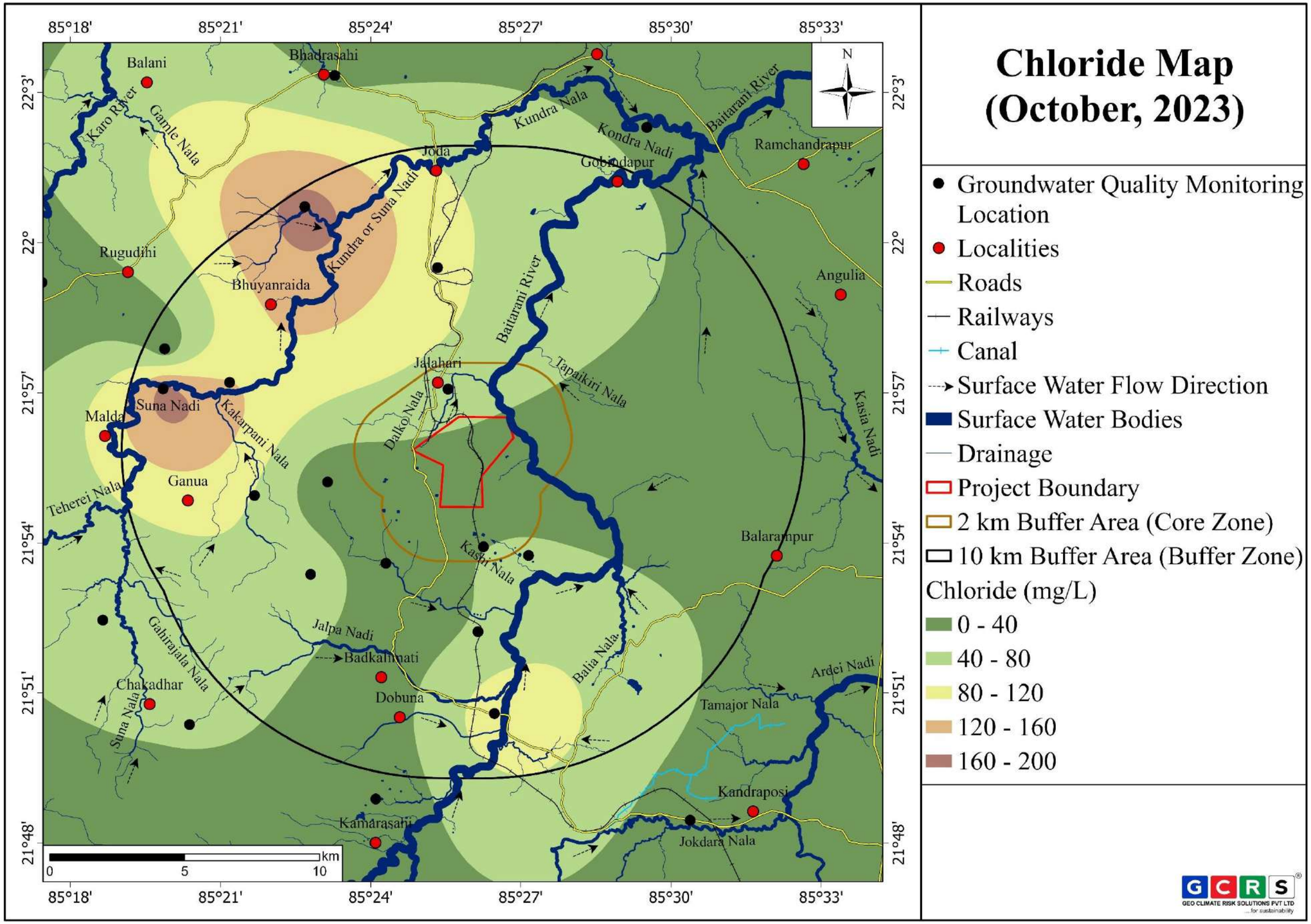


Figure 3.20: Chloride map in and around the study area (Source: Field data).

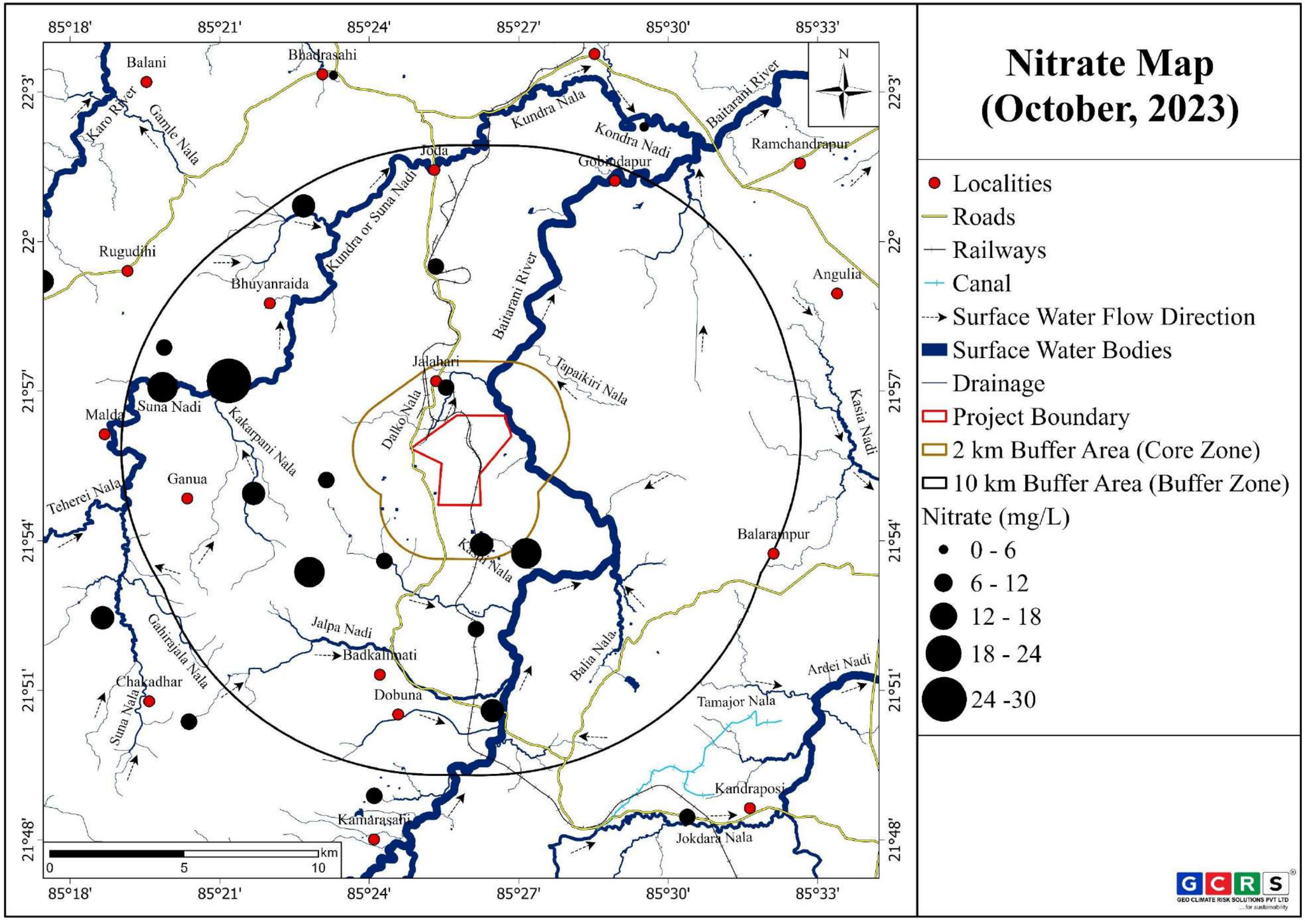


Figure 3.21: Nitrate map in and around the study area (Source: Field data).

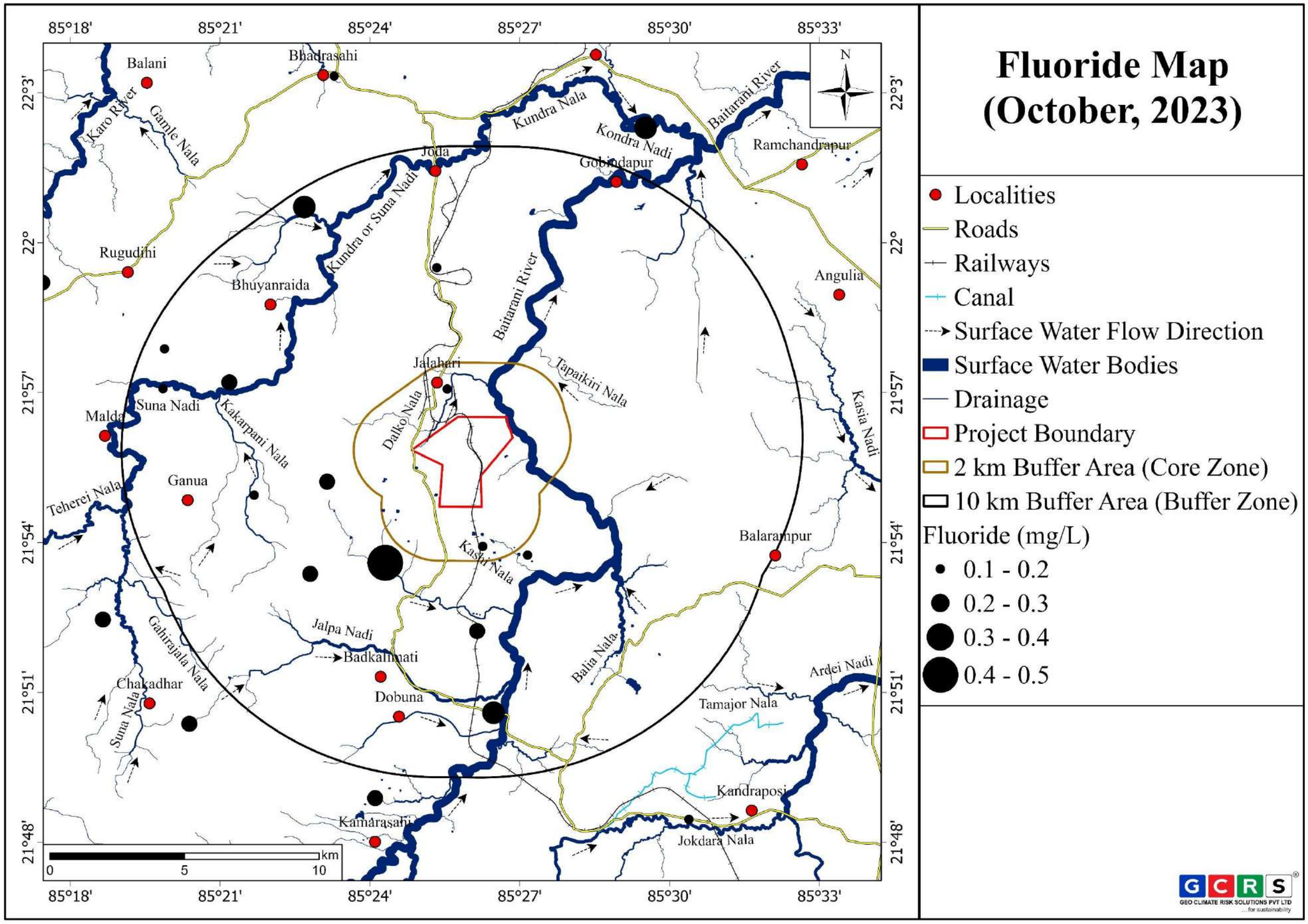


Figure 3.22: Fluoride map in and around the study area (Source: Field data).

4 APPROVED MINE PLAN

The Jajng Iron Ore mine was developed by fully-mechanized opencast method using shovel-dumper combination. The mine is divided into B-block quarry and C-block quarry. In both the quarries bench height is maintained up to 9 m. & Width up to 15 m with overall slope of 45°. The proposed production capacity of the mine is 12.80 MT from insitu reserve. The mining in Lease area is proposed by opencast working by using HEMM for drilling, excavation & haulage. The total handling of ROM as per EC is 16.50 MTPA which includes 12.80 MTPA ROM production and the rest 3.70 MTPA is dump handling. The details of dimensions of existing quarry and the proposed year wise development with production plan is furnished in Table 4.1 and Table 4.2.

Table 4.1: Details of the existing quarry.

Quarry Name	Dimension (in m)		Depth (Max) m	RL
	Length (Avg.)	Width (Avg.)		
B- Block	1386	859	74	TRL-+575 BRL-+501
C Block	1343	563	82	TRL-595 BRL-513

Table 4.2: Year wise development and production plan.

Year	Pit No	Total Tentative Excavation (Cu.M)	OB/SB/IB (in Cu.M)	ROM (cum)		Total ROM (Cu.M)	ROM 'Waste Ratio Cu.M
				Ore (Cu.M)	Mineral reject Cu.M)		
2021-22	B Block	10516050	5857660	4022308	636082	4658390	1: 1.26
	C Block	596268	296069	181765	118434	300199	1: 0.99
	Sub-Total	41112319	6153729	4204073	754517	4958590	1: 1.25
2022-23	B Block	9693255	5723130	3655084	315042	3970125	1: 1.45
	C Block	774123	402694	224196	147232	371429	1:1.09
	Sub-Total	10467378	6125824	3879280	462274	4341554	1:1.42

2023-24	B Block	9864373	5887809	3668417	308147	3976564	1:1.49
	C Block	842778	491909	284196	66672	350869	1:1.41
	Sub-Total	10707151	6379718	3952613	374820	4327433	1:1.48
2024-25	B Block	8840302	4863785	3668374	308143	3976517	1: 1.23
	C Block	879318	535549	317130	26639	343769	1: 1.56
	Sub-Total	9719620	5399334	3985503	334782	4320286	1:1.25
Total		**42006467**	**24058605**	**16021469**	**1926393**	**17947862**	**1: 1.35**

Table 4.3: Details of proposed quarry dimensions

Year	**Quarry**	**Bench Geometry**		**Bench RL(m)**		**No. of Bench Proposed**	**Quarry Dimension (m x m)**	**Quarry Slope Angle (º)**
		Height (m)	**Width (m)**	**Top**	**Bottom**			
2021-22	B-Block	9	15 or more	598	481	13	634 x 254	37.5
	C- Block			589	508	9	440 x 315	
2022-23	B-Block	9	15 or more	535	481	9	937 x 435	37.5
	C- Block			607	508	11	466 x 218	
2023-24	B-Block	9	15 or more	526	458	8	937 x 435	37.5
	C- Block			653	517	13	466 x 218	
2024-25	B-Block	9	15 or more	638	458	16	350 x 718	37.5
	C- Block			653	481	17	305 x 640	

