पत्रांक संख्या.-PO/DC/Ar-1/2025/ 1337

दिनांक:29.11.2025
30

To
The Director
Ministry of Environment, Forest & Climate Change
Regional Office (ECZ), Bungalow No.-2
Shyamali Colony
Ranchi- 834002

Sub: Six monthly Environmental Compliance reports for the period from April'2025 to Sept'2025 in respect of Cluster –I (Damoda Colliery) of BCCL.
Ref: -EC Order No. J-11015/93/2009-IA.II (M) dated 08.07.2021

Dear Sir,

Kindly find enclosed herewith the Six-monthly Environmental Compliance reports for the period from **April'2025 to Sept'2025** in respect of Cluster –I (Damoda Colliery) of BCCL.
This is for your kind information.

Yours faithfully

30/11/25
Project Officer
Damoda Colliery

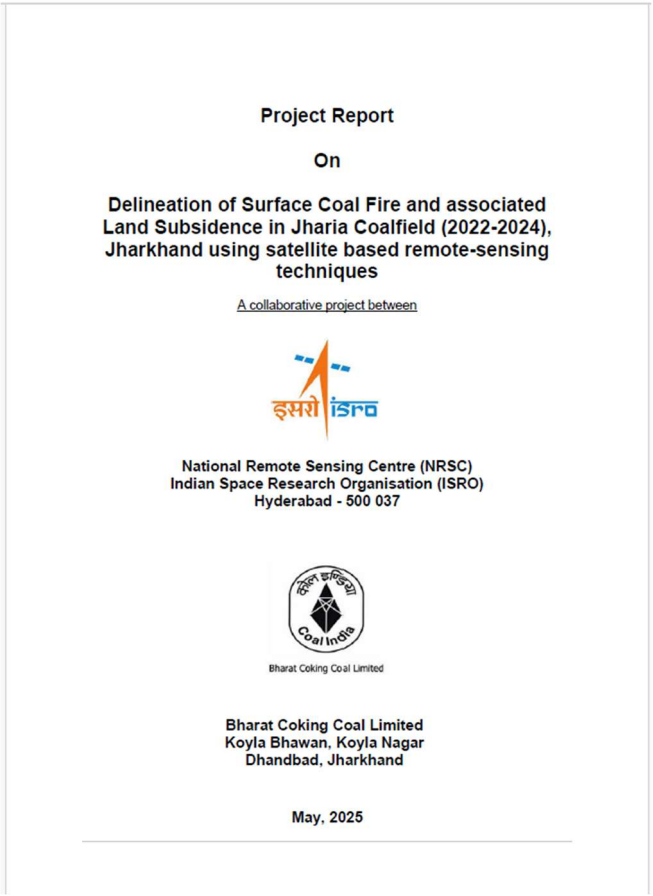
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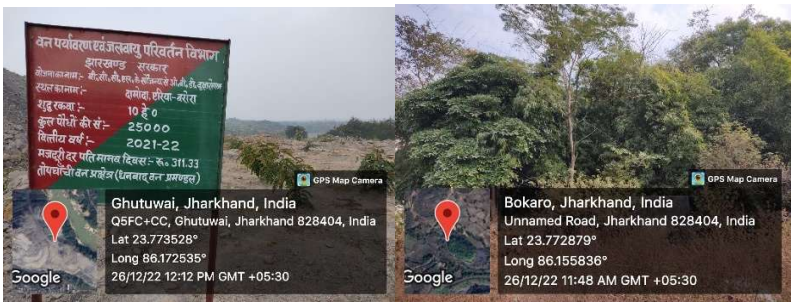
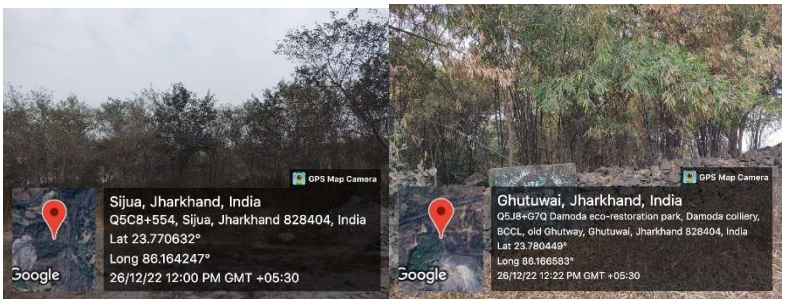
C.C to
1. HoD (Envt.) BCCL Koyla Bhawan, Dhanbad.
2. Office Copy

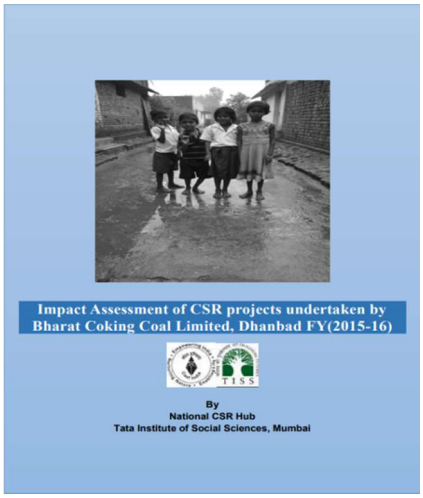
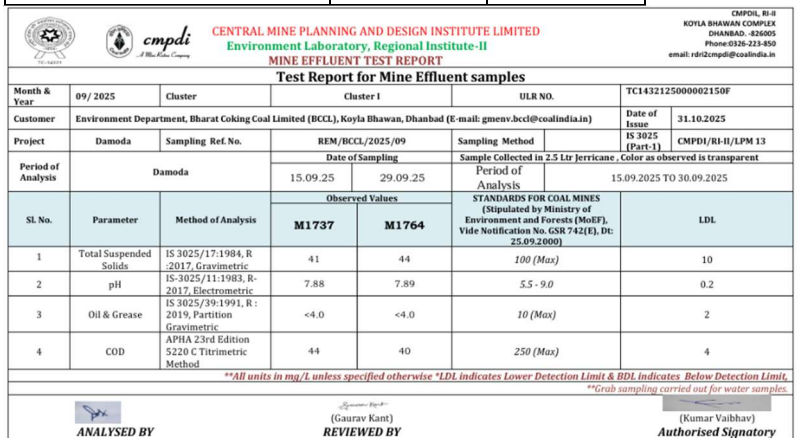
Compliance of Conditions of Environmental Clearance Granted by MoEFCC for Cluster-I

April'2025 to Sept'2025

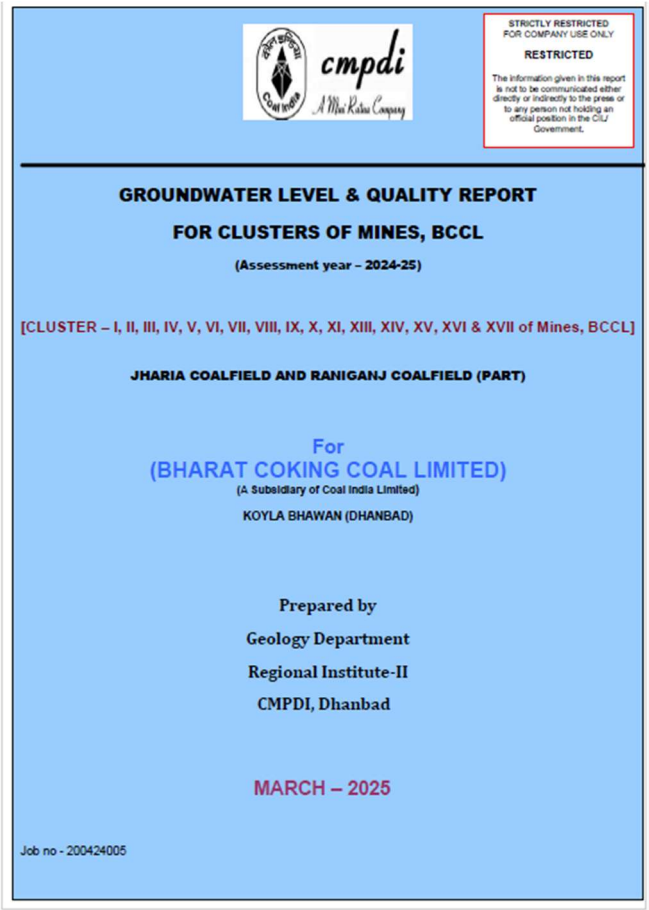
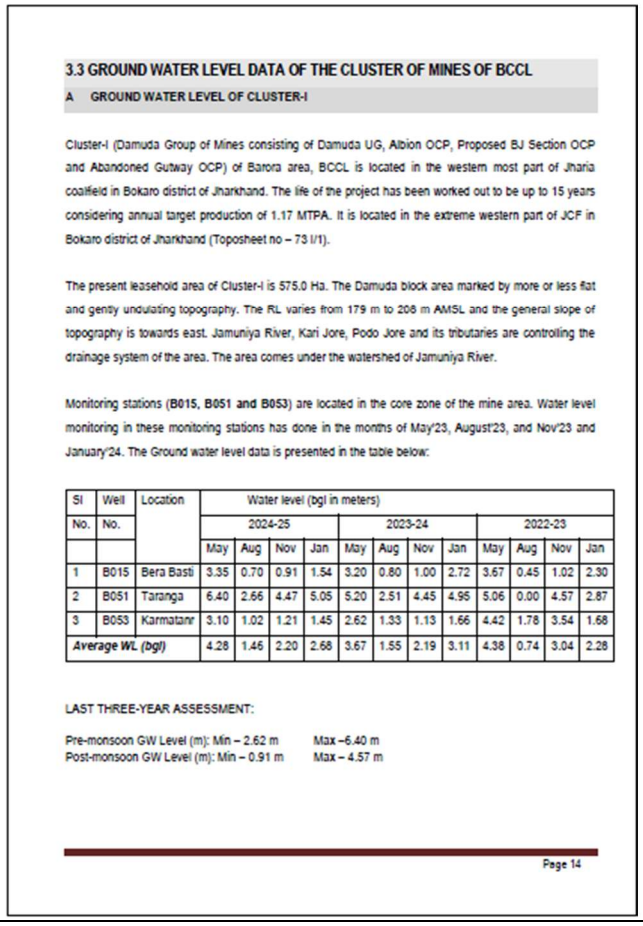
EC Order No. J-11015/93/2009-IA. II (M) dtd 08.07.2021