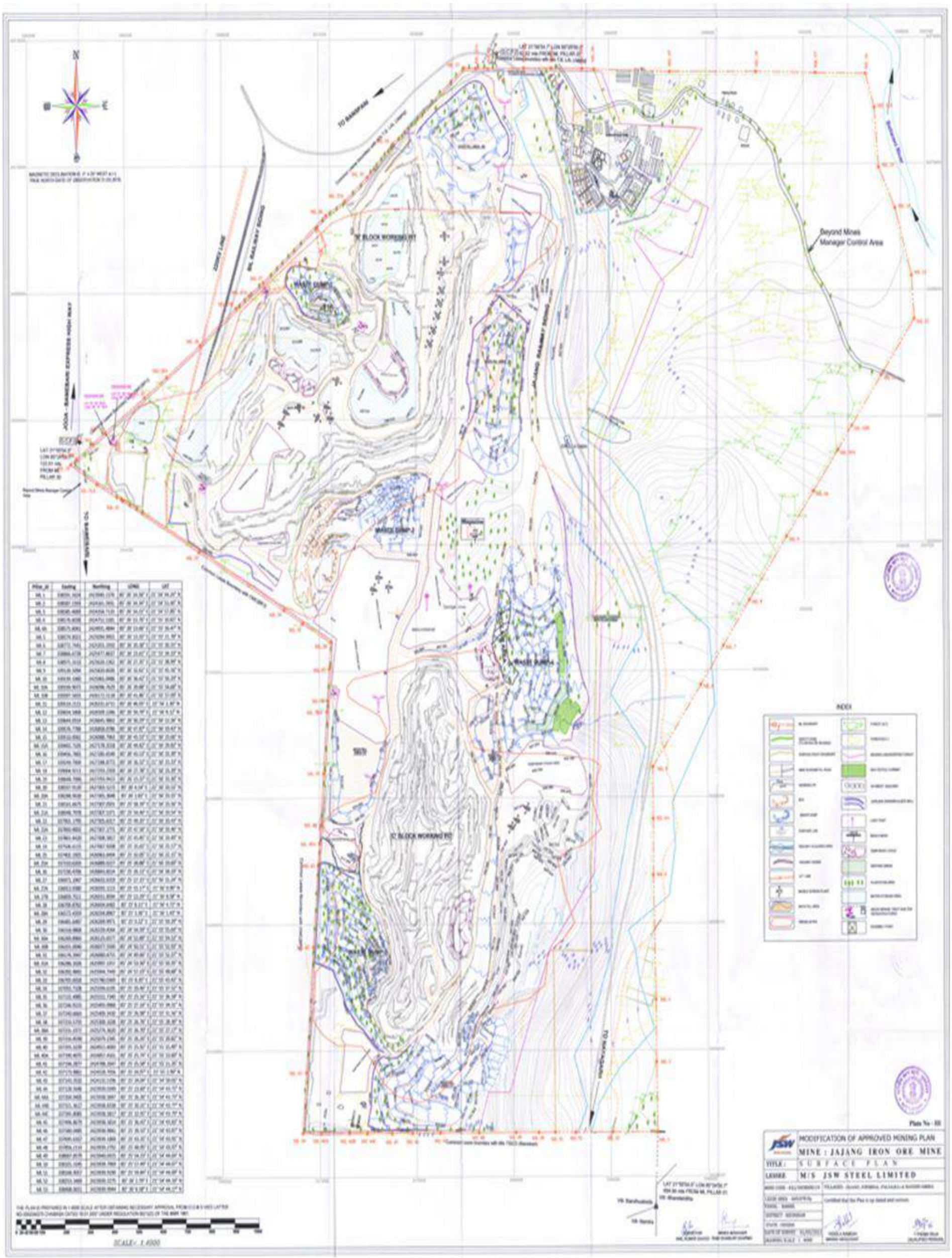


Figure 4.1: Surface plan.

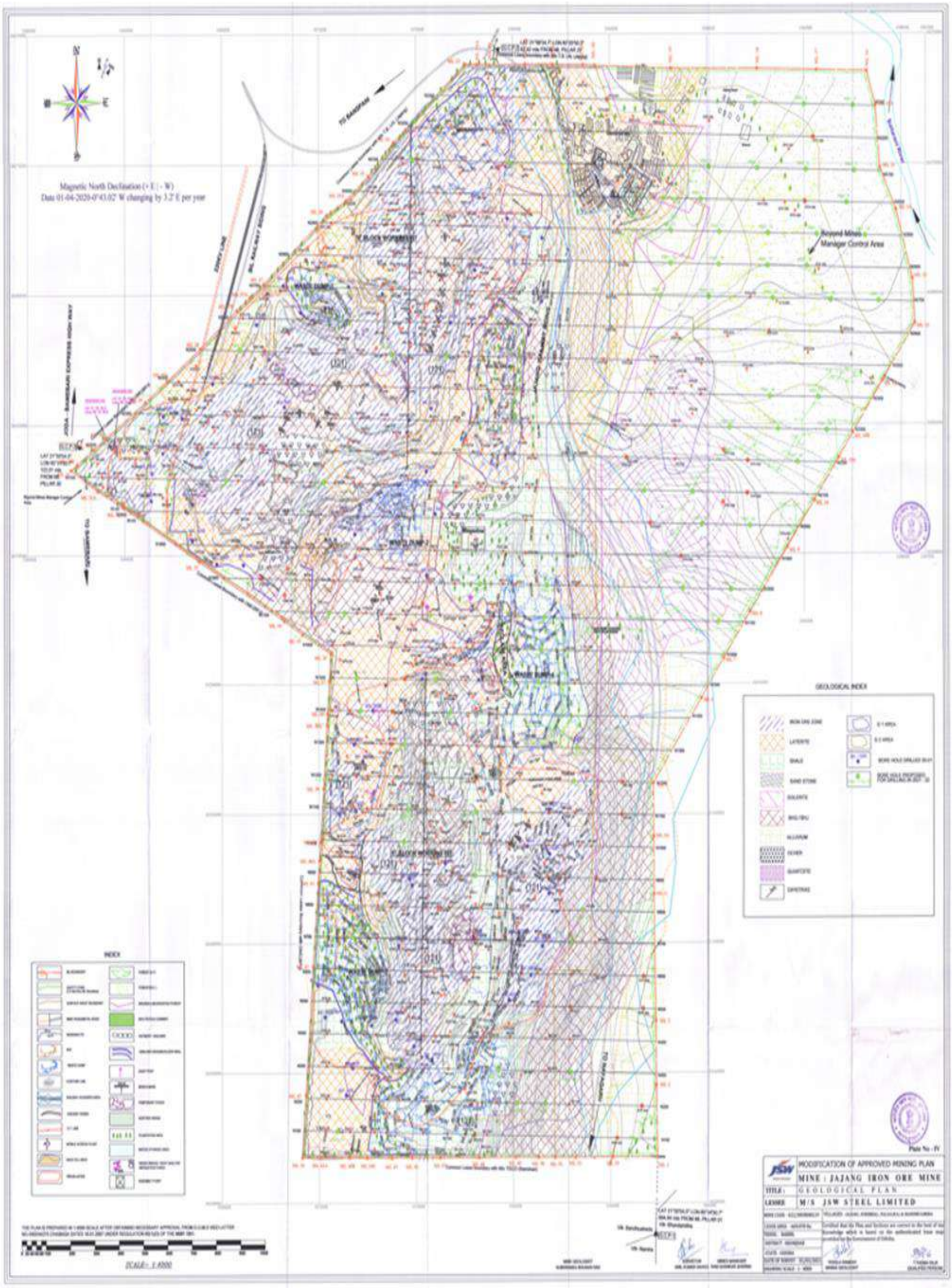


Figure 4.2: Geological plan.

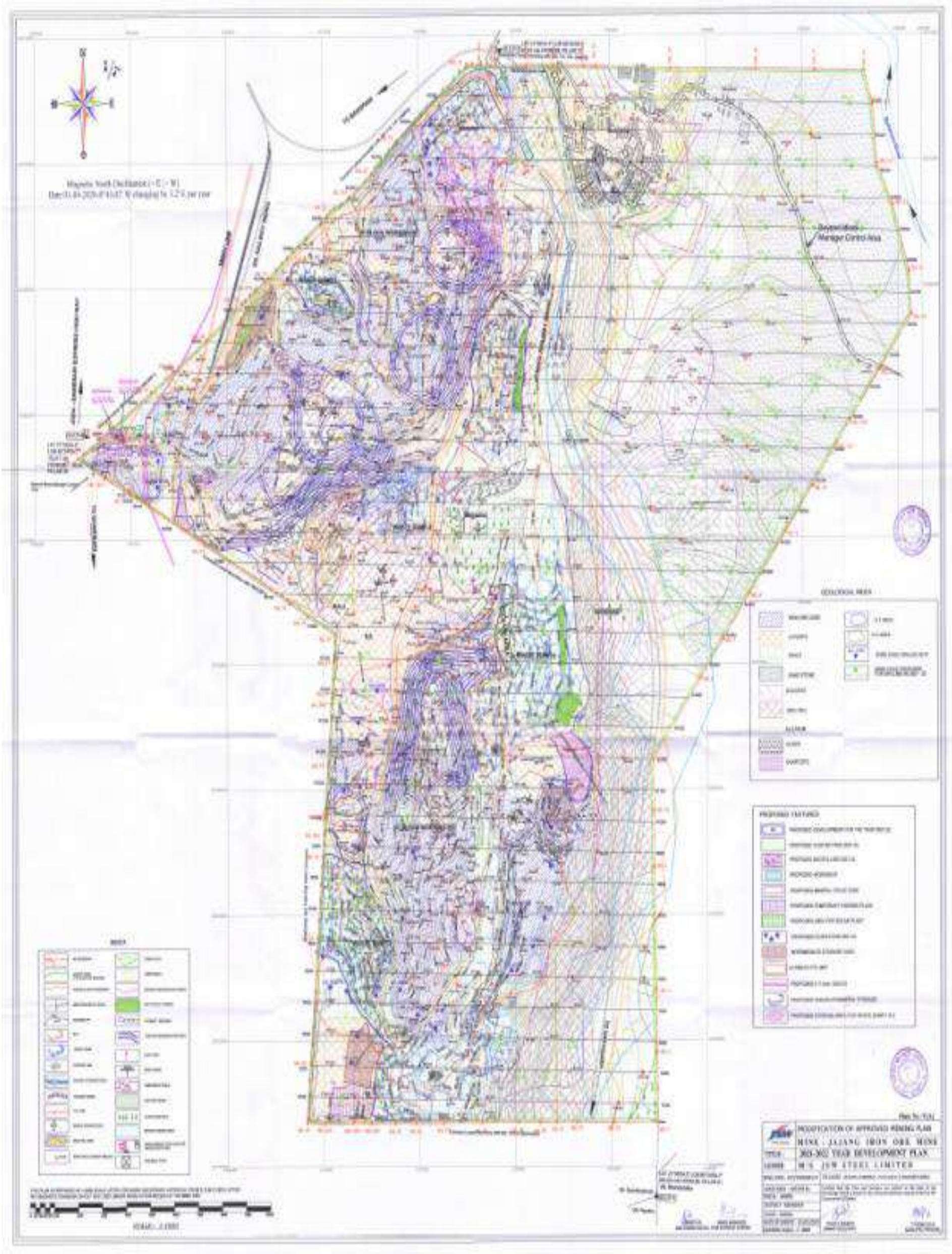


Figure 4.3: Development plan first year.

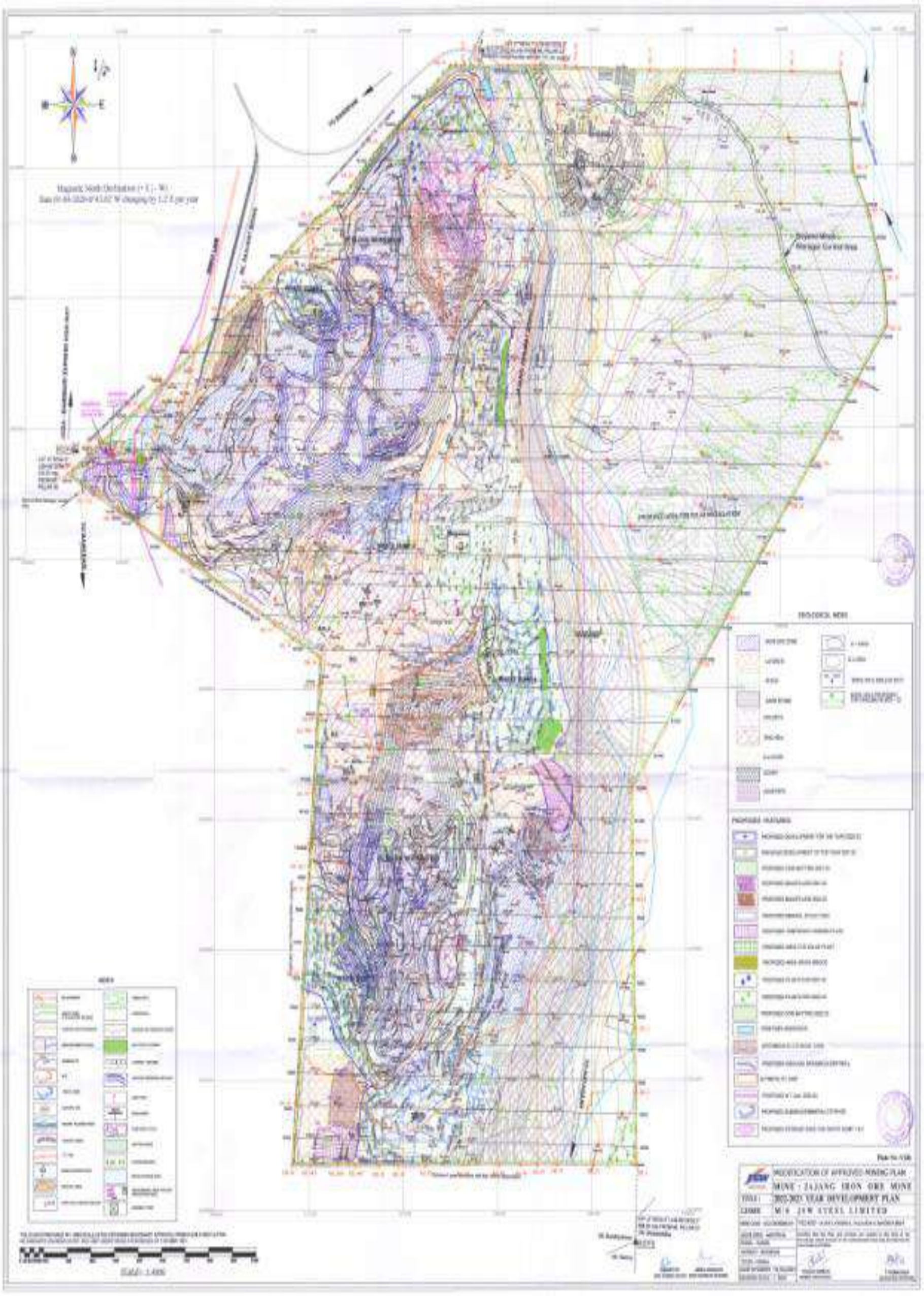


Figure 4.4: Development plan Second year.

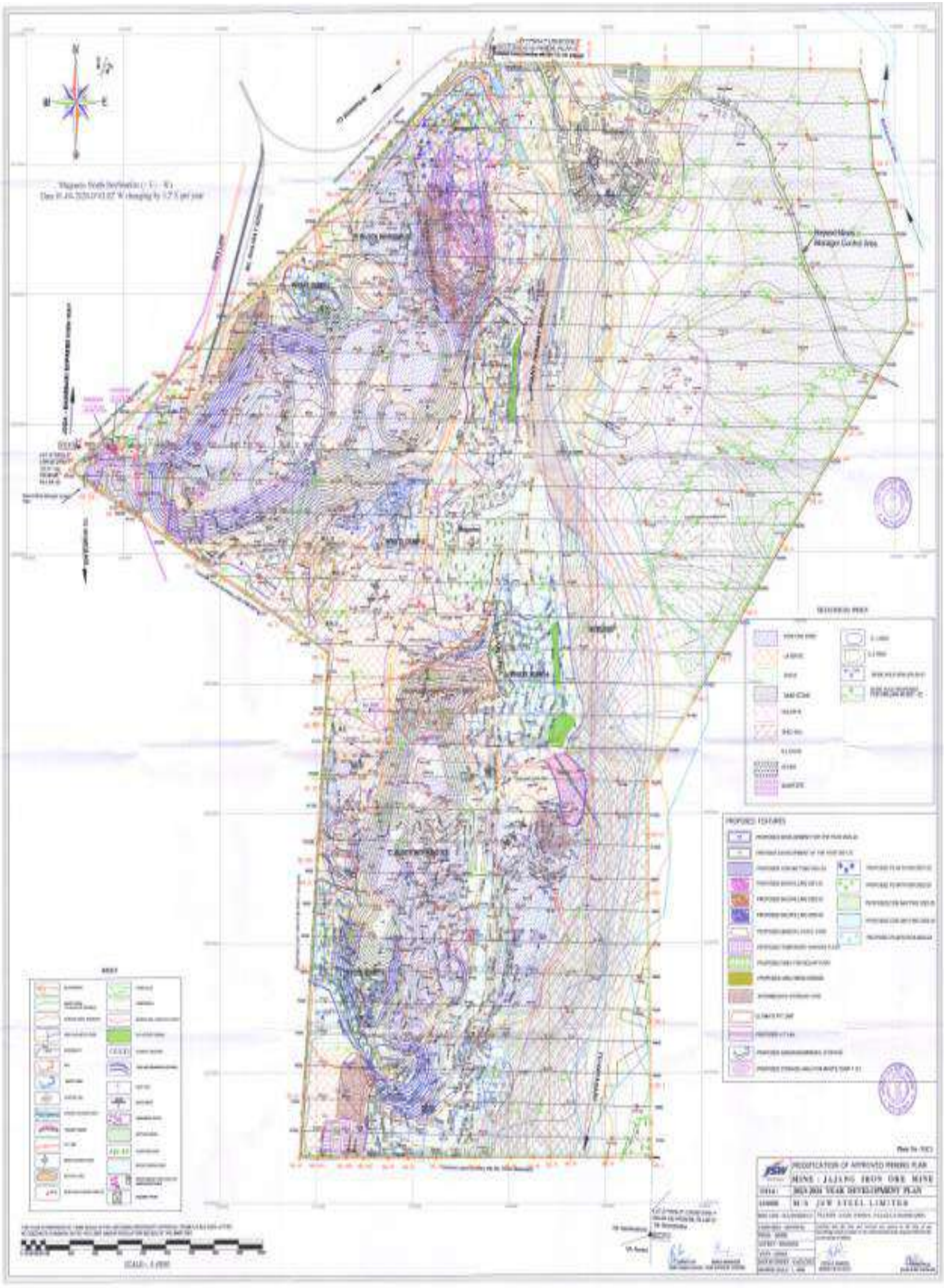


Figure 4.5: Development plan Third year.

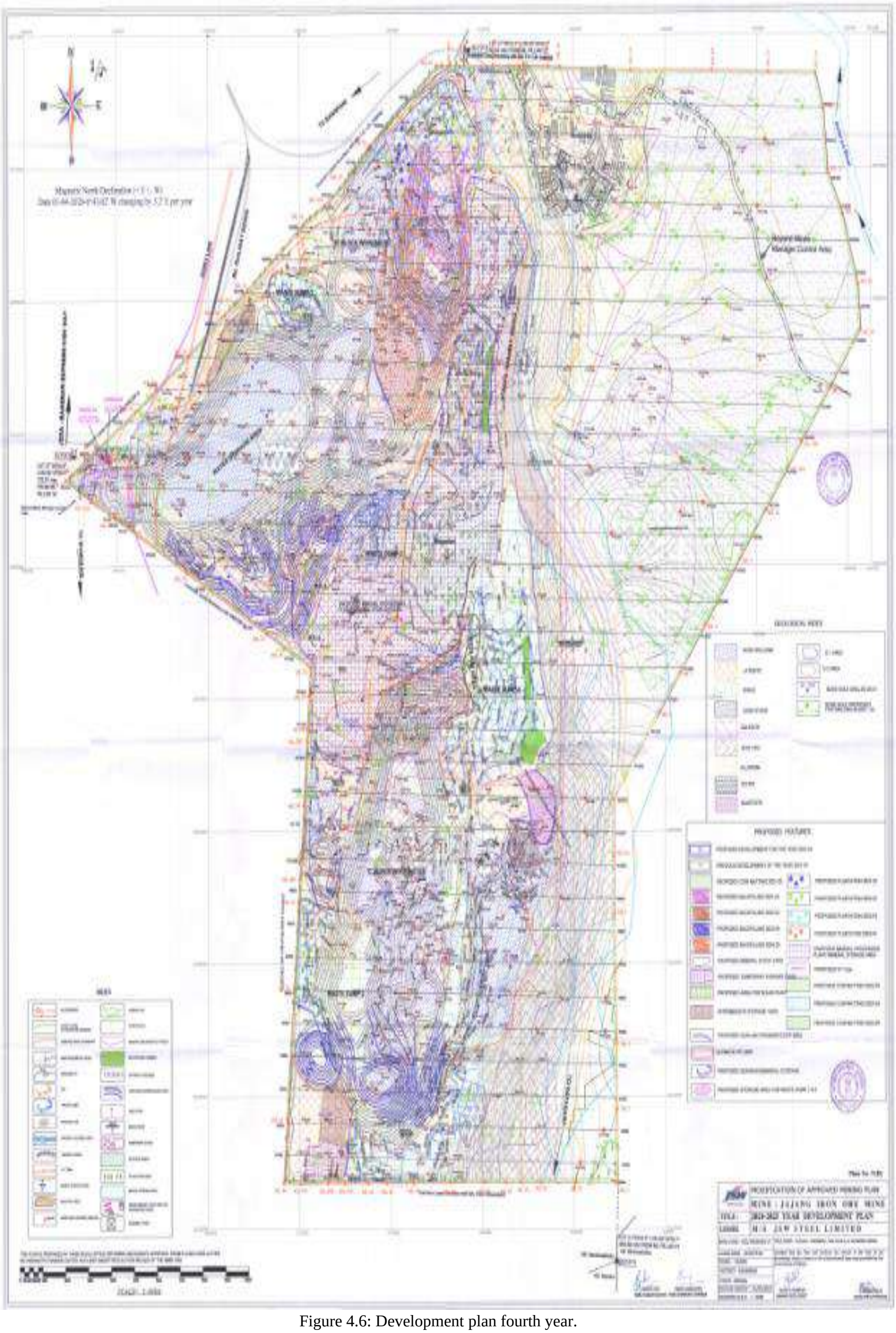


Figure 4.6: Development plan fourth year.

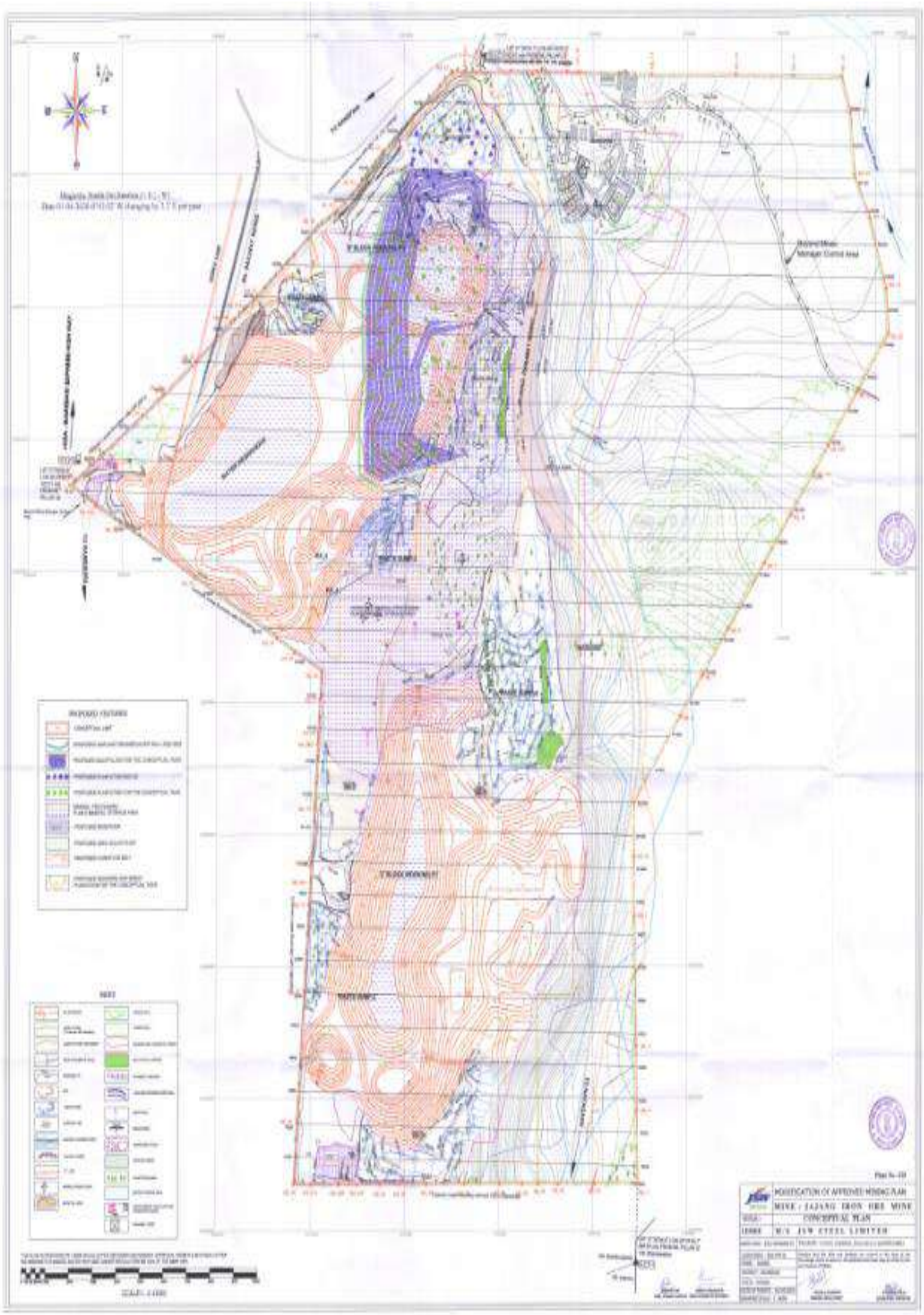


Figure 4.7: Development plan Conceptual stage.

5 ESTIMATION OF MINE SEEPAGE AND ADVANCED DEWATERING PLAN

5.1 ESTIMATION OF MINE SEEPAGE

The ground water seepages start in the mining as the water table of the area is encountered. The quantum of water which accumulates in the mine sump is quite large and varies with time and season. Any mining activity would require pumping of this water to allow mining activity.

Numerical modelling helps a lot in the evaluation of this seepage by a result of numerical modelling to predict the quantity of inflow & provides valuable information for an appropriate dewatering system. The water inflow to the pit is mainly from a confined aquifer, mainly by horizontal flow in the upper layers and vertical flow at the pit bottom.

The mine seepage has been estimated using Darcy's equation which states that flow is directly proportional to surface area of aquifer exposed in mine pit face and the gradient of water table.

Q αK I A

where,

Q = rate of flow

I = water table gradient

A= cross section area of aquifer exposed in mine pit

The above relationship may be written as

Q = KIA

or

Q = (Kb)IL

where K is permeability, b is aquifer thickness.

The mine seepage has been estimated only for the next 2 years as the Approved mine plan is upto 2025 and also JSW Steel will be surrender the mine within next 2 year. The estimated mine seepage has been provided in Table 5.1. It is estimated that the mine seepage during 2023-2024 and 2024-2025 will be about 314 and 272 m^3/day, respectively.

Table 5.1: Estimated Year wise and Quarry wise mine seepage.

Year	Quarry name	RL (mamsl)	Dimesion (m×m)	Perimeter along the groundwater flow direction	GW Gradient dh/dl (m/m)	*Hydraulic Conductivity (K, m/day)	Water table (mamsl)	Thickness of Saturated Quarry Face (b) (m)	Seepage (m3/day)	Total seepage (m3/day)
2023-2024	B-Block	526-458	937 x 435	960	0.009	3.03	480	12	314.28	
	C- Block	653-517	466 x 218	479	0.009	3.03	480	0	0.00	**314.00**
2024-2025	B-Block	638-458	350 x 718	748	0.01	3.03	480	12	271.83	
	C- Block	653-481	305 x 640	662	0.01	3.03	480	0	0.00	272.00

Note: K for that area about 3.03 m/day based on the pumping test result which is also similar to the K value reported by CGWB.

Water table gradient is estimated from hydrogeological map (lease area).

The seepage is calculated by considering the water table of the post-monsoon season only for the entire year as there is not much fluctuation in water table during the pre-monsoon season. The water level of the area is monitored during the post-monsoon season only. The seasonal water level fluctuation of the area is 0.05m which very small (Taken from CGWA monitoring well at Joda site for the latest available data (2021): https://www.indiawris.gov.in/wris/#/DataDownload).

Seepage calculation is based on constant parameters. So, the actual seepage quantity may vary from the estimated seepage quantity.

5.2 ESTIMATION OF RAINWATER QUANTUM DEWATERED

For the estimation of the rainwater quantum (runoff quantum) accumulate in the mine pit, the total working pit area is taken from the surface plan. The rainfall data (average of last 10 years) for the area is taken from the IMD data. The runoff coefficient for the mine pit area is taken as 0.2 based on Manual of Artificial Recharge of Groundwater, (CGWB, 2007). The details of pit area, rainfall, and runoff coefficient are given in Table 5.1.

Table 5.1: Estimation of rainwater quantum available for dewatering.

Catchment area (Pit Boundary) (m2)	**Average Rainfall (m)**	**Runoff Coefficient**	**Runoff Quantum (m3/year)**	**Average Per day (m3/day)**
1033548	1.32	0.2	272857	748

Runoff quantum = Pit area × Rainfall × Runoff Coefficient

The total quantum of rainwater will accumulate in the mine pit will be about 272857 m3/year. So, the average dewatering quantity will be account to about 748 m^3/day. About 450 m3/day of the accumulated rainwater will be dewatered from the mine pit and the remaining will be kept in the mine pits to recharge naturally to ground without dewatering. This dewatered water will be used for different mining activities.

5.3 ADVANCED DEWATERING PLAN

Not applicable as this is a metal mine project.

5.4 GROUND WATER MODELLING

The ground water modelling study report is given as Annexure-I.

6 MINE WATER MANAGEMENT

The total water requirement for the project is about 1714 m^3/day (Table 6.1and Table 6.2). Out of total water abstraction, 1000 m3/day will be from 7 existing borewells, 314 m3/day from mine seepage, and 450 m3/day of rainwater accumulated in the mine pit (Table 6.2). About 880 m3/day of borewell abstraction water will be used for drinking and domestic purposes, about 45 m3/day will be used for wheel washing, 30 m3/day for plantation and 29 m3/day for dry fog system. About 450 m^3/day will be used for mobile water tanker, and 314 m3/day of mine seepage water will be used for dust suppression though fixed water sprinkler. The details of water requirement is given in Table 6.1 and the water balance chart is provided in Figure 6.1.

Table 6.1: Details of water requirement.