<table>
<tr><th>Sl. no.</th><th>Specific Conditions by MOEF:</th><th>Compliance</th></tr>
<tr><td>i</td><td>Production shall not exceed beyond that for which environmental clearance has been granted for the 3 mines of cluster-1.
<table>
<tr><th>Name of mine</th><th>Normative (MTPA)</th><th>Peak (MTPA)</th></tr>
<tr><td>Damoda Colliery</td><td>0.90</td><td>1.17</td></tr>
</table></td><td>The production for the cluster is within the limit for which environment clearance has been granted.
<table>
<tr><td>Financial Year</td><td>2025-26 (upto sept)</td><td>2024-25</td><td>2023-24</td><td>2022-23</td><td>20221-22</td><td>2020-21</td></tr>
<tr><td>Coal (Te)</td><td>161208</td><td>280612</td><td>555780</td><td>519565</td><td>450050</td><td>0.00</td></tr>
<tr><td>OB (cum)</td><td>354266</td><td>709256</td><td>1939845</td><td>2552336</td><td>2559861</td><td>220457</td></tr>
</table></td></tr>
<tr><td>ii</td><td>The measures identified in the environmental management plan for Cluster-I group of mines and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia Action Plan.</td><td>Master Plan is dovetailed with environmental clearance conditions. Currently, no fire observed in Cluster-I (Damoda Colliery). Actions like trench cutting and water flushing will be taken to control mine fires including old OB dump and areas as specified in Jharia Master Plan.</td></tr>
<tr><td>iii</td><td>(a) The proponent shall prepare time-series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfields by Isothermal mapping/imaging.
(b) And monitoring temperatures of coal seams (whether they are close to spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified. Measures to prevent ingress of air (ventilation) in such areas, to prevent re-start fresh/spread fires in other areas including in mines of Cluster-I shall be undertaken.</td><td>Time -series maps of the Jharia Coalfields is prepared by NRSA for 2012 and 2018, 2021,2025 and will continue. As per study conducted by NRSA, there is no fire in the leasehold area of Cluster-I (Damoda Colliery). (Soft copy of latest NRSA report is enclosed as Annexure-I)

Project Report
On
Delineation of Surface Coal Fire and associated Land Subsidence in Jharia Coalfield (2022-2024), Jharkhand using satellite based remote-sensing techniques
A collaborative project between
National Remote Sensing Centre (NRSC)
Indian Space Research Organisation (ISRO)
Hyderabad - 500 037
Bharat Coking Coal Limited
Bharat Coking Coal Limited
Koyla Bhawan, Koyla Nagar
Dhandbad, Jharkhand
May, 2025</td></tr>
<tr><td>iv</td><td>No mining shall be undertaking where underground fires continue. Measures shall be taken</td><td>It shall be complied. As per study conducted by NRSA, there is no</td></tr>
</table>

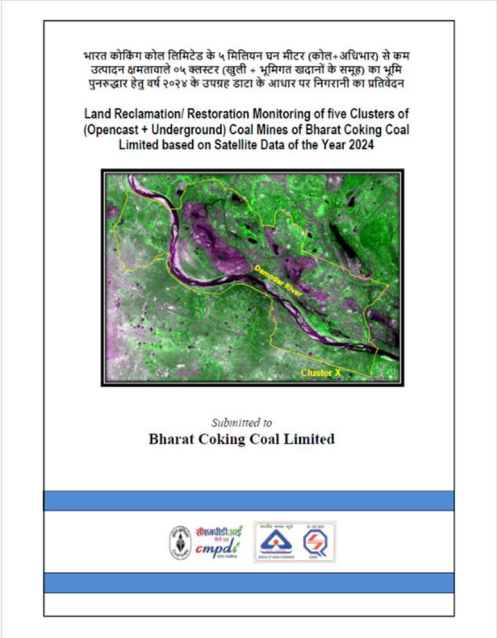
	prevent/check such fires including in old OB dump areas where fire could start due to presence of coal/ shale with sufficient carbon content.	fire in the leasehold area of Cluster-I (Damoda Colliery). No mining will be taken where underground fires continue. Actions like trench cutting and water flushing will be taken to control mine fires including old OB dump.
v	There shall be no external OB dumps. OB from the 2 patches shall be backfilled. At the end of the mining there shall be no void and the entire mined out area shall be re-vegetated. Areas where opencast mining was carried out and completed shall be reclaimed immediately thereafter.	There are no external OB dumps. Currently backfilling is under progress in A-3 revised patch. At the end of the mining, there shall be no voids and entire area will be re-vegetated and reclaimed. Progressive reclamation work is being undertaken with proper techniques suggested by the experts available in BCCL and in external agencies i.e., FRI Dehradun, CEMDE Delhi.
vi	A detailed calendar plan of production with plan for OB dumping and backfilling (for OC mines) and reclamation and final mine closure plan for each mine of cluster-1 shall be drawn up and implemented.	A detailed calendar plan of production with OB dump management plan has been prepared. Mining plan with mine closure plan as per the guidelines of Ministry of Coal have been prepared by Central Mine Planning and Design Institute (CMPDI) and it is being implemented. **Board approval copy of mining plan with mine closure plan, production plan with OB dump management plan is attached as annexure- II.**
vii	Mining shall be carried out as per statuette from the streams/nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60 m width shall be maintained along the nalas/water bodies. The small water bodies in Damoda (Albion Section) OC shall be protected to the extent feasible and the embankment proposed along water body shall be strengthened with stone pitching.	It is being followed. Stone Pitching of Kari Joriya has been completed.
viii	Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. A total area of 237.79 ha shall be reclaimed and afforested.	It is being complied. Geotagged Photos of Plantation sites are enclosed.  
ix	Specific imitative measures identified for the Jharia Coalfields in the Environmental Action Plan prepared for Dhanbad as a critically polluted area and relevant for Cluster-1 shall be implemented.	Dhanbad Action Plan is being implemented. The salient actions of this area: 1. Covered transportation of Coal 2. Water sprinkling 3. Plantation 4. Utilization of surplus mine water

<table>
<tr>
<td>x</td>
<td>A detailed CSR Action Plan shall be prepared for Cluster-I group of mines. Specific activities shall be identified for CSR for the budget of Rs 13.75 crores provided for CSR for 2010-11 and Rs 5/T of coal as recurring expenditure. The 190.51 ha of area within Cluster-I ML existing as waste land and not being acquired shall be put to productive use under CSR and developed with fruit bearing and other useful species for the local communities. In addition to afforesting 237.79 ha of area at the post-mining stage, the 204.67 ha of fallow/abandoned land and 40.64 ha waste land/barren land within Cluster-I ML shall be rehabilitated/reclaimed as forest/agricultural land under CSR Plan in consultation with local communities. Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issues raised in the Public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon shall be uploaded on the company website every year.</td>
<td>It is being complied. BCCL is implementing CSR activities, as per Govt. norms with a CSR Committee being evaluated by Tata Institute of Social Science.
A CSR department has been established at the headquarter level and area level for proper executing the CSR activities.
All welfare/ CSR activities are also uploaded in Company web site. (Soft copy of CSR activities enclosed as Annexure III)
TISS, Mumbai has conducted the baseline survey and accordingly an action plan is being formulated.
Socio economic issues and capacity building are being evaluated by Tata Institute of Social Science.
(Soft copy of TISS REPORT enclosed as Annexure IV)
 