Sl. No.	Activity	Water usage (m^3/day)	Source
1	Drinking and Domestic	500	Borewell
2	ETP and Wheel washing	45	Borewell
	Plantation	30	Borewell
	Dry fog system	29	Borewell
	Mobile water Tanker	450	Rainwater
	Fixed water Sprinker	314	Mine seepage
	Total	**1764**	

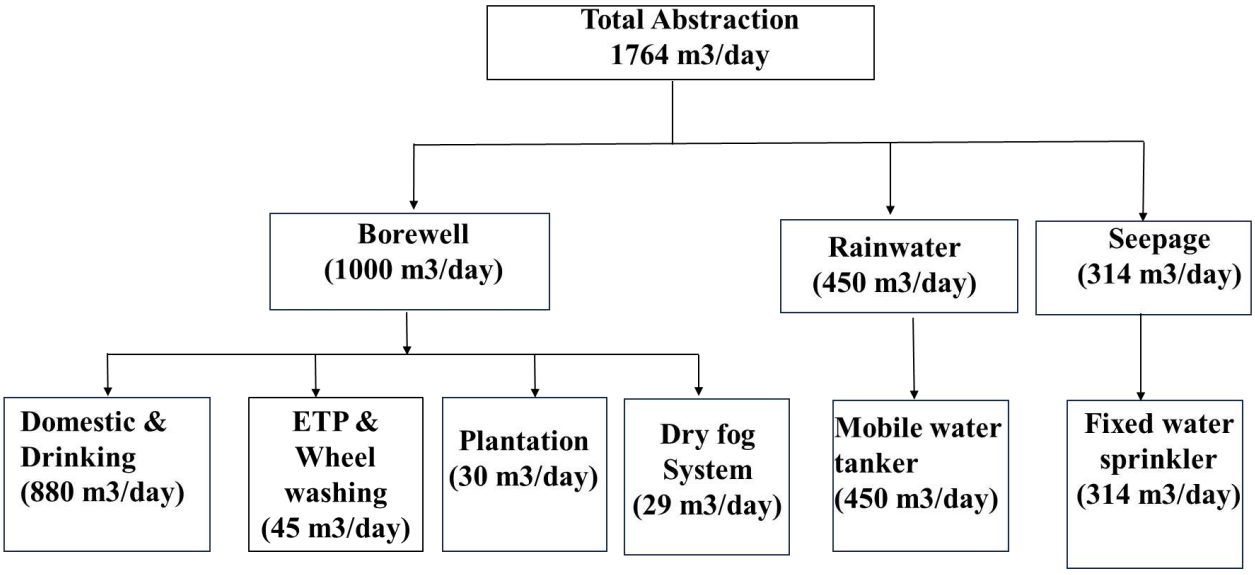


Figure 6.1: Water balance chart.

Table 6.2: Sources of water.

Sl. No.	Sources	Quantity (m^3/day)
1	Mine seepage	314
2	Accumulated rainwater in mine pit	450
3	Borewell	1000
Total abstraction		**1764**

Table 6.3: Details of borewells.

Sl.No	Borewell	Location	Latitude	Longitude	Abstraction quantum (m3/day)
1	Borewell1	Borewell Near Jaroli Cabin Railway Siding	21.938048	85.433461	14
2	Borewell2	Borewell Near Jaroli Cabin Railway Siding	21.931457	85.433929	20
3	Borewell3	Borewell Drilling Camp	21.938347	85.423957	200
4	Borewell4	Borewell Near Gate No.6	21.931950	85.416761	100
5	Borewell5	Borewell Behind Officer Colony	21.939562	85.437341	210
6	Borewell6	Borewell Near Operators Colony	21.939260	85.434235	230
7	Borewell7	Near Hanuman Temple, Jajang Office	21.93985	85.434422	226
		Total			1000

6.1 IMPACT OF MINE DEWATERING / ABSTRACTION AND MITIGATION MEASURES

Mining plays an important role in national economy and on the other hand mining adversely impact our water environment both surface as well as ground water resources. The impact of mining on surface and groundwater is due to spill/tailing, acid mine drainage, lowering of water table, degradation of water quality, disturbance on hydrological cycle and rainfall. We can say it has direct or indirect impact to our eco-system too. Groundwater resources which constitute the main use for the extraction and different mining activities are accompanied by a strong withdrawal affecting quantitative and qualitative parameters. These impacts can be controlled by taking proper mitigation measures.

Assessment of withdrawal of ground water for domestic and industrial operations is essential requirement for planning and design. Ground Water in general decline due to heavy ground water abstraction for industrial use, ground water and surface water may be estimated by hydrological balance investigations of the catchment.

6.2 IMPACT ON THE GROUND WATER REGIME

Extraction of huge amount of ground water may causes a misbalance in the water table presented in that area. It also effects the ground water flow and the rate of extraction. A cone of depression in the ground water table is created due to pumping of ground water and it will reduce the efficiency of the adjacent well in the nearby areas.

The depth to water level and long term water level data analysis (sections 3.3.3 & 3.3.4) along with the groundwater modelling study depict that there has not been any significant decline in water level observed in the study area due to this project. It is envisaged that there will be no significant impacts on the groundwater regime due to the mining activity in the next five year.

6.3 IMPACT ON SURFACE WATER SOURCES

Mine discharge impacts the surface water on both qualitatively and quantitatively. It degrades the quality of surface water as it contains pollutants. Due to the abstraction of ground water the water level of the nearby water bodies also get decreased by time to time. So proper mitigation measures can reduce the impacts of surface water.

There are no major water bodies present in the lease area. The mine discharge water is being properly treated before discharge. All the mine discharge water after proper treatment is fully utilized for different purposes with zero discharge outside the lease area. The mine has adopted proper environmental management plan (EMP) to reduce the impact on environment. It is also envisaged that there will be potential threads due to this project. Necessary measures are taken to reduce the environmental impact due to the project.

6.4 IMPACT ON WATER QUALITY

Water quality is degraded as a result of surface runoff and leachate that are frequently generated from large volume of overburden. Surface runoff carriers higher quantity of suspended solids within it and pollute the water bodies. Discharging of mine water directly to the environment also a major practice in degradation of water quality. Oil and grease mix water from the washing platforms of workshop or from the spillage is also a secondary source which may

impact the water quality. The percolation of sewerage waste from the pit head and from the colony area can also pollute the groundwater quality, if control measures are not adopted.

In the case of Jajang Iron Ore mine, the mine seepages were not directly exposed to the environment. In the mining operation, no harmfull pollutants is extracted which may further pollute the ground water. Poroper treatment facility is adopted by the mine and proposed others mitigation measures to control the water quality indignity.

6.5 MITIGATION MEASURES

As a part of environmental protection, the project has to adopt all possible measures to increase the groundwater recharge potential in the influenced and nearby areas. Moreover, wastewater recycling after due treatment will enable water conservation. Conserved water in mine pits will be given due emphasis to provide water around the year, and water quality will be maintained before and after storage. Some other mitigation measures are discussed below:

1. Dewatering of mine seepage is important mitigation measures that should be follow strictly. As this water used for various mining activity, so it should be treated and make pollutant free.
2. To avoid contamination around mines, mine water has mainly been treated by a neutralization process to add a neutralizer, This process can effectively remove toxic ions from mine water through precipitation which will be used for dust suppression, greenbelt development, etc. and excess water will be let out into nearby streams.
3. Oil and grease traps must be planned in HEMM workshop for removal of TSS and Oil and Grease from vehicle wash needed to completely collect, store, treat, and reused. Treated water can be used for dust suppression and for raising plantation within the workshop premises.
4. Settlement tanks should be proposed for the settlement of suspended solids before pumping out water from the mine.
5. During Rainfall, water running through dumps is expected to mix with loose overburden and associated material. Garland drains, check dams and sedimentation tanks will be constructed around the OB dump and the lease area to reduce soil erosion and arrest suspended solids before discharging the run-off water into the natural water regime as well as to prevent stormwater from entering the lease area. Regular cleaning of drains will be done for de-silting the same. The reclaimed / Backfilled area will be properly graded and kept slightly sloping against mine workings so that water does not

flow into the mine workings.

6. Domestic effluent from Mine Office, Canteen etc. shall be treated in Sewage Treatment Plant. Treated effluent will be used for horticulture and sewage sludge will be used as manure.
7. Artificial recharge ponds are also suitable to catch the rainwater and recharge the ground water further. Proper utilization of run-off water available in this region will lead to a surplus for groundwater recharge.
8. To maintain the groundwater regime in the area unaffected, all the major buildings of the project should be facilitated by suitable rainwater harvesting structures. Therefore, the implementation of water harvesting & artificial recharge structures will be a milestone for the groundwater system as a return flow.

WATER CONSERVATION

Water conservation practices have been taken as a part of the project. To maintain the ground water regime unaffected in the area some of the following measures have been taken into account.

To recharge the underground water table, rainwater harvesting structures are proposed to be developed in mine. The proposed rain water harvesting structure will be of rooftop harvesting structure and collection pond type structure.

Certain measures are adopted for rain water harvesting and artificial recharge to ground water to maintain ground water regime affected in the area (Table 6.5 and Figure 6.2).

Estimation of Quantum of runoff available through Rain water harvesting (within premises)

The total volume of runoff available in the lease area through rainwater harvesting is estimated by following Manual of Artificial Recharge of Ground Water, (CGWB, 2007). For this calculation average rainfall data of last 10 years (2013-2022) has been taken (1.352 m).

Table 6.4: Estimation of Quantum of runoff available through Rain water harvesting (within premises).

Sl. No.	Particulars	Area (m^2) (To be filled)	Rain fall (m) (To be filled)	Runoff Coefficient*	Quantum of Run off available (m^3/Year)
	1	2	3	4	5 (2*3*4)
1	Roof Top of building/Shed/	387910	1.352	0.85	445786.172
2	Road/Paved area	93030	1.352	0.65	81754.764
3	Open Land	3985370	1.352	0.2	1077644.048
4	Green Belt	2224460	1.352	0.15	451120.488
5	Total (m^2)	6690770		Total Quantum of available runoff (m^3/y)	2056305.472

About 2056305.472 m^3/year of rainwater will be available through rainwater harvesting in the lease (Table 6.4).

Table 6.5: Details of settiling ponds.

Settling Pond Location	Lenghth (m)	Breadth (m)	Height (m)	Area (m2)	Volume (m3)
Near BIL Railway Sliding Pond-1	56	76	5	4256	21280
Near BIL Railway Sliding Pond-2	200	120	1.5	24000	36000
Total				**28256**	**57280**
Avearge annual quantity of rainwater harvested (m3)					**171840**

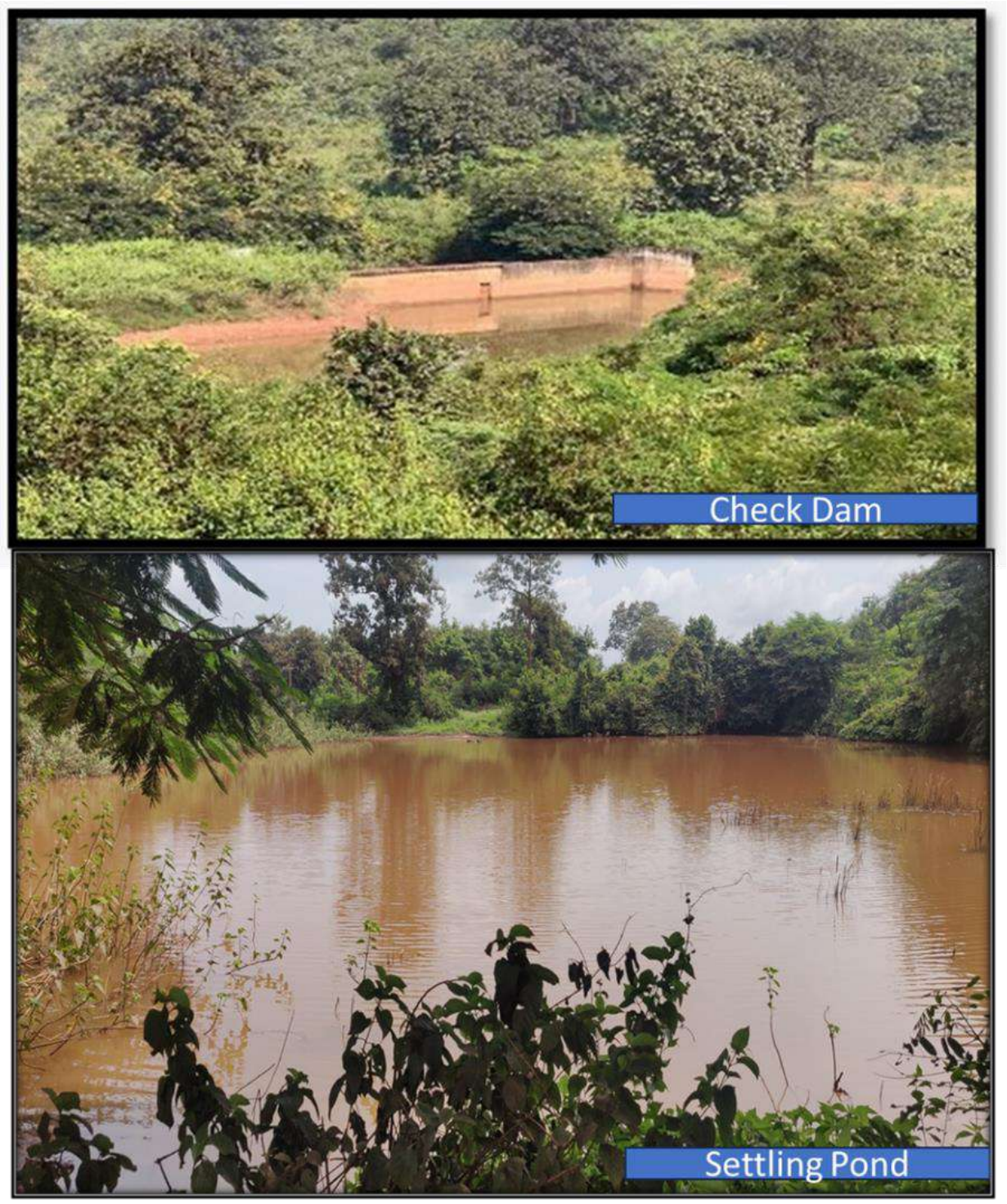


Figure 6.2 : Settling pond and Check dam.

7 SALINE WATER DISPOSAL STRATEGIES

In the mine lease area and surrounding, there is no saline water as a source of groundwater. Accordingly, the mine has no interaction with saline water therefore this section is not applicable in the instance assessment.

8 OTHER DETAILS PERTAINING TO THE PROJECT

Not Applicable.

9 SUMMARY AND CONCLUSION

Jajang Iron Ore Mine of M/s JSW Steel Ltd granted lease area of 669.078 Ha (as per DGPS Survey)/666.150 Ha (as per ROR) land in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda, Tehsil Barbil, District Keonjhar, Odisha by Government of Odisha, District Keonjhar which comes under toposheet no. 73 G/5 with Lat: $21^0$54’44.23926" to $21^0$56’33.49374"N & Long: $85^0$24’49.65672" to $85^0$26’50.70226"E.

The predominant land use in the study is forestland, which covers about 66.09% of the total study area, followed by mining area (9.30%), Current fallow (8.48%), cropland (8.25%), scrubland (4.03) and so on. Overall study area is comprising of cluster of small hillocks which brings variations in the slopes. The elevation of the study area ranges from 412 to 896 mamsl. The maximun altitude found in the southwestern part. The elevation in the lease area ranges from 461 to 646 mamsl. The predominant geomorphological features of the region are Moderately Dissected Hills and Valleys of structural origin, followed by pediment, pediplain, active quarry, highly dissected hills and valleys of structural origin, hill, intermontane valley etc.

The Baitarani River constitutes the principal drainage system in the study area. The river Baitarani flows in the eastern part of the lease boundary. Some small seasonal nallas flowing in the study area and meet ultimately to Baitarani River. The study area's drainage system is predominantly dendritic. The Suna Nadi & Kundra Nala flows in the northeast direction and drains the northwestern part of the study area. The southern and southeastern part of the study area is drained by Jalpa Nadi, Kashi nala, Balia Nala & Barha Nala. Other than these perennial water courses, some small seasonal channels can be observed in the study area which finally get merge into the River Baitarani.

The nearest Ramsar Wetland Site to the project boundary is Satkosia Gorge, Odisha situated at an aerial distance of about 160.49 km in the Southwest direction. Hence, no Ramsar sites are present in the vicinity of 500 m from the mine lease or within the study area. A certificate regarding the same is not applicable for the particular proposal.

Banded Iron Formation (BIF) hosted iron ores with their variants are occurred comprises the economic ore deposits in this region. Banded Hematite Jasper (BHJ), Banded Hematite Quartzite (BHQ), Banded Hematite Shale (BHS), Ferruginous shale are major BIF members. Hematite ore is found bedded, laminated, massive, & in powdery form and

associated with this BIF formation. Sandstone, volcanic formation, laterite, soil and alluvium is also observed in the study area. Sandstone is conspicuously well developed and are interbedded with lenticular bands of conglomerate. Banded Hematite Jasper is conspicuously well developed on almost all the ridges in this area. Iron ore in this area occurs usually on the hilltop and is flanked by Banded Hematite Jasper, Intercalated bands of shale are locally found within the ore. The ore bodies are frequently covered by laterite, soil & debris and occurs as blankets over the BIF. Hematite is the major constituent mineral, biscuity/friable in nature found in between BHJ/BHQ and laminated ore. Massive ores are fine-grained, dense and compact in nature.

The aquifers of the study area are mainly composed of quartzite, which covers the maximum area, and have a yield capacity of 1 to 2.5 %. The sandstone has maximum water yielding up to 6%, followed by the shale, basement gneiss and intrusive that yield water up to 3%, 3%, & 2%, respectively. The water table elevation in the study area ranges between 478.76 to 635.92 mamsl during May, 2023 and ranges between 480.75 to 637.97 mamsl during October 2023. Variation in the groundwater flow direction can be observed, locally. The regional trend of groundwater flow direction in the overall study area is generally towards north. The study area is an undulating terrain with number of hills. The groundwater flow direction is generally following the surface topography. The local groundwater flow direction is towards the river. The depth to water level in the study area varied from 3.08 to 8.24 mbgl during May, 2023 whereas it varied from 1.03 to 6.79 mbgl during October, 2023. It ranged from 4.89 to 6.79 mbgl during May, 2023 and ranged from 2.50 to 4.83 mbgl during October, 2023 in the core zone. Outside the buffer zone, it varied from 5.19 to 7.19 mbgl during May, 2023 and 2.82 to 5.25 mbgl during October, 2023. The water level fluctuation in the study area varied from 1.33 to 2.56 m. The long-term water level data shows, only seasonal fluctuation with cyclic and sinusoidal changes representing the recharge and discharge of ground water during the different period has been observed which can be due to variations in rainfall patterns and no significant decline in water level is identical during observation period.

The mine seepage has been estimated only for the next 2 years as the Approved mine plan is upto 2025 and also JSW Steel will be surrender the mine within next 2 year. It is estimated that the mine seepage during 2023-2024 and 2024-2025 will be about 314 and 272 m^3/day, respectively.

The total water requirement for the project is about 1714 m3/day. Out of total water abstraction, 1000 m3/day will be from 7 existing borewells, 314 m3/day from mine seepage, and 450 m3/day of rainwater accumulated in the mine pit. About 880 m3/day of borewell abstraction water will be used for drinking and domestic purposes, about 45 m3/day will be used for wheel washing, 30 m3/day for plantaion and 29 m3/day for dry fog system. About 450 m3/day will be used for mobile water tanker, and 314 m3/day of mine seepage water will be used for dust suppression though fixed water sprinkler. As per the criteria for categorization of area made by Central Ground Water Authority for the development point of view (GWRA, 2022) the present study area falls under 'Safe Category'. Enough scope exists for dewatering of required amount (1314 m^3/ day) of ground water (mine seepage: 314 m3/day, Rainwater: 450 m3/day and borewell: 550 m3/day). It will not have any appreciable impact on ground water resources in the area.

10 ACCREDITATION CERTIFICATE

Accreditation Board of CGWA

Certificate of Accreditation

M/s. Geoclimate Risk Solutions
Vishakhapatnam, A.P.

Has been accredited as a Ground Water Professionals to prepare reports in the Functional Areas of

- *Impact Assessment of Existing / Proposed GW Extraction*
- *GW Modelling*
- *Hydrogeological conditions in mining projects.*

Valid from : 15.02.2021 *Certificate No. : CGWA/RGI/005*

Valid thru : 14.02.2026 *Dated : 07.07.2021*

क्षेत्रीय निदेशक
Regional Director
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

सदस्य
Member
आरजीएनजीडब्ल्यूटीआरआई
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ABBREVIATIONS

CGWA – Central Ground Water Authority

CGWB – Central Ground Water Board

Cu.M- Cubic meter

DEM – Digital Elevation Model

GSI – Geological Survey of India

HEMM- Heavy Earth Moving Machinery

km – kilometer

m amsl – meter above mean sea level

m bgl – meter below ground level

mg – milligram

m – meter

MTPA- Million tonnes per annum

OB – Over Burden

OC – Open Cast

ROM- Run-of-mine

ROR- Records of Rights

SRTM – Shuttle Radar Topography Mission

USGC – United States Geological Survey

UT – Union Territories

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Annexure I: Water quality analysis reports

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(FORMERLY GLOBAL EXPERTS)
An ISO-9001:2008 Certified Company

C-23, BJB Nagar,
Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globalexperts@gmail.com
visit us: www.globaltechenvexpt.com

GTEEPL/LQR/56

TEST REPORT

TC-10101

NABL ULR NO	:	**TC 101012300000169P**	
Report No.	:	**GTEEPL/10/23/GW/169J**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Ganua (21.91581, 85.36132)**	
Identification of Sample	:	**Ground Water (KWQ10)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	550
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	30.2
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	11.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	53.1
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	32
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	183
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	190.4
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	27.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.11
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	16.5
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.23
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

Authorised Signatory
Global Tech Enviro Experts Pvt. Ltd.

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C-23, BJB Nagar,
Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globalexperts@gmail.com
visit us: www.globaltechenvexpt.com

TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 10101230000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169H**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Chormalda (21.95341, 85.35306)**	
Identification of Sample	:	**Ground Water (KWQ8)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.90
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	300
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	36.5
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	3.7
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	16.4
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.6
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	122
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	120.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	6.3
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.25
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	24.25
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.08
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globalexperts@gmail.com
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GTEEPL/LQR/56

TEST REPORT

TC-10101

NABL ULR NO	:	**TC 101012300000169P**
Report No.	:	**GTEEPL/10/23/GW/169G** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Kasira (21.93368 , 85.23715)**
Identification of Sample	:	**Ground Water (KWQ7)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.1
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	490
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	44.6
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	17.1
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	27.6
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.9
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	183
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	85.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	25.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.22
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	25.1
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.09
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169F**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Kalmanga (21.95129 , 85.33089)**	
Identification of Sample	:	**Ground Water (KWQ6)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.9
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	650
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	58.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	18.3
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	31.5
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	36
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	250
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	171.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	17.1
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.17
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	19.6
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.18
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
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GTEEPL/LQR/56 **TEST REPORT**

TC-10101

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169D** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Badpatuli (21.87426 , 85.31084)**
Identification of Sample	:	**Ground Water (KWQ4)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.75
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	360
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	34.5
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	9.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	25.2
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	6.2
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	122
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	49.98
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.25
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.30
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	12.5
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.16
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globaltexperts@gmail.com
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TEST REPORT

TC-10101

NABL ULR NO	:	**TC 1010123000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169C**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Guruda (21.92028 ,85.38568)**	
Identification of Sample	:	**Ground Water (KWQ3)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.9
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	350
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	14.3
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	24.3
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	18.5
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.3
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	183
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	17.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.5
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.26
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	10.6
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.03
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169B** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Paduliposi (21.98669, 85.2906)**
Identification of Sample	:	**Ground Water (KWQ2)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	420
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	36.2
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	19.5
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	18.3
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.8
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	220
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	18.49
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	5.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.29
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	15.4
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.14
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
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TEST REPORT

TC-10101

NABL ULR NO	:	**TC 10101230000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169A**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Katesahi (21.96459, 85.3314)**	
Identification of Sample	:	**Ground Water (KWQ1)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.1
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	250
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	22.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	5.2
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	19.1
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.6
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	116.0
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	18.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	3.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.10
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	11.2
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.21
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169AI** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Rengalbeda (21.8076 , 85.5064)**
Identification of Sample	:	**Ground Water (BWQ4)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.23
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	150
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	12.3
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	2.5
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	15.5
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	3.09
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	55
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	17.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	25.3
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.17
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	6.2
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.14
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169AG**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Sreejoda (21.8895 , 85.3800)**	
Identification of Sample	:	**Ground Water (DWQ8)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.8
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	300
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	30.4
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	7.3
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	17.3
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.6
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	134
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	59.7
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.2
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	21.2
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.17
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO : **TC 1010123000000169P**
Report No. : **GTEEPL/10/23/GW/169AE** Issue Date: 07.10.2023
Name of the Client : **Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address : Visakhapatnam, Andhra Pradesh
Date of Sampling : 01.10.2023 Date of Receiving: 02.10.2023
Date of Testing : 02.10.2023 To 06.10.2023
Sampling Location : **Palasa Ka (21.8987 , 85.4376)**
Identification of Sample : **Ground Water (DWQ5)**
Quantity of Sample : 1LTR X 2
Sampling procedure : GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.08
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	370
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	28.5
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	15.1
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	24.2
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	3.2
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	146
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	39.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	3.5
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.20
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	15.8
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.16
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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C-23, BJB Nagar,
Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169AD** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Mithirda (21.8395 , 85.3397)**
Identification of Sample	:	**Ground Water (DWQ4)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.99
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	380
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	34.2
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	9.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	24.2
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	4.1
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	116
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	43.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	31.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.30
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	7.8
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.15
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169AC** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Basantapur (21.8147 , 85.4017)**
Identification of Sample	:	**Ground Water (DWQ3)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.1
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	250
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	24.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	4.9
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	21.4
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.2
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	116
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	17.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	5.9
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.25
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	6.9
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.14
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Fax:- 0674-2433487
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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169AA** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Gobindapur (22.03837,85.49196)**
Identification of Sample	:	**Ground Water (JWQ14)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.03
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	300
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	24.3
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	9.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	22.7
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	2.5
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	110
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	35.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	3.6
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.40
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	3.9
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.11
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169Y**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Jalahari (21.9512 , 85.42577)**	
Identification of Sample	:	**Ground Water (JWQ10)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.9
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	500
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	52.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	11.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	33.5
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	2.9
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	177
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	64.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.5
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.15
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	11.9
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.23
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Ph.: 0674-2436853
Fax:- 0674-2433487
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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169X** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Nayagarh (21.84316 , 85.44125)**
Identification of Sample	:	**Ground Water (JWQ9)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.61
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	390
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	38.6
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	5.2
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	35.4
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	5.6
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	37
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	99.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	21.6
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.40
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	21.6
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.22
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Ph.: 0674-2436853
Fax:- 0674-2433487
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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 10101230000000169P**
Report No.	:	**GTEEPL/10/23/GW/169W** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Namira (21.89578 , 85.4526)**
Identification of Sample	:	**Ground Water (JWQ8)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	400
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	38.5
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	13.0
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	23.2
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.1
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	159
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	46.0
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	14.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.10
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	22.3
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.10
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 10101230000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169V**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Unchabali (21.87043 , 85.43573)**	
Identification of Sample	:	**Ground Water (JWQ7)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.76
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	260
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	20.2
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	3.9
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	27.4
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	4.1
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	73.0
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	46.6
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	13.6
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.30
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	9.5
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	<0.05
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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Fax:- 0674-2433487
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GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**	
Report No.	:	**GTEEPL/10/23/GW/169R**	Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**	
Address	:	Visakhapatnam, Andhra Pradesh	
Date of Sampling	:	01.10.2023	Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023	
Sampling Location	:	**Jhadagaon (22.05562 ,85.38806)**	
Identification of Sample	:	**Ground Water (GWQ4)**	
Quantity of Sample	:	1LTR X 2	
Sampling procedure	:	GTEEPL/LSOP/09	

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	200
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	28.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	2.1
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	8.2
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.2
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	61
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	32.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	5.2
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.10
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	2.9
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.19
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

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GLOBAL TECH ENVIRO EXPERTS PVT. LTD. BHUBANESWAR C-23,BJB NAGAR

N.B.:
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....END OF REPORT....

GLOBAL TECH ENVIRO EXPERTS PVT. LTD.
(FORMERLY GLOBAL EXPERTS)
An ISO-9001:2008 Certified Company

C-23, BJB Nagar,
Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
visit us: ...globaltechenvexpt.com

TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169Q** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Joda (21.99168 , 85.4223)**
Identification of Sample	:	**Ground Water (KWQ17)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	7.80
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	350
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	40.2
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	3.7
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	26.1
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	2.8
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	134
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	92.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.5
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.19
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	6.5
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	<0.05
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

Authorised Signatory
Global Tech Enviro Experts Pvt. Ltd.

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An ISO-9001:2008 Certified Company

C-23, BJB Nagar,
Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globalexperts@gmail.com
visit us: www.globaltechenvexpt.com

TC-10101

GTEEPL/LQR/56 **TEST REPORT**

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169P** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Balada (21.89318 , 85.40508)**
Identification of Sample	:	**Ground Water (KWQ16)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	380
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	34.1
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	7.1
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	32.3
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.5
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	177
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	25.5
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	7.9
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.50
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	11.9
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	0.14
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

Authorised Signatory
Global Tech Enviro Experts Pvt. Ltd.

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....END OF REPORT....

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Bhubaneswar-751014
Ph.: 0674-2436853
Fax:- 0674-2433487
E-mail- globalexperts@rediffmail.com
globaltexperts@gmail.com
visit us: www.globaltechenvexpt.com

GTEEPL/LQR/56 **TEST REPORT** TC-10101

NABL ULR NO	:	**TC 1010123000000169P**
Report No.	:	**GTEEPL/10/23/GW/169M** Issue Date: 07.10.2023
Name of the Client	:	**Geo Climate Risk Solutions Pvt. Ltd (GCRS)**
Address	:	Visakhapatnam, Andhra Pradesh
Date of Sampling	:	01.10.2023 Date of Receiving: 02.10.2023
Date of Testing	:	02.10.2023 To 06.10.2023
Sampling Location	:	**Camp Of Tisco (22.01194 ,85.37808)**
Identification of Sample	:	**Ground Water (KWQ13)**
Quantity of Sample	:	1LTR X 2
Sampling procedure	:	GTEEPL/LSOP/09

Sl. No.	Name of the Parameters	Unit	Testing Method	Requirement as per IS 10500:2012 RA 2018	Analysis Result
1	pH	....	IS 3025(Part-11)1983 RA 2017	6.5-8.5	8.0
2	Electrical Conductivity	µs/cm	IS 3025(Part-14) :2021	.....	300
3	Calcium as Ca	mg/l	IS 3025 (Part-40) 1991 RA 2019	75(max)	24.6
4	Magnesium as Mg	mg/l	APHA 3500 Mg B :2017	30(max)	7.3
5	Sodium as Na	mg/l	IS 3025: (Part-45) 1993 RA 2019	-----	22.4
6	Potassium as K	mg/l	IS 3025: (Part-45) 1993 RA 2019	-------	1.3
7	Bicarbonate (HCO3)	mg/l	IS 3025(Part-51) : 2001	.....	165
8	Chloride as Cl	mg/l	IS 3025(Part-32)1988 RA 2019	250(max)	170.45
9	Sulphate as SO4	mg/l	IS 3025 (Part 24/Sec 1) : 2022	200(max)	8.9
10	Fluoride as F	mg/l	APHA 23RD Ed.4500 F-D:2017	1(max)	0.34
11	Nitrate as NO3	mg/l	APHA 4500 NO3-B :2017	45(max)	15.6
12	Iron as Fe	mg/l	IS 3025(Part-53) 2003 RA 2019	1(max)	<0.05
13	Manganese as Mn	mg/l	IS 3025(Part-59)2006 RA 2017	0.1(max)	<0.05

Authorised Signatory
Global Tech Enviro Experts Pvt. Ltd.

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....END OF REPORT....