</td>
</tr>
<tr>
<td>xi</td>
<td>Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water courses / agriculture. The quality of the water discharged shall be monitored at the outlet points and proper records maintained thereof and uploaded regularly on the company website.</td>
<td>It is being complied. Mine water is being stored at sump of Albion OCP and after treatment through Pressure Filter is being used for domestic purpose, water sprinkling in mines, in plantation activities, it is not discharged into natural water courses/agriculture farms. Regular monitoring of Water Quality Parameters is being carried out by CMPDIL. Max. value of parameters of mine discharge is given in the table below:
<table>
<tr><td>Total Suspended Solids</td><td>41</td><td>44</td></tr>
<tr><td>pH</td><td>7.88</td><td>7.89</td></tr>
<tr><td>Oil and Grease</td><td>< 4</td><td>< 4</td></tr>
<tr><td>COD</td><td>44</td><td>40</td></tr>
</table>

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
MINE EFFLUENT TEST REPORT
CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
email: rdri2cmpdi@coalindia.in
Test Report for Mine Effluent samples
<table>
<tr><td>Month & Year</td><td>09/ 2025</td><td>Cluster</td><td colspan="2">Cluster I</td><td>ULR NO.</td><td>TC143212500000215OF</td></tr>
<tr><td>Customer</td><td colspan="5">Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)</td><td>Date of Issue 31.10.2025</td></tr>
<tr><td>Project</td><td>Damoda</td><td>Sampling Ref. No.</td><td colspan="2">REM/BCCL/2025/09</td><td>Sampling Method</td><td>IS 3025 (Part-1) CMPDI/RI-II/LPM 13</td></tr>
<tr><td rowspan="2">Period of Analysis</td><td rowspan="2">Damoda</td><td colspan="2">Date of Sampling</td><td colspan="2">Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent</td><td></td></tr>
<tr><td>15.09.25</td><td>29.09.25</td><td>Period of Analysis</td><td colspan="2">15.09.2025 TO 30.09.2025</td></tr>
<tr><td rowspan="2">Sl. No.</td><td rowspan="2">Parameter</td><td rowspan="2">Method of Analysis</td><td colspan="2">Observed Values</td><td rowspan="2">STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)</td><td rowspan="2">LDL</td></tr>
<tr><td>M1737</td><td>M1764</td></tr>
<tr><td>1</td><td>Total Suspended Solids</td><td>IS 3025/17:1984, R :2017, Gravimetric</td><td>41</td><td>44</td><td>100 (Max)</td><td>10</td></tr>
<tr><td>2</td><td>pH</td><td>IS-3025/11:1983, R-2017, Electrometric</td><td>7.88</td><td>7.89</td><td>5.5 - 9.0</td><td>0.2</td></tr>
<tr><td>3</td><td>Oil & Grease</td><td>IS 3025/39:1991, R : 2019, Partition Gravimetric</td><td><4.0</td><td><4.0</td><td>10 (Max)</td><td>2</td></tr>
<tr><td>4</td><td>COD</td><td>APHA 23rd Edition 5220 C Titrimetric Method</td><td>44</td><td>40</td><td>250 (Max)</td><td>4</td></tr>
</table>
**All units in mg/L unless specified otherwise *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,
**Grab sampling carried out for water samples.
ANALYSED BY (Gaurav Kant) REVIEWED BY (Kumar Vaibhav) Authorised Signatory</td>
</tr>
</table>

		(Soft copy of monitoring report is enclosed as Annexure V) **Monitoring report in regularly uploaded to company website.** **URL link- https://www.bcclweb.in/?page_id=15361andlang=en**
xii	No groundwater shall be used for the mining activities. Additional water required, if any, shall be met from mine water or by recycling/reuse of the water from the existing activities and from rainwater harvesting measures. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.	It is being complied. No groundwater is used for the mining and other related activities. Surface mine water is being used for industrial purposes like water sprinkling, plantation and domestic purposes. Mine water after treatment through Filtration by Pressure Filters is supplied to Damoda Colony, BJ Colony and Basti, Sijua Basti, Sijua Pahadi, Albion Colony, Karmatand, Patrakuli, Ghutway village. Two nos. pressure filter of capacity 1250 Gallon /day have already been installed at Damoda Colliery.  There are 03 no. of Rain Water Harvesting Structure at Barora Area which has administrative control over Cluster-I Damoda Colliery.
xiii	Continuous monitoring of long-term impacts of dumping of fly ash (for life of the mine) and leaching of heavy metals on soil and water quality of the study area shall be undertaken and the details of which shall be submitted to the Central Ground Water Board, SPCB and to the Regional Office of this Ministry at Bhubaneswar, as part of the compliance report. Permanent monitoring arrangements such as piezometers shall be established in and around mine areas covering potential impact zone for contamination of heavy metals due to leachates from fly ash. In case of increasing levels of heavy metals detected in groundwater, further dumping of fly ash shall be stopped immediately. Independent third-party monitoring of impacts of dumping of fly ash shall also be undertaken and reported to the regulatory authorities and uploaded on the company website. In case, the disposal of fly ash into the de-coaled voids is not found to be an environmentally suitable option, the balance void shall be converted into water reservoir of a maximum depth of 35m which shall be gently sloped. The upper benches of the reservoir shall be stabilized with plantation and the periphery of the reservoir fenced.	Complied. At present there is no fly ash being dumped.
xiv	Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and construction of new	Groundwater level and quality is being monitored by CMPDIL. Water level monitoring at 4 hydrograph stations has been done in the months of May'24, Aug'24, Nov '24 and Jan'25 and the Ground water

	piezometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post monsoon (November) and winter (January) seasons and for quality including As and F during the month of May. Data thus collected shall be submitted to the Ministry of Environment and Forests and to the Central Pollution Control Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	level data is enclosed below:  STRICTLY RESTRICTED FOR COMPANY USE ONLY RESTRICTED The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL/ Government. cmpdi A Mini Ratna Company GROUNDWATER LEVEL & QUALITY REPORT FOR CLUSTERS OF MINES, BCCL (Assessment year – 2024-25) [CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV, XVI & XVII of Mines, BCCL] JHARIA COALFIELD AND RANIGANJ COALFIELD (PART) For (BHARAT COKING COAL LIMITED) (A Subsidiary of Coal India Limited) KOYLA BHAWAN (DHANBAD) Prepared by Geology Department Regional Institute-II CMPDI, Dhanbad MARCH – 2025 Job no - 200424005  3.3 GROUND WATER LEVEL DATA OF THE CLUSTER OF MINES OF BCCL A GROUND WATER LEVEL OF CLUSTER-I Cluster-I (Damuda Group of Mines consisting of Damuda UG, Albion OCP, Proposed BJ Section OCP and Abandoned Gutway OCP) of Barora area, BCCL is located in the western most part of Jharia coalfield in Bokaro district of Jharkhand. The life of the project has been worked out to be up to 15 years considering annual target production of 1.17 MTPA. It is located in the extreme western part of JCF in Bokaro district of Jharkhand (Toposheet no – 73 I/1). The present leasehold area of Cluster-I is 575.0 Ha. The Damuda block area marked by more or less flat and gently undulating topography. The RL varies from 179 m to 208 m AMSL and the general slope of topography is towards east. Jamuniya River, Kari Jore, Podo Jore and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Jamuniya River. Monitoring stations (**B015, B051 and B053**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below: Sl No. / Well No. / Location / Water level (bgl in meters) 2024-25: May, Aug, Nov, Jan 2023-24: May, Aug, Nov, Jan 2022-23: May, Aug, Nov, Jan 1 B015 Bera Basti 3.35 0.70 0.91 1.54 3.20 0.80 1.00 2.72 3.67 0.45 1.02 2.30 2 B051 Taranga 6.40 2.66 4.47 5.05 5.20 2.51 4.45 4.95 5.06 0.00 4.57 2.87 3 B053 Karmatanr 3.10 1.02 1.21 1.45 2.62 1.33 1.13 1.66 4.42 1.78 3.54 1.68 *Average WL (bgl)* 4.28 1.46 2.20 2.68 3.67 1.55 2.19 3.11 4.38 0.74 3.04 2.28 LAST THREE-YEAR ASSESSMENT: Pre-monsoon GW Level (m): Min – 2.62 m Max –6.40 m Post-monsoon GW Level (m): Min – 0.91 m Max – 4.57 m Page 14