ANNEXURE X





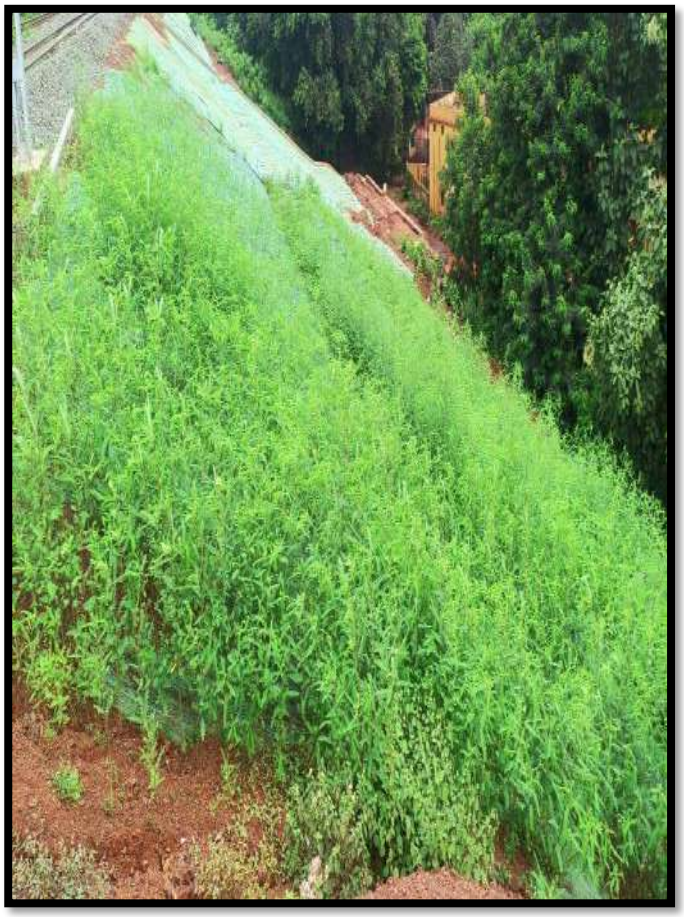




ANNEXURE XI









Mango Plantation





Dump Plantation







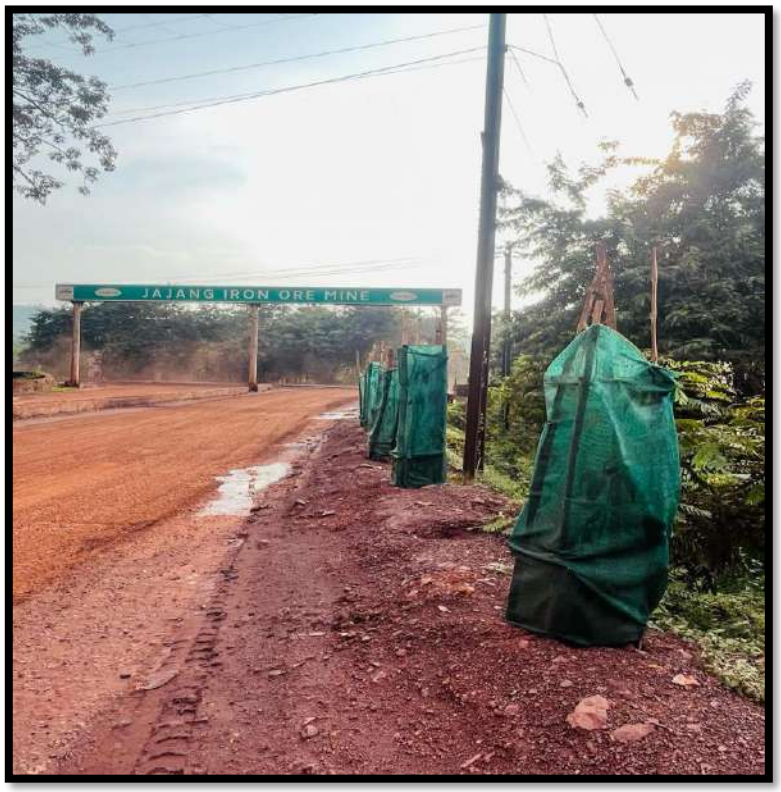




Drip Irrigation






JAJANG IRON ORE MINE








GUAVA
KHAJUR
ASHOKA

ANNEXURE XII

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Odisha

Date	:	**21/05/2023**
Time	:	**11:00:40 AM**
Validity upto	:	**20/05/2024**

OD09M3265

Certificate SL. No.	:	OR02900140008831
Registration No.	:	OD09M3265
Date of Registration	:	29/Aug/2018
Month & Year of Manufacturing	:	July-2018
Valid Mobile Number	:	******5456
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	OR0290014
GSTIN	:	21BUQPR4269B1ZJ
Fees	:	Rs.177.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	1.62	0.5

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Odisha

Date	:	**24/08/2023**
Time	:	**20:18:24 PM**
Validity upto	:	**23/02/2024**

OR04N3195

Certificate SL. No.	:	OR03400610013104
Registration No.	:	OR04N3195
Date of Registration	:	08/Sep/2011
Month & Year of Manufacturing	:	August-2011
Valid Mobile Number	:	******2793
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	OR0340061
GSTIN	:	21BKDPM4258G1ZE
Fees	:	Rs.177.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	1.01

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Odisha

Date	:	**06/08/2023**
Time	:	**18:56:11 PM**
Validity upto	:	**05/08/2024**

OD09Q3114

Certificate SL. No.	:	OR00900140003553
Registration No.	:	OD09Q3114
Date of Registration	:	09/Aug/2019
Month & Year of Manufacturing	:	April-2019
Valid Mobile Number	:	******0218
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	OR0090014
GSTIN	:	21ARQPD7480A2Z2
Fees	:	Rs.177.00
		(GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	1.62	0.08

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Odisha

Date	:	**05/07/2023**
Time	:	**17:23:56 PM**
Validity upto	:	**04/01/2024**

OD05Y2625

Certificate SL. No.	:	OR00501490008820
Registration No.	:	OD05Y2625
Date of Registration	:	12/Jan/2017
Month & Year of Manufacturing	:	October-2016
Valid Mobile Number	:	******7325
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	OR0050149
GSTIN	:	21CGIPS6879M1ZJ
Fees	:	Rs.177.00 (GST to be paid extra as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.79

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

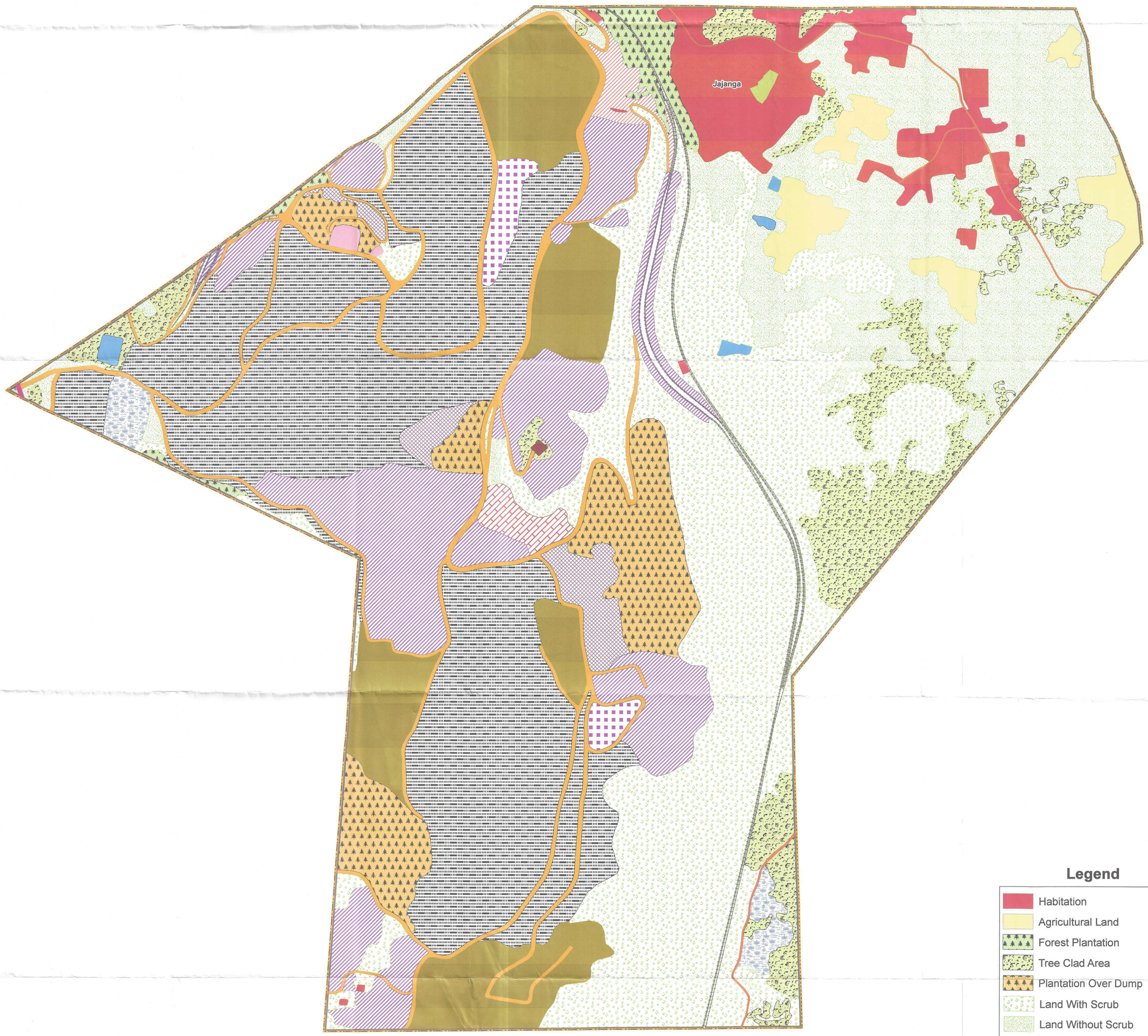
ANNEXURE XIII

LANDUSE / LANDCOVER MAP OF JAJANGA IRON ORE MINE IN KEONJHAR DISTRICT OF M/S JSW STEEL LTD.

0 0.375 0.75 1.5 Kilometers

SCALE - 1:5,000

N W E S



Legend

- Habitation
- Agricultural Land
- Forest Plantation
- Tree Clad Area
- Plantation Over Dump
- Land With Scrub
- Land Without Scrub
- Waterlogging / Marshy / Swampy
- Tank / Pond
- Mining Quarry
- Sub - Grade Dump
- OB Dump
- Stock Yard / Ore Stack
- Back Filling
- Site Services
- Workshop
- Processing Yard
- Magazine
- State Highway
- Haul Road
- Other Road
- Railway Line
- Park / Garden / Zoo
- Safety Zone
- Mining Lease Boundary

ORISSA SPACE APPLICATIONS CENTRE
Map No. 2601/1
Date 09-12-2021
Auth. Signatory
BHUBANESWAR

SOURCE : -

Drone Image Supplied By M/s JSW Steel Ltd.
Month - August , Year - 2021

ORSAC

ANNEXURE XIV

Steel Limited

Regd. Office: JSW Centre
Bandra Kurla Complex,
Bandra (East), Mumbai – 400 051
CIN : L27102MH1994PLC152925
Phone : +91 22 4286 1000
Fax : +91 22 4286 3000
Website : www.jsw.in

OFFICE ORDER

Letter No. JSW/S/CO/2023/303

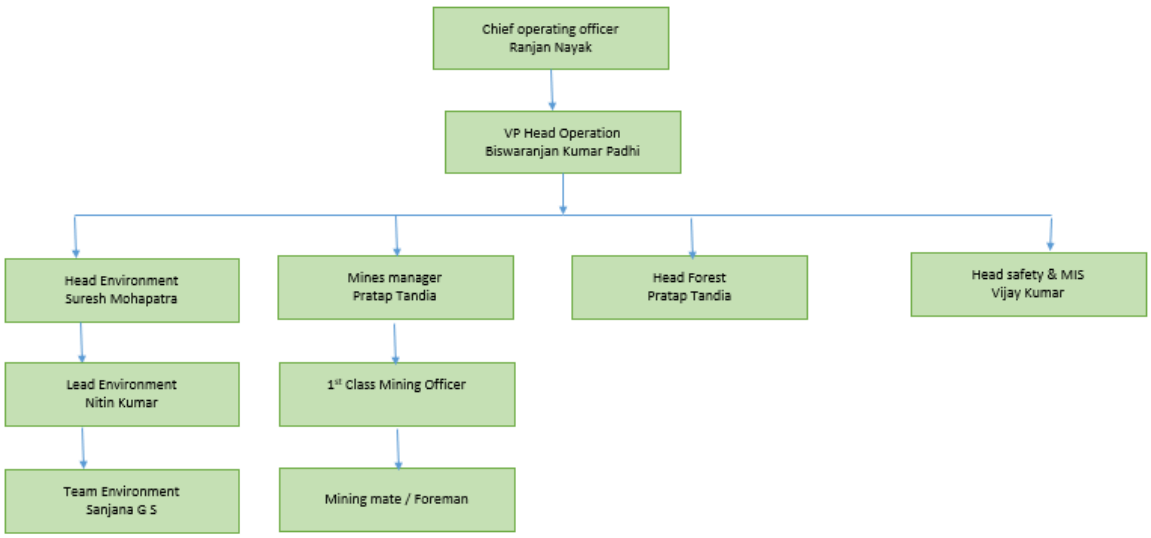
JAJANG IRON ORE MINES

Environment Management Cell

Environment management cell (EMC) working for the management of Environmental monitoring of the mines and to act upon mitigation measures on the impacts of the production of mine with its surrounding environment so that pollution load, water and air quality can be maintained. Key functioning of EMC would be for compliance monitoring and to adhere with Environmental aspects and issues of the project during operation phase. EMC created with an objective of organizational framework for operating Environment Management System (EMS) and other functions of responsibilities for environmental betterment; and formulating Environmental Action Plans (EAPs) which specify mitigation, periodic and annual monitoring activities during project implementation and operation phase of mining.

The potential activities structured for the control mechanism by EMC, such activities are: Air pollution due to the emission of particulate matter, Gaseous pollutants and fugitive emissions; Noise pollution due to various noise generating equipment and mining activities; Wastewater generation from domestic activities; and Solid waste disposal. In order to minimize these impacts and to ensure that the environment in and around the project site as well as the neighboring population is well protected; an effective environment management plan to be developed and maintained by Environment management cell.

Organogram



Ranjan Nayak
Chief Operating Officer

ANNEXURE XV

Jajang Mines Expenditure Incurred for 2023-24

Sl.No	Expenditure Head -Particulars (INR)	Jajang
1	Horticulture Services (Gardening services, Manpower)	4517135
2	Plantation and maintenance services	1923000
3	Nursery Development	3120000
4	Construction & Maintenance of garland drains	420000
5	Construction & Maintenance of retaining walls	4666666
6	Geo-textiling- Coir Mating/ slope stabilisation, etc.	935165.4
7	Dust Suppression activities- Water Sprinkling (fixed and mobile), Dust suppression chemicals, Road sweeping vehicle	8828000
8	Manual Environment parameters monitoring (AIR,WATER,NOISE and Ground Vibration)	1229880
9	CAAMS Environment parameters monitoring	557148
10	Installation and Service of Flowmeter and Piezometer	143086.2
11	Installation of Online noise meter	330000
12	Environmental Awareness Programmes/ MEMC program	451866.72
13	Land Scaping/ Land Restoration	0
14	Any other expenses related to Environment protection, Infrastructure, machineries, etc.(if any)	0
		2,71,21,947

Steel Limited

Regd. Office: JSW Centre
Bandra Kurla Complex,
Bandra (East), Mumbai – 400 051
CIN : L27102MH1994PLC152925
Phone : +91 22 4286 1000
Fax : +91 22 4286 3000
Website : www.jsw.in

No. JSW/S/CO/2024/327 Date: 11/05/2024

To,
The Member Secretary
State Pollution Control Board, Odisha,
Paribesh Bhawan, A/118, Nilakantha Nagar, Unit-8,
BHUBANESWAR- 751012

Sub: - Submission of report for the recommendations of carrying capacity study made by CSIR-NEERI, for environmentally sustainable iron and manganese ore mining activity for **Jajang Iron Ore Mine of M/s JSW Steel Ltd.**

Ref: - 1. New Consent Order No 2942 vide letter no 4820/IND-I-CON-247 dated 30.03.2024.