		Data of ground water level and quality is submitted to the Ministry of Environment and Forests and to the Central Pollution Control Board/SPCB **(Soft copy of Latest Ground level monitoring report is enclosed as Annexure VIA)** **Piezometer installation:** Construction of 2 nos. of Piezometric well is complete.  There are 03 no. of Rain Water Harvesting Structure at Barora Area which has administrative control over Cluster-I Damoda Colliery. (Geotagged photos of rain water harvesting structures enclosed as annexure XIII)
xv	ETP shall also be provided for workshop, and CHP, if any. Effluents from the mines shall be treated to conform to prescribed standards if is discharged into any water course outside the lease area. The quality of effluent/water discharged shall be monitored at outlet points. Proper records shall be maintained thereof and uploaded regularly on the company's website.	It is being complied. There is no CHP. Mine discharge water is being allowed to settle down in the mine sumps before disposal into storage reservoirs. The monitoring of mine water quality parameters is being done by CMPDIL and parameters are well within the prescribed limit provided by CPCB. Fortnightly reports have been prepared by CMPDI and uploaded regularly to company's website. URL Link- https://www.bcclweb.in/?page_id=15361andlang=en CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED Environment Laboratory, Regional Institute-II MINE EFFLUENT TEST REPORT CMPDIL, RI-II KOYLA BHAWAN COMPLEX DHANBAD -826005 Phone:0326-223-850 email: rdri2cmpdi@coalindia.in **Test Report for Mine Effluent samples** Month & Year: 09/ 2025 — Cluster: Cluster I — ULR NO.: TC1432125000002150F Customer: Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in) — Date of Issue: 31.10.2025 Project: Damoda — Sampling Ref. No.: REM/BCCL/2025/09 — Sampling Method: IS 3025 (Part-1) — CMPDI/RI-II/LPM 13 Period of Analysis: Damoda — Date of Sampling: 15.09.25 to 29.09.25 — Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent — Period of Analysis: 15.09.2025 TO 30.09.2025 | Sl. No.	Parameter	Method of Analysis	Observed Values M1737	Observed Values M1764	STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	LDL
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1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	41	44	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.88	7.89	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	44	40	*250 (Max)*	4	 ***All units in mg/L unless specified otherwise *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,* ***Grab sampling carried out for water samples.* ANALYSED BY — (Gaurav Kant) REVIEWED BY — (Kumar Vaibhav) Authorised Signatory

xvi	For monitoring the land use pattern and post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1: 50000) of the core zone and buffer zone, from the start to the end of mine life, shall be prepared once in 3 years (for anyone particular season which is consistent in the time series). The report shall be submitted to MOEF and its Regional office at Bhubaneswar.	Presently a time series map of vegetation cover in the Jharia Coal Field is being carried out through CMPDI, Ranchi using satellite imagery for every 3 years and it has been uploaded on the official website of company. Further CMPDI has been requested to prepare "Time series of land use maps based on satellite imagery of the core zone and buffer zone in the scale 1:50000 **(Soft copy of latest land reclamation report is enclosed as annexure VI)**  भारत कोकिंग कोल लिमिटेड के ५ मिलियन घन मीटर (कोल+अधिभार) से कम उत्पादन क्षमतावाले ०५ क्लस्टर (खुली + भूमिगत खदानों के समूह) का भूमि पुनरुद्धार हेतु वर्ष २०२४ के उपग्रह डाटा के आधार पर निगरानी का प्रतिवेदन Land Reclamation/ Restoration Monitoring of five Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data of the Year 2024 Dhanbad District Cluster X *Submitted to* **Bharat Coking Coal Limited**
xvii	A Final Mine Closure Plan along with a Plan for Habitat Restoration and with details of Corpus Fund shall be submitted to the Ministry of Environment and Forests for approval before the final mine closure. The species selected for Habitat Restoration for post-mining land shall include a specific Plan for development of agro-forestry using a mix of native species found in the study area.	BCCL has deposited the amount in a separate ESCROW ACCOUNT for corpus fund as per Mine Closure Guidelines as specified in the mine closure Plan. A Final Mine Closure Plan along with details of Corpus Fund will be submitted to the Ministry of Environment and Forests after five years before mine closure for approval. Native species (Sheesham, Sirish, Arjuna, grasses etc) are being used in mine reclamation. **(Soft copy of Details of amount deposited enclosed as Annexure VII)**
xviii	Corporate Environment Responsibility: The Company shall have a well laid down Environment Policy approved by the Board of Directors'. The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished. To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or	A well-defined Corporate Environment Policy has already been laid down and approved by the Board of Directors. Updated Environment policy posted on BCCL website. Link of the policy is- https://www.bcclweb.in/environment/CEP_280220.pdf Complied. A hierarchical system of the company to deal with environmental issues from corporate level to mine level already exists. Being complied.

	shareholders or stakeholders at large.	
B	General Conditions by MoEFCC::	
i	No change in technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	Being complied.
ii	No change in the calendar plan including quantum of mineral coal and waste being produced shall be made.	Noted.
iii	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring PM_{10}, $PM_{2.5}$, SOx and NO_x. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, in particulates shall be carried out at least once in a year.	Complied. The location of monitoring stations in Jharia Coal Field has been finalized in consultation with the Jharkhand State Pollution Control Board. Ambient air quality along with heavy metals such as Hg, As, Ni, Cd, Cr, etc. is regularly monitored by CMPDIL.  STRICTLY RESTRICTED FOR COMPANY USE ONLY RESTRICTED The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL / GOVERNMENT.  TRACE METAL CONCENTRATION OF AMBIENT AIR QUALITY REPORT OF BHARAT COKING COAL LIMITED, (FOR THE HALF YEAR ENDING, JUNE, 2025)  CMPDI ISO 9001 Company Regional Institute-II Dhanbad, Jharkhand 1

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Results and interpretations

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

TRACE METAL CONCENTRATION IN AMBIENT AIR QUALITY

Name of the Company: **Bharat Coking Coal Limited** Year : **2025-26.**

PERIOD: **HALF YEAR ENDING JUNE, 2025**

HEAVY METAL ANALYSIS REPORT OF AMBIENT AIR QUALITY

Results of 6 Heavy Metal for the month of May-2025

SAMPLE CODE	DATE	Station Name	Cd CONC. IN µg/m3	Hg CONC. IN µg/m3	As CONC. IN ng/m3	Cr CONC. IN µg/m3	Ni CONC. IN ng/m3	Pb CONC. IN µg/m3
A1	20.05.25	Karmatand Village	BDL	BDL	BDL	BDL	2.03	0.005
A2	19.05.25	Damoda	BDL	BDL	BDL	BDL	2.14	BDL
A3	20.05.25	Madhuband Washery	BDL	BDL	BDL	BDL	BDL	BDL
A4	19.05.25	Block-II	BDL	BDL	BDL	BDL	BDL	0.006
A5	16.05.25	Muraidih	BDL	BDL	BDL	BDL	2.25	BDL
A6	29.05.25	Block-IV	BDL	BDL	BDL	BDL	BDL	BDL
A7	30.05.25	Govindpur/Ramkanali	BDL	BDL	BDL	BDL	BDL	0.032
A8	26.05.25	Nichitpur	BDL	BDL	BDL	BDL	BDL	BDL
A9	27.05.25	East Basseriya	BDL	BDL	BDL	BDL	BDL	BDL
A10	16.05.25	Dhansar/Kusunda	BDL	BDL	BDL	BDL	BDL	BDL
A11	16.05.25	Dobari	BDL	BDL	BDL	BDL	BDL	0.006
A12	30.05.25	Kusmatand Village	BDL	BDL	BDL	BDL	BDL	BDL
A13	30.05.25	Jeenagora	BDL	BDL	BDL	BDL	BDL	BDL
A14	22.05.25	Bhowrah North	BDL	BDL	BDL	BDL	BDL	BDL
A15	20.05.25	Sudamdih Washery	BDL	0.001	BDL	BDL	BDL	0.030
A16	21.05.25	Pootki	BDL	BDL	BDL	BDL	BDL	0.015
A17	21.05.25	Moonidih UGP	BDL	BDL	BDL	BDL	BDL	BDL
A18	22.05.25	Rudih Basti	BDL	BDL	BDL	BDL	BDL	0.007
A19	28.05.25	Murlidih 20/21	BDL	BDL	BDL	BDL	BDL	BDL
A20	21.05.25	Lohapatti	BDL	BDL	BDL	BDL	BDL	BDL
A21	26.05.25	Kharkharee	BDL	BDL	BDL	BDL	BDL	BDL

5

(Soft copy of monitoring report is enclosed as Annexure IX)

Iv	Data on ambient air quality (PM_{10}, $PM_{2.5}$, SOx and NO_x and heavy metals such as Hg, As, Ni, Cr, etc.) and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhubaneswar and to the State Pollution Control Board and the Central Pollution Control Board once in six months. Random verification of samples through analysis from independent laboratories recognized under the EP Rules, 1986 shall be furnished as part of the compliance report.	Data on ambient air and other monitoring data is being regularly submitted to the Ministry and pollution control board along with compliance report. Fortnightly reports have been prepared by CMPDI and uploaded regularly to company's website. URL Link- https://www.bcclweb.in/?page_id=15361andlang=en **(Soft copy of monitoring report is enclosed as Annexure V)**

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Air Quality Test Report

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD - 826005
Phone:0326-223-850
email: rdri2cmpdi@coalindia.in

Test Report for Ambient Air Samples

Month & Year	09/2025	Cluster	Cluster I	ULR NO.	TC143212500000213 2F
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	31.10.25
Project	Damoda (A2)	Sample Ref. No.	REM/BCCL/2025/09	Sampling Method	CMPDI/RI-II/LPM 11 , (IS 5182)
Date of Sampling	02.09.25 17.09.25	Period of Analysis	02.09.2025 to 25.10.2025	Zone of Station: Core Zone	AREA Industrial Area