Dear Sir,

With reference to aforesaid subject, please find enclosed herewith the 9 Points NEERI Compliance Status Report and carrying capacity study made by CSIR-NEERI, for environmentally sustainable iron and manganese ore mining activity of FY 2023-24 for **Jajang Iron Ore Mine of M/s JSW Steel Ltd**.

Seeking your co-operation as always.

Thanking you,

Yours Faithfully
For JSW Steel Ltd

Mrutyunjaya Mahapatra

Mrutyunjaya Mahapatra
(Authorized Signatory)

Encl: As above

Copy to- The Regional Officer, Regional Office, State Pollution Control Board, Keonjhar, At – Baniapat, College Road, Keonjhar-758 001, Office of the State Pollution Control Board, Odisha

NEERI REPORT COMPLIANCE STATUS - JAJANG MINE

Sl. No.	Recommendation by CSIR-NEERI	Action Taken
1	The individual lease holders shall make assessment and quantification of emission load generation (in terms of air pollution, noise, wastewater and solid waste) from each of the mining activity (including transportation) for the period starting from 1st April to 31stMarch and submit report by June of every year. Efforts should be made to further eliminate/ minimize generation of air pollution/ dust, noise, wastewater, solid waste generation in successive years through use of better technology. Necessary guidance many be sought from Regional Officer, SPCB on load calculation.	The project has already been practicing different environmental safeguard measures for prevention of the air pollution. The measures are- 1. Mobile water sprinkling arrangement has been provided for the haul roads, processing area and loading / unloading points to minimize dispersion of air borne dust particles. 2. Fixed water sprinkling of 3.7km is being maintained and operated. 3. Wet drilling arrangement with acoustic enclosure is in practice to control dust right at the source. 4. Dust Suppression System (Dry fog system) being provided at all appropriate places of mineral handling plants (crusher& screening plant) and other areas. Same are being maintained for proper dust control. Regular Monitoring of ambient air quality parameters being carried out through M/s Ecomen. Monitoring reports of FY 2023-24 were submitted in your good office vide our letter no. JSW/C/O/2024/326 dated 11.05.2024. 5. No process water being discharged from the mine. Regular Monitoring of water quality parameters being carried out and Monitoring reports of FY 2023-24 were submitted in your good office vide our letter no. JSW/C/O/2024/326 dated 11.05.2024. 6. Noise producing equipment's are covered as far as practicable. Workers engaged in Operations are provided with ear plugs / muffs. Besides this, acoustic enclosures are provided for all machines operating within the mines. Regular Noise Monitoring being carried out and Monitoring reports of FY 2022-23 were submitted in your good office vide our letter no. JSW/C/O/2024/326 dated 11.05.2024. 7. The overburden generated as solid waste is stacked at the earmarked areas and are covered by Coir matting. Additional coir-matting of 5678 sq.m is being done as per requirement which will be followed by tree plantation after arrival of monsoon.

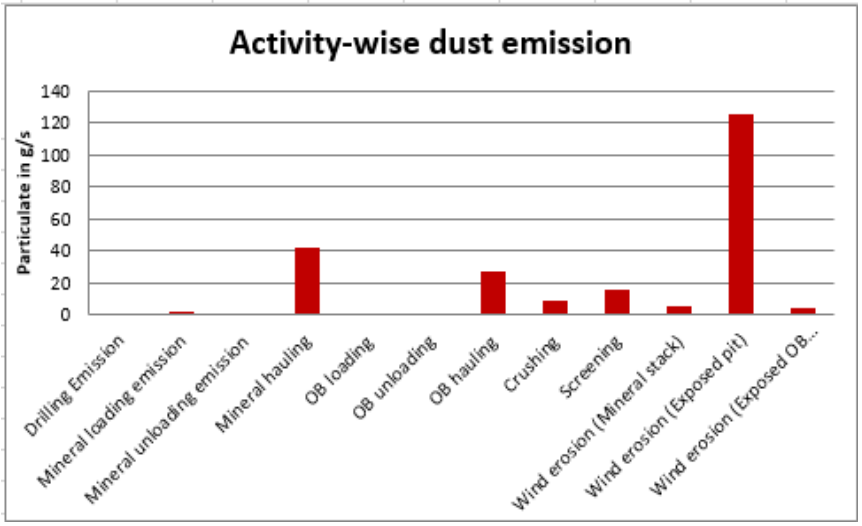
		8. The vehicles carrying the loaded materials are being covered with tarpaulin. 9. Annual Assessment and quantification of emission load generation (in terms of air pollution, noise, waste water and solid waste) as per prescribed standards is enclosed as **Annexure I.**
2	Monitoring of ambient air and fugitive emission in core zone shall be carried out on daily basis. Minimum four ambient air quality monitoring stations shall be installed in the core zone. Out of four, at least one on-line monitoring station shall be installed in case of mines having EC capacity of 3 MTPA of more. Moreover, one station should be located near the ore carrying truck entry and exit gate of mine. A letter in this regard has already been communicated to individual leaseholder of capacity 3 MTPA and above vide Board's Letter no-7807, dt. 30.06.2018.	Regular monitoring of ambient air and fugitive emission is being carried out through M/s Ecomen Private Ltd. Monitoring reports of FY 2023-24 were submitted in your good office vide letter no. JSW/C/0/2024/326 dated 11.05.2024. We have installed Four Continuous Ambient Air Quality Monitoring Stations (CAAQMS) and Digital Display Board in consultation with Regional Officer, Keonjhar. All 4 CAAQMS are equipped with data transfer facility to SPCB and we have authorized Phoenix Robotix Pvt. Ltd. (Datoms) for transmitting data to OSPCB and already completed the necessary setup for data transfer from all 4 locations to OSPCB Server.
3	Monitoring in buffer zone shall be carried out by through NABET accredited agency preferably, at locations of nearest human habitation including schools and other public amenities located nearest to source of dust generation as applicable. The monitoring station shall be installed in core and buffer zone in consultation with Regional Officer, SPCB.	Regular Monitoring in buffer zone is being carried out at locations of nearest human habitation (residential area) engaging an NABET Accredited laboratory (Ecomen Private Ltd) Monitoring reports of FY 2023-24 were submitted in your good office vide letter no. JSW/C/0/2024/326 dated 11.05.2024.
4	Monitoring stations shall be facilated for measurement of CO as an additional parameter to the other parameters SPM, PM_{10}, $PM_{2.5}$, SO_2 and NO_2. The monitoring result shall be compiled and submitted to Board on annual basis.	Regular Monitoring of CO as an additional parameter being carried out along with other AAQ data. Monitoring reports of FY 2023-24 were submitted in your good office vide letter no. JSW/C/0/2024/326 dated 11.05.2024.

5	All the vehicles engaged in mining and transporting activity in the mine shall have Pollution under Control (PUC) certificate. A record of the same shall be maintained for verification of inspecting agency.	Mineral carrying trucks are not allowed to go out of the lease area without tarpaulin cover and is being monitored by security personnel at the exit gate. Similarly, the transportation vehicles are not allowed to enter the mines without having valid PUC by the security personnel.
6	Noise level should be monitored near the major sources of noise generation within the core zone once in week and submit the report annually. Further, date, time and distance of measurement shall also be indicated with the noise levels in the report. The data shall be used to map the noise generation from different activities and efforts should be made to maintain the noise levels with the acceptable limits of CPCB. The monitoring schedule shall be informed to Regional Officer, SPCB in order to ensure his presence 25% of the monitoring programme.	Weekly Noise monitoring is being carried out through M/s Ecomen Private Ltd. (Accredited Laboratory). Monitoring reports of FY 2023-24 were submitted in your good office vide letter no. JSW/C/0/2024/326 dated 11.05.2024.
7	Measurement of flow rate of the springs and perennial nallah passing through the mining lease area shall be done on monthly basis. Identification of the perennial streams to be brought under the monitoring programme and the location the flow measurement shall be determined in consultation with Regional Officer, SPCB. The consolidates report shall be submitted to Board on annual basis.	No natural water course and water resources are obstructed due to mining operations & the same will be taken care of Monitoring of flow rate measurement of the different water bodies is being carried out through M/s Ecomen Private Ltd. Monitoring reports of FY 2023-24 were submitted in your good office vide letter no. JSW/C/0/2024/326 dated 11.05.2024.
8	Effort shall be made to recycle or reuse the treated wastewater from ETP of work shop and STP of residential colony instead of discharging to outside.	Workshop along with Oil & Grease trap system being provided in the mine area. STP of capacity 30KLD has been installed. Meanwhile the soak pits are being used.
9	Annual environmental sustainability report (ESR) shall be made highlighting the efforts made towards environmental protection with respect to different environmental components vis-à-vis production performance of the mine on monthly basis. The data collected as per EC and CTE/CTO conditions should be utilized to prepare the annual sustainability report. The report shall be submitted to SPCB and RO, MoEF&CC by June of every year.	Jajang Mine started operations since July 2022. Annual environmental sustainability report (ESR) in enclosed as **Annexure II.**

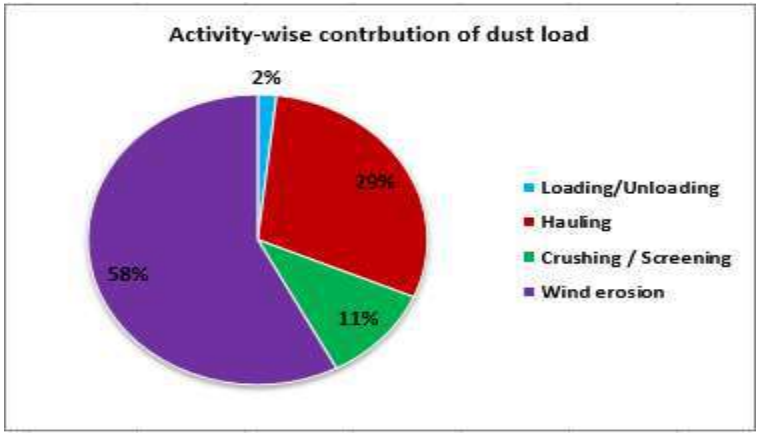
ANNEXURE I

RESULTS OF DUST LOAD CALCULATIONS

	Particulate matter in (g/s)	Particulate matter in (kg/d)	Particulate matter (kg per ton of ore)
Drilling Emission	0.08600582	7.430902494	0.000362483
Mineral loading emission	1.8882229	163.1424586	0.007958169
Mineral unloading emission	0.41734913	36.05896488	0.001758974
Mineral hauling	41.9711932	3626.311092	0.176893224
OB loading	1.26831082	109.5820549	0.005345466
OB unloading	0.60360894	52.1518127	0.002543991
OB hauling	27.6048359	2385.057824	0.116344284
Crushing	9.25925926	800	0.03902439
Screening	16.2037037	1400	0.068292683
Wind erosion (Mineral stack)	5.71709307	493.9568412	0.024095456
Wind erosion (Exposed pit)	125.248141	10821.43942	0.527875094
Wind erosion (Exposed OB dump)	4.25579468	367.7006606	0.017936618
Total	**234.524**	**20262.83**	**0.988431**



Major Activity	Dust load (kg/day)
Loading/Unloading	360.935291
Hauling	6011.36892
Crushing / Screening	2200
Wind erosion	11683.0969



GO TO MAIN PAGE

GO TO DATA ENTRY PAGE

Annual Environmental Sustainability Report (ESR) for Jajang Iron Ore Mine of M/s JSW Steel Ltd.

Introduction-

The Jajang iron ore mine (erstwhile lessee M/s Rungta Mines Limited) was one of the mines whose lease expired on 31.03.2020. The lease area is located in villages Jajang, Joribahal, Palsa (Ka), Bandhuabeda, Tehsil Barbil, District Keonjhar, Odisha state.

Government of Odisha vide letter No. 3007/S&M/Bhubaneshwar/IV(Misc)SM-66/2016 dated 18th March 2020 issued the notice for grant of Mining Lease (ML) for Jajang Iron Ore Block over an area of 666.15 ha as per ROR (669.078 ha as per DGPS computation) in villages Jajang, Jadibahal, Palsa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar district, Odisha for a mineable reserve size of about 34.87 Million tonnes (Mt).

In pursuant to the Mines and Minerals (Development and Regulation) Act, 1957 and the Mineral (Auction) Rules, 2015, Govt. of Odisha issued the notice inviting tender dated 6th December, 2019 for commencement of the auction process to grant the mining lease in respect of Jajang Iron Ore Block located in villages Jajang, Joribahal, Palsa (Ka), Bandhuabeda under Barbil tehsil of Keonjhar district, Odisha. The e-auction process was conducted in accordance with the tender document and the mineral auction rule, 2015 for the said mineral block and M/s JSW Steel Limited was declared as the Preferred Bidder under Rule 9(9) (iii) of Mineral (Auction) Rules, 2015.

Without prejudice to the generality of the provisions of section 8B (2) of the MMDR Act, 1957, the details of the valid rights, approvals, clearances, licenses, and the like held by the previous lessee are vested in favor of M/s JSW Steel Ltd by the Govt. of Odisha for a period of 2 years from the date of execution of lease deed or till the date of getting fresh approvals, clearances, licenses, permits, and the like, whichever is earlier vide order No-4190/SM, dated 29.05.2020. M/s JSW Steel Limited being successful bidder upon execution of mining lease deed, the Successful Bidder shall immediately, but not later than one hundred twenty days from the date of execution of mining lease, apply afresh for all necessary rights, approvals, clearances, licenses and the like under the applicable statutes, rules or regulations, as the case may be, for obtaining the necessary clearances to enable further continuance of the mining operations beyond two years and vesting order shall be valid for a period of two years from the date of execution of new lease deed or till the date of getting all fresh approvals, clearances, licenses, permits, and the like, whichever is earlier."

Subsequent to signing of the **MDPA, M/s JSW Steel Limited** has made payment of the third instalment being the eighty percent of the upfront value and executed and registered the mining lease with the Government of Odisha on 27.06.2020 and the mining lease was granted in favor of M/s JSW Steel Limited for a period of 50 years w.e.f 27.06.2020.

Indicative Coordinates Range of the Jajang Iron Ore Mine

Pillar No.	Latitude	Longitude
1	21°54'44.23926" N	85°26'14.55590" E
23	21°56'33.49374" N	85°25'45.85255" E
31	21°55'52.37093" N	85°24'49.65672" E
12	21°56'08.11524" N	85°26'50.70226" E

Fully mechanized open cast method of mining by drilling and blasting and by deploying HEMM equipment's like hydraulic drills and excavators, wheel loaders, dumpers, will be undertaken. The height and width of the benches for iron ore will be kept at 9 m and 15 m respectively. The working of benches will be commenced from top and extended to bottom benches. The excavated ROM ore is proposed to be processed in the crushing and screening plants to obtain the lump and fine ore as product mix. The iron ore lumps and iron ore fines extracted from the mine will be transported through railway/port/road to JSW Steel Plants. There are two nos of railway siding namely, RMJC-JSW Railway Siding and part of BIL Siding existing within the ML area. These sidings is being used for transportation of ore of Jajang block.

Production in FY 2023-24

From April 2023 to March 2024, Jajang Mine has produced 8.324 MT Iron Ore (ROM)and dispatched to Steel Plants

Environment Management in Jajang Mine

Air Management-

Blasting Operation

- Controlled blasting method is in practice by restriction of explosive charge in the holes.
- Well-designed blast by effective stemming and use of mili second delay detonators, Proper blasting designing to see that the optimum breakage occurs.
- To control ground vibrations and arrest fly rocks, advanced initiation system is being used for blasting
- Ground vibrations are also being monitored and the results are well within limits.