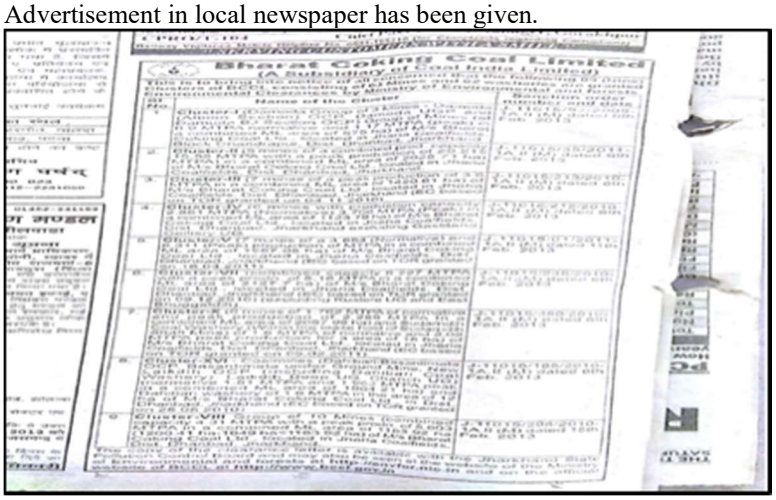
Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) A4483	Observed Values (in µg/m³) A4561	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	73	73	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	38	34	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	30	31	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY (Gaurav Kant) REVIEWED BY (Kumar Vaibhav) Authorised Signatory

Note: The results above relate to the samples tested as received. This report cannot be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

v	Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc. shall be provided with ear plugs/muffs.	It is being Complied in mines and also the Noise levels are below the Ambient Noise Standard (Day time 75 dB and Night Time (70 dB for Industrial Area). Regular maintenance of vehicles and other machineries are being practiced for control of noise level. Fortnightly reports have been prepared by CMPDI and uploaded regularly to company's website. URL Link- https://www.bcclweb.in/?page_id=15361andlang=en **(Soft copy of monitoring report is enclosed as Annexure V)** CMPDIL, RI-II KOYLA BHAWAN COMPLEX DHANBAD. -826005 Phone:0326-223-850 email: rdri2cmpdi@coalindia.in CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED Environment Laboratory, Regional Institute-II Ambient Noise Level Test Report Month & Year: 09/ 2025 — Cluster: Cluster I — ULR NO.: TC143212500000216 6F Customer: Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in) — Date of Issue: 31.10.2025 Project: Damoda Colliery — Sample Ref. No.: REM/BCCL/2025/ 09 — Sampling Method: CMPDI/RI-II/LPM 22 Date of Sampling: 02.09.25 / 17.09.25 — Zone Category of Station: Core Zone Sl. No. | Parameter | Hour / Time of day | Observed Values (in Leq dB(A)) First Fortnight | Observed Values (in Leq dB(A)) Second Fortnight | Method of Analysis | Range Of Testing | LDL | NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards. Zones | Limits in dB 1 | Noise Level dB(A)Leq - Day | 06:00 - 07:00 | 51.1 | 51.8 | CPCB, Protocol for Ambient Level Noise Monitoring - 2015 | 35 dB-135 dB | 35 dB(A) | Industrial Commercial Residential Silence | 75 65 55 50 2 | 07:00 - 08:00 | 54.6 | 55.6 3 | 08:00 - 09:00 | 56.6 | 57.9 4 | 09:00 - 10:00 | 62.9 | 64.2 5 | 10:00 - 11:00 | 63.6 | 65.6 6 | 11:00 - 12:00 | 64.4 | 63.9 7 | 12:00 - 13:00 | 65.5 | 66.4 8 | 13:00 - 14:00 | 64.1 | 65.8 9 | 14:00 - 15:00 | 58.4 | 57.7 10 | 15:00 - 16:00 | 57 | 57.6 11 | 16:00 - 17:00 | 55.5 | 55.9 12 | 17:00 - 18:00 | 54.3 | 56 13 | 18:00 - 19:00 | 53.6 | 54.5 14 | 19:00 - 20:00 | 52 | 54.1 15 | 20:00 - 21:00 | 51.6 | 51.9 16 | 21:00 - 22:00 | 50.2 | 52 Leq DAY | 60.1 | 61.5 1 | Noise Level dB(A)Leq -Night | 22:00-23:00 | 49.2 | 49.4 | CPCB, Protocol for Ambient Level Noise Monitoring - 2015 | 35 dB-135 dB | 35 dB(A) | Industrial Commercial Residential Silence | 70 55 45 50 2 | 23:00- 00:00 | 44.7 | 45.6 3 | 00:00- 01:00 | 44 | 44.3 4 | 01:00-02:00 | 43 | 43 5 | 02:00-03:00 | 42.4 | 42.4 6 | 03:00-04:00 | 42 | 41.9 7 | 04:00-05:00 | 41.9 | 42.5 8 | 05:00-06:00 | 42.5 | 42.4 Leq NIGHT | 44.5 | 44.7 *LDL indicates Lower Detection Limit **All noise measurements are integrated for a 01 hour period. All units in dB(A) Sampling Assistants ANALYSED BY — (Gaurav Kant) REVIEWED BY — (Kumar Vaibhav) Authorised Signatory
vi	Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, and treated so as to conform to the standards including for heavy metals before discharge prescribed under GSR422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluents.	The work of monitoring of ambient environment is being done by CMPDIL, Ranchi. Physico-Chemical characteristics of effluents are well within the prescribed limit. Fortnightly reports have been prepared by CMPDI and uploaded regularly to company's website. URL Link- https://www.bcclweb.in/?page_id=15361andlang=en **(Soft copy of monitoring report is enclosed as Annexure V)**
vii	Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transportation of the mineral shall be covered with tarpaulins and optimally loaded.	It is being complied. The vehicles which have valid PUC certificates are only allowed for transportation of coal. (Attached as annexure XIV) Transportation of coal is done through tarpaulin covered vehicles. Overloading and over speeding are avoided to avoid spillage of coal. 
viii	Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring	It is being done by CMPDIL, Ranchi having NABL accreditation.

	and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EP Rules, 1986.	
ix	Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects. Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed.	It is being complied. A separate full-fledged Human Resource Development Department is conducting regular training programme on these issues. Apart from this Vocational Training Centers are existing in all the areas of BCCL, which provides periodical training on the safety and occupational health issue to each of the workers working in the mines. **(Soft copy of Training list enclosed as Annexure VIII)**
x	A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.	Complied. A full-fledged Environment cell, with a suitable qualified multidisciplinary team of executives has been established. GM (Environment) at head quarter level, co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company.
xi	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.	It is being complied. Separate head "plantation", and "environment" is there for recurring expenditure and used for eco-restoration, environmental protection measures, statutory payments etc.
xii	The Project authorities shall advertise at least in two local newspapers that are widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the Ministry of Environment and Forests at http://envfor.nic.in	Complied. Advertisement in local newspaper has been given. 
xiii	A copy of the environmental clearance letter shall be marked to concerned Panchayat/ZilaParishad, Municipal Corporation or Urban Local Body and local NGO, if any, from whom any suggestion/representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on the company's website.	Complied. Clearance letter has been displayed on Company web site. Link of the clearance letter of Cluster-I is - https://www.bcclweb.in/?page_id=4781 Also, Clearance letter has been sent to Mukhiya of different Panchayat.
xiv	A copy of the clearance letter shall be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Centre and Collector's Office/Tehsildar's Office for 30 days.	Complied.
xv	The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same	Complied. Clearance letter and compliance status have been displayed on Company web site and updated regularly. Link of url- https://www.bcclweb.in/?page_id=4731andlang=en The monitoring data of environmental quality parameter (air, water, noise

	in the public domain. The monitoring data of environmental quality parameters (air, water, noise and soil) and critical' pollutants such as PM_{IO}, $PM_{2.5}$, and NO_x (ambient and stack if any) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mines office and in corporate office and on the company's website.	and soil) and critical pollutant such as PM_{10}, $PM_{2.5}$, SO_2 and NO_x (ambient) and critical sectoral parameters is being displayed at the entrance of the Area office.
xvi	The project proponent shall submit six monthly reports on the status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the MOEF, the respective Zonal offices of CPCB and the SPCB.	Being complied.
xvii	The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data information/monitoring reports.	Complied Noted. Project authority is ready to extend its full cooperation for any kind of visit and inspection conducted by Regional Office in connection with EC Conditions Compliance.
xviii	The environmental statement for each financial year, ending 31st March, in Form-V to be submitted mandatorily by the project proponent to the State Pollution Control Board concerned as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently. This shall also be uploaded on to the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MOEF by E-mail.	Environmental Statement (Form-V) has been regularly submitted for each financial year to Jharkhand State Pollution Control Board. Same is uploaded on the company's website along with the status of compliance of EC conditions and also submitted to MOEF. **(Soft copy of Environmental Statement (Form V) is enclosed as Annexure X)**
C	**Other Conditions by MoEFCC:**	**Compliance**
i	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Agree.
ii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Agree.
iii	The above conditions will be enforced *inter-alia,* under the provisions of the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules. The proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	It is being complied.
iv	The Environmental Clearance is subject to the outcome of the Writ Petition filed by M/S Bharat Coking Coal Limited (BCCL) in response to the closure orders issued by the Jharkhand State Pollution Control Board which is pending in the Jharkhand High Court.	Agree.
	New Condition in Amended EC (8 July, 2021)	**Compliance**
I.	The production of cluster shall not be exceed 1.17 MTPA without any change in overall production capacity.	The production for the cluster is within the limit for which environment clearance has been granted.

II.	In-active OB dump shall not be kept barren/ open and immediately reclaimed and regraded to improve the land form and covered by temporary grass etc. For better land use post mining on closure.	It is being complied. Green belt of 6.00 Ha exits in Damoda lease hold area and Eco restoration of 13 Ha has been already developed and being maintained properly. 10 Ha OB Dump plantation aound Sijua Pahadi Village has been completed.
III.	PP shall regularly check the water quality of mine pit water for drinking water standards at regular interval of time.	Regular monitoring of water quality has been done by CMPDIL, Ranchi. **(Soft copy of monitoring report is enclosed as Annexure XI)**
IV.	Thick green belt of 50 mt width at the boundary in the down wind direction of the project site shall be developed to mitigate/ check the dust pollution.	Thick green belt is already present along Jamunia river. 10 Ha OB dump plantation has been done around the periphery of Sijua Bastee to mitigate the dust pollution.
V.	Peripheral tree plantation around the affected villages of Sijua, patracoli, Karmatand, Bastee and Village and Parsatand Village which is near to OB dump of 60 Mtr shall be done within two years.	10 Ha OB dump plantation has been done around the periphery of Sijua Bastee. 1.26 Ha OB dump planation has been done in FY-2024-25 in Ghutway. 2.00 Ha OB Dump plantation in Ghutway, 2.00 Ha along river Jamunia have been proposed in FY 2025-26.
VI.	PP shall submit a third-party assessment of EC Compliance shall be undertaken once in three years through reputed agency.	Noted. Work Order has been given to IIEST, Shibpur for third party assessment of EC Compliance. (Copy of work order has been enclosed)
VII.	Continuous Monitoring at occupational safety and health hazards and the corrective action need to be ensured.	Being Complied.
VIII.	Continuous air quality monitoring Station (2 nos.) shall be installed and monitoring should be commenced within 10 months from date at least at 2 locations in consultation of SPCB. Data so generated shall be displayed on Company's web site and at entry gate with digital display.	Installation and commissioning of CAAQMS had been done but due some technical problems with PM2.5 analyser tender has been cancelled. PO has been placed (annexure-II) and Installation will be completed after supply of CAAQMS. PM 10 Analyser is installed at Fire Area Workshop of Cluster-I (Damoda Colliery) with connectivity to JSPCB. Link- https://jsac.jharkhand.gov.in/pm10/
IX.	Persons of nearby villagers shall be given training on livelihood and skill development to make them employable.	Noted. Regular training for livelihood like tailoring, stitching, beautician course, Computer training course has already been taken up which will be strengthen and flourish in due course of time.
X.	Hon'ble Supreme Court in an Writ Petition(s) Civil No. 114/2014, Common Cause vs Union of India andOrs vide its judgment dated 8th January, 2020 has directed the Union OF India to impose a condition in the mining lease and a similar condition in the environmental clearance and the mining plan to the effect that the mining lease holders shall, after ceasing mining operations, undertake re-grassing the mining area and any other area 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. Compliance of this condition after the mining activity is over at the cost of mining lease holders/ Project Proponent. The implement report of the above said condition shall be sent to the Regional Office MoEFCC.	Noted. After ceasing mining operations/mine closure, re-grassing/restoration of the mining area will be done, which is fit for growth of fodder, flora, fauna etc. The implementation report will be sent to the Regional Office of MoEFCC at regular interval.
XI.	Project Proponent shall obtain blasting permission from DGMS for conducting mining operation near villages and also explore deployment of rock breakers of suitable capacity in the project to avoid blasting very near to villages. There shall be no damages caused to Habitation/ structures due to blasting activity.	Complied **(Soft copy of blasting permission is enclosed as Annexure XII)**

5 nos. Of Fog Canon (Mist Sprayer) shall be installed to reduce the impact of air pollution.	Complied. Fog canon has been installed.

Asst. Mgr. (Envt.)
Damoda colliery

Manager
Damoda colliery

Project Officer
Damoda colliery

Annexure-I

Project Report

On

Delineation of Surface Coal Fire and associated Land Subsidence in Jharia Coalfield (2022-2024), Jharkhand using satellite based remote-sensing techniques

A collaborative project between

National Remote Sensing Centre (NRSC)
Indian Space Research Organisation (ISRO)
Hyderabad - 500 037

Bharat Coking Coal Limited

Bharat Coking Coal Limited
Koyla Bhawan, Koyla Nagar
Dhandbad, Jharkhand

May, 2025

NATIONAL REMOTE SENSING CENTRE

REPORT / DOCUMENT CONTROL SHEET

1	**Security Classification**	Restricted			
2	**Distribution**	BCCL and ISRO			
3	**Report / Document version**	**(a) Issue no. 01**	**(b) Revision & Date**	--	
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5	**Document Control Number**	**NRSC-RSA-GSG-GMED-May 2025-TR-0002805-V1.0**			
6	**Title**	**Delineation of Surface Coal Fire and Associated Land Subsidence in Jharia Coalfield (2022-2024), Jharkhand Using Satellite Based Remote-Sensing Techniques**			
7	**Particulars of collation**	**Pages** 43	**Figures** 19	**Tables** 6	**References** 18
8	**Author(s)**	Shri Punit R Jalan, S/E 'SC', Shri Priyom Roy, S/E 'SE', Smt Nirmala Jain, S/E 'SE', Dr. Tapas Ranjan Martha, Head GMED			
9	**Affiliation of authors**	Geosciences Group, RSA-A, NRSC/ISRO			
10	**Scrutiny mechanism**	**Compiled by** Shri Punit R Jalan S/E 'SC' 16/05/25	**Reviewed by** Dr. Tapas Ranjan Martha Head, GMED Dr. I.C. Das Group Director, Geosciences	**Approved /Controlled by** DD (RSA-A)	
11	**Originating unit**	NRSC			
12	**Sponsor(s)/ Name and Address**	BCCL			
13	**Date of Initiation**	18/05/2022			
14	**Date of Publication**	16/05/2025			
15	**Abstract (with Keywords):**	Surface coal fires cause not only economic damage to the countries but also create harsh working conditions for the mine workers due to prolonged exposure to toxic fumes. Along with this, the sub-surface fire and underground mining create a void beneath the ground, causing subsidence and affecting local communities by damaging infrastructures. The present study addresses the delineation of surface coal fires for 2022-2024 and mining-related subsidence. Thermal and SWIR bands with high and medium spatial resolutions of winter season Landsat-8/9 images were used to identify the anomalous pixels (high temperature) compared to the surrounding area and demarcated as coal mine fire area. Further, ALOS-PALSAR 2, L band microwave data, was used to identify the zone of probable land subsidence (using differential interferometry) due to mining. The identified areas were field verified in 2023 and 2024, where the fire areas were classified in terms of mine fires and overburden dump fires, and the subsidence was verified through ground evidence. The study presents a comparative analysis of the dynamics of coal fire area between the previous studies and the maps generated for 2022 to 2024 and a block-wise distribution of coal fire zones for both classes (mine fire and overburden fire). The fire area increased from ~1.85 sq.km in 2020 to ~4.54 sq.km in 2022 and then again increased in 2023 to ~5.00 sq.km, which subsequently decreased to ~3.91 sq.km in 2024. The cardinal direction-wise comparative analysis for individual years is investigated to understand the major contributors to the total fire areas and changes from the previous year. Apart from this, subsidence in the old overburden dumping area of Nudkhurkee OCP was identified and verified during the fieldwork, where the cause of subsidence can be due to the settling of the dumped materials. The final coal mine fire and subsidence maps of the Jharia coal field are prepared.			