Excavation, Hauling and Crushing & Screening

- Dry fog system for crusher & screen plants are provided.
- Proper maintenance of HEMM
- Using sharp teeth for shovels and other soil excavation equipment, and their periodical replacements.
- Acoustic enclosures for operator cabin.
- Avoiding overloading of dumpers
- Provision of dust filters / masks to workers working at highly dust prone and affected areas
- Imparting sufficient training to operators on safety and Environmental parameters.





Transportation

- Regular water sprinkling is being carried out by engaging mobile water tankers on the mine benches, mine haul, loading and unloading points and transfer points for dust suppressions.
- Maintenance of haul road by regular grading is carried out through grader, dozer.
- Ensuring that all mineral trucks are covered by tarpaulin.
- Vehicular emissions controlled through regular and proper preventive maintenance schedules.
- It is ensured that there is no overloading of trucks by having Quick Dispatch system at the weigh bridge near the dispatch gate.
- Regular water sprinkling arrangements have been made on the transportation roads/public road through mobile water tankers.
- Tarpaulin Covering in Railway Wagons.
- It is ensured that there is no overloading of trucks by having Quick Dispatch system at the weigh bridge near the dispatch gate.
- PUC check is done for the random vehicles.
- Road sweeping Machines are being used at the transportation road outside the lease area.
- All the dispatch trucks are being sent through sensor-based wheel washing system which has recirculation system.
- Dust suppressant chemicals are being used to control the dust emission on the haul roads, which also reduces the water consumption.



MAINTAINING IDEAL HAUL ROAD WIDTH AND BERM HEIGHT





DOZER AND GRADER AT WORK MAINTAINING HAUL ROAD CONDITION



50 KL WATER TANKER



16 KL WATER TANKER



TARPAULIN COVER ON RAILWAY SIDINGS



ROAD SWEEPING MACHINE



WHEEL WASHING SYSTEM



DUST SUPPRESSANT CHEMICAL



PUC Check for Dispatch Trucks

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Odisha

Date	:	**07/07/2023**
Time	:	**15:45:27 PM**
Validity upto	:	**06/01/2024**

Certificate SL. No.	:	OR00900420004868
Registration No.	:	OR09P9786
Date of Registration	:	27/Jul/2011
Month & Year of Manufacturing	:	June-2011
Valid Mobile Number	:	******6197
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	OR0090042
GSTIN	:	21AKSPA6757G1Z4
Fees	:	Rs.177.00 (GST to be paid extra as applicable)
ML observation	:	No

Vehicle Photo with Registration plate
60 mm x 30 mm



Sr. No.	Pollutant (as applicable)	Units (as applicable)	Emission limits	Measured Value (upto 2 decimal places)
1	2	3	4	5
Idling Emissions	Carbon Monoxide (CO)	percentage (%)		
	Hydrocarbon, (THC/HC)	ppm		
High idling emissions	CO	percentage (%)		
	RPM	RPM	2500 ± 200	
	Lambda	-	1 ± 0.03	
Smoke Density	Light absorption coefficient	1/metre	2.45	0.63

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

PUC CERTIFICATE

Storage of Minerals

- Stack is being prepared and occasional water sprinkling is done to avoid the dust formation. Along with this garland drains are being constructed and fog canons are being used to avoid the fugitive dust emission.
- Regular Fugitive monitoring is done on loading and unloading areas.





DUST CONTROL MINERALS STACKING AREA

Total 08 Ambient monitoring stations, 04 in core zone and 04 in buffer zone has been established along with 06 fugitive dust emission stations. The values are being analyzed by NABL Accredited Laboratory and are well within the limit. Total 4 continuous ambient air quality monitoring stations has been established which are directly connected with SPCB Server.



CAAQMS at Guest House Area Jajang



Electronic Digital Display Board near Jajang Mine Gate No 2

Consolidated Air Quality Monitoring Data of FY 2023-2024

JAJANG IRON ORE MINES										
AAQ DATA FOR THE PERIOD APRIL 2023 TO MARCH 2024										
	PM10 [µg/m3]		**PM2.5 [µg/m3]**		**SO2 [µg/m3]**		**NO2 [µg/m3]**		**CO [mg/m3]**	
	Maximm	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**
CORE ZONE										
Mines Office	68.1	54.2	26.8	18.4	18.6	12.5	19.6	13.2	0.66	0.51
Entry& Exit Gate	64.6	44.2	21.7	18.0	16.9	14	19	15.5	0.55	0.52
Residential Colony	63.2	31	25.1	19.1	16.7	13.8	21.1	12.9	0.64	0.19
Work Shop Area	62.4	55.9	28.8	23.8	18.1	16.1	20.2	11.7	0.59	0.62
BUFFER ZON E										
Jajang Village	50.5	48.5	15.9	11.3	14.4	12.7	15.5	12.3	0.46	0.43
Jaraibahal Village	46.9	42.3	18.2	15.1	14.9	12	16.5	13.5	0.44	0.4
Bandabeda Village	45.5	42.1	15.1	12.2	14.8	12.2	16	11.1	0.47	0.42

Kamal pur Village	43.7	40.1	15.6	12.7	15.1	12.2	15.6	12.2	0.47	0.42
NAAQ (24hr standard)	**100 [µg/m3]**		**60 [µg/m3]**		**80 [µg/m3]**		**80 [µg/m3]**		**2 [mg/m3] (8 hourly)**	

Water & OB Management

- Garland drains maintained of suitable size around mine area and dump with proper gradients to prevent rain water descent into active mine area.
- Settling ponds maintained to prevent flow of fine particles from OB / Waste dumps, check dams, parapet / retaining walls & garland drains.
- Usage of stored water in the settling ponds for watering of haul roads, vehicle washing and green belt development etc.
- De- silting of garland drains & settling ponds is being carried out at regular intervals.
- Maintenance of all the runoff management structures.






Retaining Wall, GeoCoir Matting & Plantation on Backfilled Area 2



Check Dam near railway siding



Plantation on OB Dump no 2



Safety zone Plantation



Aftercare of saplings (Planted in Waste Dump - 2 & 4)



Avenue Plantation



In-house Nursery





Orchard in Jajang Mine



View Point



Fruit Bearing & Flowering Plants in Orchard





Hazardous Waste Storage Area in Jajang Mine Workshop

Consolidated Ground Water Quality Monitoring Data of FY 2023-2024

JAJANG IRON ORE MINES						
Kamalpur Village (Borewell)						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	7.18	6.9	7.06	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	152	130	140.00	**500**	**2000**
Total Hardness as CaCO3	mg/l	64	40	50.75	**200**	**600**
Chloride as Cl	mg/l	18	8	13.75	**250**	**1000**
Fluorides as F	mg/l	0.22	0.13	0.19	**1**	**1.5**
Iron as Fe	mg/l	0.23	0.09	0.18	**1**	**No Relaxation**
Sulphates	mg/l	12.8	8.2	11.05	**200**	**400**
Jajang Village (Borewell)						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	6.96	6.62	6.79	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	160	113	140.25	**500**	**2000**
Total Hardness as CaCO3	mg/l	92	52	80.50	**200**	**600**
Chloride as Cl	mg/l	18	14	15.25	**250**	**1000**
Fluorides as F	mg/l	0.25	0.19	0.22	**1**	**1.5**
Iron as Fe	mg/l	0.16	0.1	0.14	**1**	**No Relaxation**
Sulphates	mg/l	16.5	12.1	14.28	**200**	**400**

Jurudi Village (Dug well)						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	7.15	6.62	6.89	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	162	151	157.25	**500**	**2000**
Total Hardness as CaCO3	mg/l	68	63	65.00	**200**	**600**
Chloride as Cl	mg/l	22	18	19.50	**250**	**1000**
Fluorides as F	mg/l	0.33	0.24	0.28	**1**	**1.5**
Iron as Fe	mg/l	0.19	0.12	0.15	**1**	**No Relaxation**
Sulphates	mg/l	15.5	13.9	14.75	**200**	**400**
Jalahari Village (Bore well)						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	6.92	6.76	6.86	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	124	111	116.75	**500**	**2000**
Total Hardness as CaCO3	mg/l	60	48	54.50	**200**	**600**
Chloride as Cl	mg/l	19.2	14	16.98	**250**	**1000**
Fluorides as F	mg/l	0.28	0.23	0.26	**1**	**1.5**
Iron as Fe	mg/l	0.2	0.12	0.16	**1**	**No Relaxation**
Sulphates	mg/l	16.5	12.2	14.13	**200**	**400**
Tap water near Jajang village						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	7.18	6.73	6.99	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	144	125	133.25	**500**	**2000**
Total Hardness as CaCO3	mg/l	56	48	51.25	**200**	**600**

Chloride as Cl	mg/l	24	12	19.50	**250**	**1000**
Fluorides as F	mg/l	0.26	0.11	0.21	**1**	**1.5**
Iron as Fe	mg/l	0.2	0.07	0.16	**1**	**No Relaxation**
Sulphates	mg/l	17.5	8.97	14.62	**200**	**400**
Dugwell Near BIL Siding						
Parameter	**Units**	**Max.**	**Min**	**Avg.**	**Acceptable Limits**	**Permissible Limits**
pH	-	7.25	6.68	6.92	**6.5-8.5**	**No Relaxation**
Total Dissolved Solids as TDS	mg/l	151	118	129.75	**500**	**2000**
Total Hardness as CaCO3	mg/l	77	60	69.50	**200**	**600**
Chloride as Cl	mg/l	24	14	20.00	**250**	**1000**
Fluorides as F	mg/l	0.23	0.2	0.22	**1**	**1.5**
Iron as Fe	mg/l	0.2	0.11	0.16	**1**	**No Relaxation**
Sulphates	mg/l	22.6	19.2	20.43	**200**	**400**

Consolidated Surface Water Quality Monitoring Data of FY 2023-2024

JAJANG IRON ORE MINES				
Baitarini River UpStream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	7.12	6.74	**6.5-8.5**
Total Dissolved Solids	mg/l	248	155	**1500**
BOD	mg/l	8	2.1	**3**
DO	mg/l	7.3	3.6	**4**
Chlorides	mg/l	32.3	16	**600**
Fluorides	mg/l	0.35	0.11	**1.5**
Iron	mg/l	0.42	0.11	**50**

Baitarani River Downstream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream WaterStandards**
PH	-	7.49	6.62	**6.5-8.5**
Total Dissolved Solids	mg/l	278	143	**1500**
BOD	mg/l	14	2.6	**3**
DO	mg/l	8	2.8	**4**
Chlorides	mg/l	44	20	**600**
Fluorides	mg/l	7.52	0.18	**1.5**
Iron	mg/l	0.32	0.1	**50**

Suna River Upstream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	7.34	6.57	**6.5-8.5**
Total Dissolved Solids	mg/l	224	134	**1500**
BOD	mg/l	5.2	1.8	**3**
DO	mg/l	7.2	2.3	**4**
Chlorides	mg/l	32	14	**600**
Fluorides	mg/l	0.46	0.15	**1.5**
Iron	mg/l	0.28	0.09	**50**
Suna River Downstream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	7.54	6.7	**6.5-8.5**
Total Dissolved Solids	mg/l	282	184	**1500**
BOD	mg/l	10	2.9	**3**
DO	mg/l	6.9	3.2	**4**
Chlorides	mg/l	48	18	**600**
Fluorides	mg/l	0.48	0.16	**1.5**
Iron	mg/l	0.25	0.19	**50**

Jalpa Nadi Upstream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	6.97	6.71	**6.5-8.5**
Total Dissolved Solids	mg/l	188	120	**1500**
BOD	mg/l	4.5	1.7	**3**
DO	mg/l	6.2	2.7	**4**
Chlorides	mg/l	26	11	**600**
Fluorides	mg/l	0.37	0.24	**1.5**
Iron	mg/l	0.22	0.11	**50**
Jalpa River Downstream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	7.46	6.98	**6.5-8.5**
Total Dissolved Solids	mg/l	268	113	**1500**
BOD	mg/l	9.4	2.3	**3**
DO	mg/l	6	3.2	**4**
Chlorides	mg/l	42	18	**600**
Fluorides	mg/l	0.39	0.23	**1.5**
Iron	mg/l	0.26	0.14	**50**
Kakarpani River UpStream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	6.95	6.43	**6.5-8.5**
Total Dissolved Solids	mg/l	210	148	**1500**
BOD	mg/l	5.8	3	**3**
DO	mg/l	6.8	1.6	**4**
Chlorides	mg/l	30	16	**600**

Fluorides	mg/l	0.31	0.18	**1.5**
Iron	mg/l	0.26	0.13	**50**
Kakarpani River UpStream				
Parameter	**Units**	**Maximum**	**Minimum**	**Limits for Stream Water Standards**
PH	-	7.25	6.77	**6.5-8.5**
Total DissolvedSolids	mg/l	360	152	**1500**
BOD	mg/l	6.9	2.5	**3**
DO	mg/l	6.9	2.2	**4**
Chlorides	mg/l	34	22	**600**
Fluorides	mg/l	0.48	0.27	**1.5**
Iron	mg/l	0.36	0.19	**50**

Noise Management

- Providing sound proof operator's cabin for equipment like dumpers, shovel, tippers, etc.
- Planting trees at various places within the lease area to act as acoustic barriers.
- Proper and regular maintenance of vehicles, machinery and other equipment. All HEMMs are monitored for any abnormal sound and rectified with due precaution by maintenance personnel.
- Providing workers with ear muffs & earplugs against high noise levels.
- Conducting regular health check-ups of workers including Audiometry test Controlling the time of exposure of workers towards high noise areas

Jajang Iron Ore Mines			
CORE ZONE	**max**	**min**	**Standards**
DUMPER OPERATOR CABIN	74.1	64.2	**75 dB(A)**
LOADER OPERATOR CABIN	74.2	59.1	
CRUSHER PLANT AREA	73.8	60.4	
SCREEN PLANT AREA	73.9	62.8	
MINES OFFICE AREA	73.8	59.4	
EXCAVOTAR OPERATOR CABIN	74.6	61.8	
DOZER OPERATOR CABIN	73.2	58.8	

BUFFER ZONE					**STANDARDS**	
	Leq Day		Leq Night		**Day Equivalent**	**Night Equivalent**
	MAX	**MIN**	**MAX**	**MIN**		
GUEST HOUSE AREA	54.3	49.2	45.8	36.5	55 dB(A)	45 dB(A)
EAST BOUNDARY	71.5	56.5	69.9	42.7	75 dB(A)	70 dB(A)
WEST BOUNDARY	73.7	59.8	70	49.5		
NORTH BOUNDARY	72.7	59.4	67	51.3		
SOUTH BOUNDARY	72.7	58.3	68.8	51.3		
SOUTH BOUNDARY	69.7	60.6	60.2	53.1		

Jajang Environmental Protection Measures Expenditure (head wise breakup) incurredfrom in FY 2023-24

Expenditure Incurred for 2023-24

SI No.	Expenditure Head -Particulars (INR)	Jajang
1	Horticulture Services (Gardening services, Manpower)	4517135
2	Plantation and maintenance services	1923000
3	Nursery Development	3120000
4	Construction & Maintenance of garland drains	420000
5	Construction & Maintenance of retaining walls	4666666
6	Geo-textiling- Coir Mating/ slope stabilisation, etc.	935165.4
7	Dust Suppression activities- Water Sprinkling (fixed and mobile), Dust suppression chemicals, Road sweeping vehicle	8828000
8	Manual Environment parameters monitoring (AIR,WATER,NOISE and Ground Vibration)	1229880
9	CAAMS Environment parameters monitoring	557148
10	Installation and Service of Flowmeter and Piezometer	143086.2
11	Installation of Online noise meter	330000
12	Environmental Awareness Programmes/ MEMC program	451866.72
13	Land Scaping/ Land Restoration	0
14	Any other expenses related to Environment protection, Infrastructure, machineries, etc.(if any)	0
		2,71,21,947