Acknowledgements

The project team is grateful to Dr. Prakash Chauhan, Director, NRSC for his support at various stages of project execution. We are extremely grateful to Dr. K. Sreenivas, Deputy Director (RSAA), NRSC for his overall guidance and encouragement. We also thank Dr. I C Das, Group Director (GSG), NRSC for providing us with his critical feedback. We also thank Smt B Santhisree, Group Head (SDPEG) and Shri N Raghavender, Scientist-SF (SDPEG), NRSC for providing us the instrument and necessary instructions for smooth operation during the field. We thank BCCL for providing us the opportunity to collaborate for this work. We thank Shri Full Jha, General Manager (JMP), BCCL and Shri Mithilesh Kumar, General Manager (Mining), BCCL in aiding us by providing necessary resources for ease of access to the locations lying within the mines of BCCL. We thank BCCL team Shri Srijan Thakur, Deputy Manager (JMP), Shri Shashi Prakash, Assistant Manager (JMP) and Mushtaq Ahmed, Assistant Manager (Central Survey) for assisting us in navigation during the field visit for coal fire areas and subsidence sites.

Executive Summary

Surface coal fires cause not only economic damage to the countries but also create harsh working conditions for the mine workers due to prolonged exposure to toxic fumes. Along with this, the sub-surface fire and underground mining create a void beneath the ground, causing subsidence and affecting local communities by damaging infrastructures. The present study addresses the delineation of surface coal fires for 2022-2024 and mining-related subsidence. Thermal and SWIR bands with high and medium spatial resolutions of winter season Landsat-8/9 images were used to identify the anomalous pixels (high temperature) compared to the surrounding area and demarcated as coal mine fire area. Further, ALOS-PALSAR 2, L band microwave data, was used to identify the zone of probable land subsidence (using differential interferometry) due to mining. The identified areas were field verified in 2023 and 2024, where the fire areas were classified in terms of mine fires and overburden dump fires, and the subsidence was verified through ground evidence. The study presents a comparative analysis of the dynamics of coal fire area between the previous studies and the maps generated for 2022 to 2024 and a block-wise distribution of coal fire zones for both classes (mine fire and overburden fire). The fire area increased from ~1.85 sq.km in 2020 to ~4.54 sq.km in 2022 and then again increased in 2023 to ~5.00 sq.km, which subsequently decreased to ~3.91 sq.km in 2024. The cardinal direction-wise comparative analysis for individual years is investigated to understand the major contributors to the total fire areas and changes from the previous year. Apart from this, subsidence in the old overburden dumping area of Nudkhurkee OCP was identified and verified during the fieldwork, where the cause of subsidence can be due to the settling of the dumped materials. The final coal mine fire and subsidence maps of the Jharia coal field is prepared.

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CHAPTER I

INTRODUCTION

Coal fire is a perennial problem in Jharia coal field (JCF) covering 447 sq. km. area in the Dhanbad district of Jharkhand state. The severity and extent of mine fires in some of the Indian coalfields, particularly Jharia and Raniganj coalfields, are quite alarming. Combustion can occur either within coal or in coal dumps on the surface. Considerable economic loss and environmental problem arises due to the coal fire. Coal fire burns valuable coal and also creates difficulties in mining by increasing the cost of production or making existing operations difficult. Noxious gases like sulphur dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, which are the result of coal burning process, often affect the immediate surroundings of an active coal fire area (Gangopadhyay, 2003). These greenhouse gases not only affect local atmosphere but also play a crucial role in the damages, found associated with coal fire such as land surface subsidence and surface cracking.

Coal fires are caused by oxidation of coal but the reaction involved in oxidation of coal is not understood till date. Broadly, the potential for spontaneous combustion lies in its ability to react with oxygen at ambient temperature. This occurs through the reaction of oxygen at the surface of the coal resulting in an exothermic reaction. As a consequence, the temperature of coal rises and if temperature reaches the threshold temperature, ranging between 80^0 to 120^0C, a steady reaction starts, which produces carbon dioxide. Temperature keeps on increasing once CO_2 started to form and at 2300°C, the exothermic reaction becomes rapid. It is known that high grade coals (high carbon content) are more fire prone, though the reason behind this is not well understood. Another important parameter, which controls fire, is the size of the particles. Larger the effective area of coal (fire particles), more rapidly the reaction proceeds. Cracks, fissures play a role like positive catalysts to coal oxidation by slowly supplying oxygen / air through their conduits.

Coal mining in Jharia Coal Field (JCF) started way back in 1895. History of fire in Jharia Coal Field dates back to 1916 when the first incidence of fire was reported from XIV seam of Bhowrah colliery. JCF was nationalised in 1972 and over the decades, the fire has spread or been contained but never extinguished. The combination of underground fire and subsidence have affected vast areas of JCF.

1.1 Background

Bharat Coking Coal Ltd. (BCCL), a Public Sector Undertaking is engaged in coal mining activities in the area. As a part of its operational activity, BCCL is monitoring the existing fire locations in the area and also their relative movement with time. Additionally, BCCL funds several activities to monitor and map the dynamic nature of the coal fires. In this regard, several satellite-based research works were taken up for mapping the coal fire in last two decades in the area (Chatterjee, 2006; Chatterjee et al., 1996; Martha et al., 2010; Reddy et al., 1993). These projects were funded and supported by BCCL. NRSC has carried out coal fire mapping projects in the past; conducting an airborne campaign in 1989 and using Landsat-5 TM data in 1995 (Bhattacharya et. al., 1995) over Jharia coalfield, Jharkhand and using data for 2001 over Raniganj coalfield, West Bengal. Further another project was executed in 2006, in which coal fire of the Jharia Coalfield was mapped for 2003 and 2006, using ETM+ and ASTER data, respectively. In the last decade, three similar projects were executed by NRSC in 2012, 2017 and 2020 to map the coal fire and land subsidence.

The current project is based on the letter (Ref. no. BCCL/GM(JMP)/File-2022/283) from General Manager (JMP), BCCL addressed to Director, NRSC on the 30 of September 2022 with a request to take up Coal fire and Land Subsidence study of the Jharia Coal Field using space-borne remote sensing techniques and to report the status of the same for the year 2022, 2023 and 2024 (three years). The project was initiated on 18-05-2023.

1.2 Objectives

The following objectives are formulated on the basis of the above-mentioned background.

- To map the coal fire in the study area based on pixel integrated relative radiant temperature derived Landsat-8/9 Thermal data as on 2022, 2023 and 2024.
- To compare the change in the coal fire distribution in the Jharia coalfield within the period of 2020, 2022, 2023 and 2024.
- To identify the land subsidence zones in Jharia coalfield, Jharkhand using microwave data.

1.3 Study Area

Jharia Coalfield is located in the Dhanbad district of Jharkhand state (Figure 1) and it is named after the main coal mining town of Jharia. It is situated in the Damodar River valley and is about 250 km NW of Kolkata. The coalfield is contained approximately within latitudes 23º 42’ N and 23º 50’N and longitudes 86º 09’E and 86º 30’E.

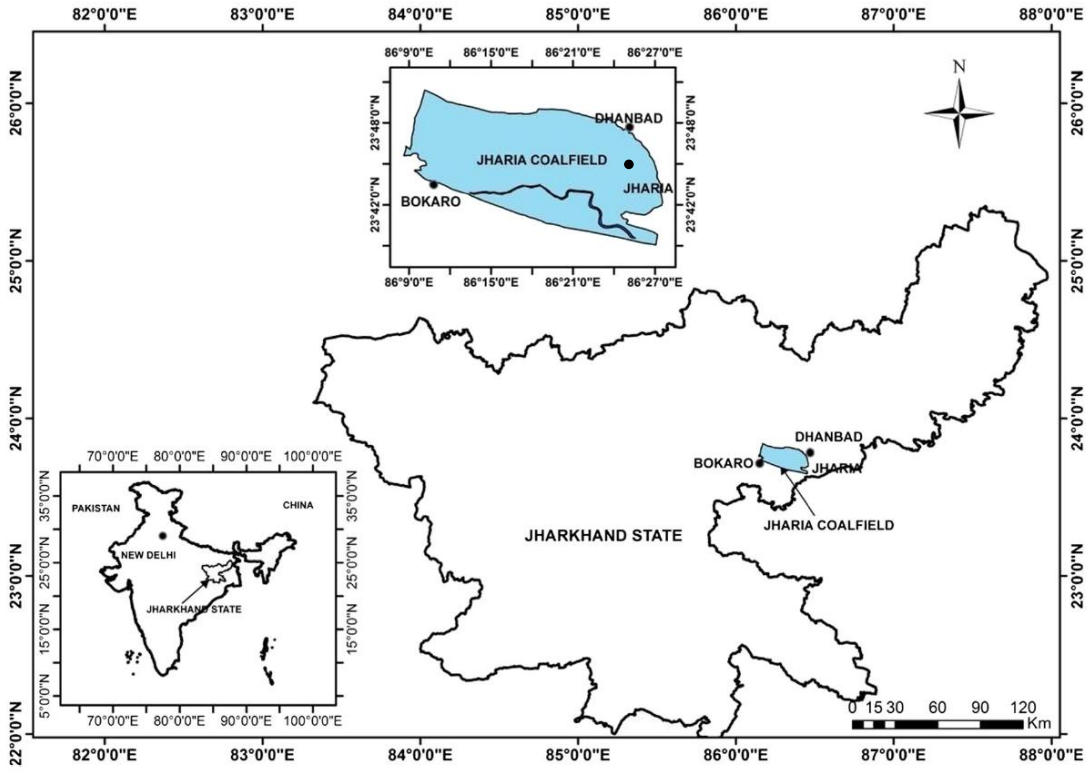


Figure 1: Study area map of Jharia Coalfield, Jharkhand.

CHAPTER II

GENERAL DESCRIPTION OF THE STUDY AREA

2.1 Location and Accessibility

Jharia is an old mining town in the Dhanbad district of Jharkhand. This town is famous for its surrounding mines producing high grade coal and supplying mainly to the neighbouring industrial areas. Jharia is approximately 6 km in south western direction from Dhanbad town and connected by metal road. Dhanbad is well connected to Kolkata by road and rail.

2.2 Physiography, Drainage and Climate

Jharia coalfield is characterised by undulatory topography with very low rolling slope towards the eastern part of the area. The average height of the area is around 200 meters above the mean sea level. Damodar is the major river in the study area. The other tributaries to the Damodar River in this area are Jamuniya Nadi, Khudia Nadi, Khatri Nadi, Jarian Nala, Kari Jora and Domohani Nadi. Damodar River flows from west to east in this area. The minimum temperature is ~10º C in the month of December – January and maximum temperature is ~50º C in the month of May – June.

2.3 General Geology

Gondwana Super Group of rocks of Up. Carboniferous to Lr. Cretaceous age (i.e. from 320 MY to 98 MY) are exposed here. Gondwana Super Group rocks unconformably overlie Archaean rocks. In Gondwana rocks, Raniganj and Barakar Formations of Permian age have more potential as far as the coal production is concerned. Barakar Formation is exposed in north and north eastern part of the basin (Figure 2). Most of the coal mines are confined to the Barakar Formation in JCF. Barakars consists of coarse, medium grey and white sandstones, shales and coal seams. Raniganj consists of grey and greenish soft feldspathic sandstones, shales and coal seams. Faults are prevalent in this portion of basins (Figure 2). NW trending faults are conspicuous in and around the northern part of Jharia coalfield. Many lamprophyre and dolerite dykes are also exposed in this area in a criss-cross manner. The Raniganj Formation though coal bearing, has suffered much deformation due to

faulting, thus causing difficulty for mining in the area. The generalised stratigraphy of JCF is mentioned below (after Saraf, et al., 1995).

FORMATION	LITHOLOGY	MAXIMUM THICKNESS
Supra Panchet	Red and Grey sandstones and shales	300m
Panchet	Micaceous Yellow and Grey sandstones, Red and Greenish shales	600m
Raniganj	Grey and Greenish soft feldspathic sandstones, shales and coal seams	1050m
Ironstone Shales	Dark carbonaceous shales with ironstone bands	360m
Barakar	Coarse and medium Grey and white sandstones, shales and coal seams	630m
Talchir Boulder Bed	Coarse sandstones above and Greenish shales below	300m

Table 1: Generalised stratigraphy of JCF.

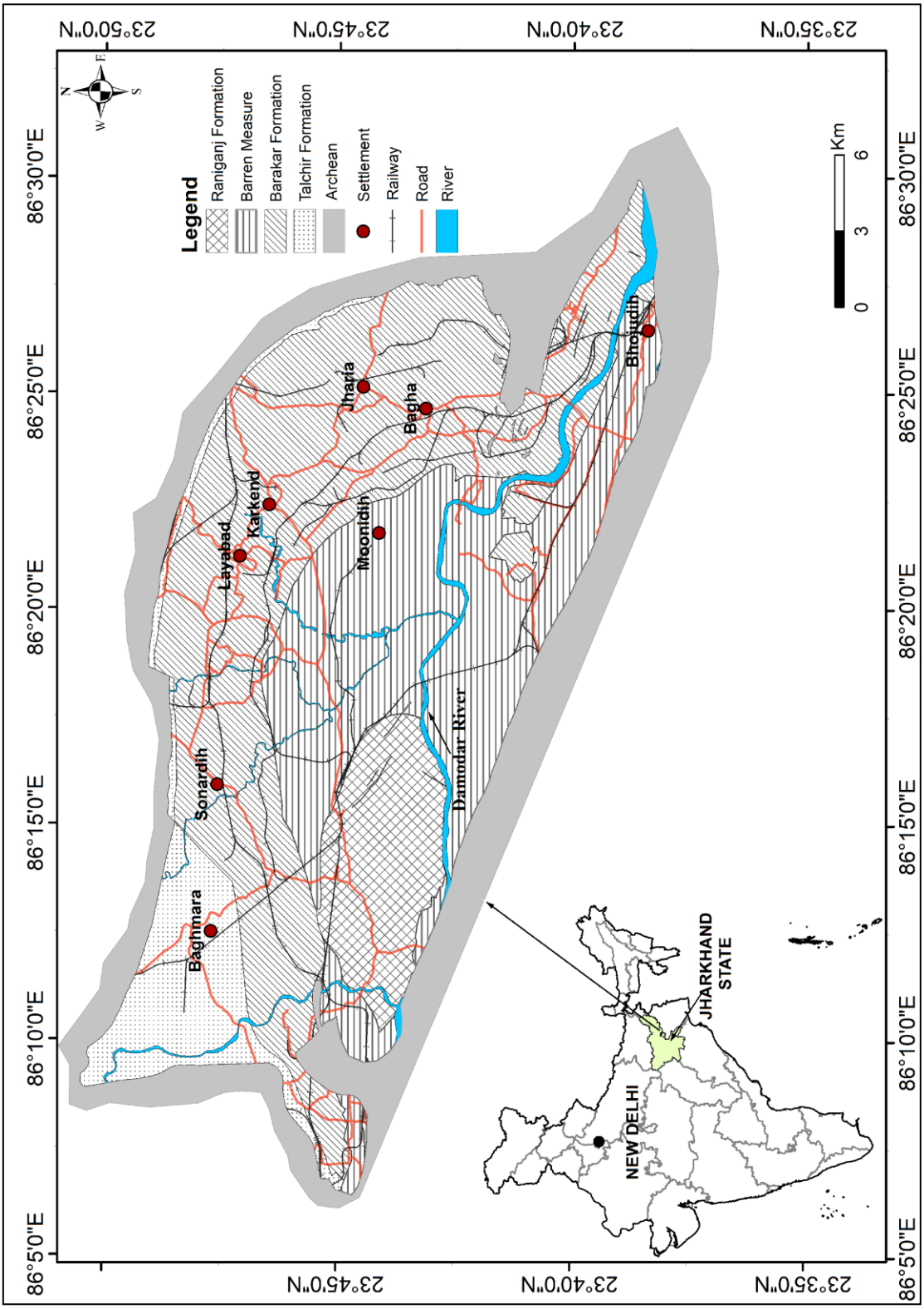


Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (Source: NGDR).

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

Coal fire map was created from three years period from 2022 to 2024 using Landsat bands details of which are provided in the table 2. A comparative analysis was carried out for each year based on the previous year and 2020 coal fire map prepared by NRSC from the Landsat 8 TIRS bands.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Seven scenes of "Fine Beam mode" SLC data were taken from PALSAR-2 archives over a period from February, 2021 to February, 2024. This was done to identify long term terrain changes and differentiate the same from short term changes due to mining excavations and overburden dumping.

Table 2: List of satellite data used in the present study.

Satellite	**Sensor**	**Resolution**	**Time**	**Date**	**Data source**
Landsat-8	TIRS 1/2	100m	Daytime	28 November 2022	USGS, USA
Landsat-9	TIRS 1/2	100m		12 December 2023 and 03 December 2024	
	NIR	30m			
	SWIR 1/2	30m			
ALOS	PALSAR-2 (Fine Beam mode)	10 m	NA	27 February 2021	JAXA, Japan
				11 November 2021	
				26 February 2022	
				10 November 2022	
				25 February 2023	
				07 December 2023	
				24 February 2024	
Landsat Satellite Bands			Wavelength (um)		
NIR			0.85 – 0.88		
SWIR 1			1.57 - 1.65		

SWIR 2	2.11 – 2.29
TIRS 1	10.6 – 11.19
TIRS 2	11.5 – 12.51
PALSAR-2 Frequency/ Wavelength: 1.27 Ghz / 23.62cm	

3.2 Ancillary data

1. Geological map of Jharia coal field
2. Mine surface plans as provided by BCCL

CHAPTER IV

REMOTE SENSING DATA ANALYSIS

4.1 Methodology for fire zones identification and field verification

4.1.1 Processing of Landsat TIRS band Data

Since the launch of Landsat 4/5 satellite and subsequent launch of other Landsat 7/8/9 has made space borne thermal data available through its thermal infrared sensor (TIRS) bands. This has enabled monitoring of the earth with a spatial resolution of 100 m in the thermal domain with a repeat cycle of 16 days. The Landsat-8/9 has two channels (Band 10 and Band 11) in the thermal infrared region (Table 1) which ranges from 10.4 micrometer to 12.5 micrometer (Gangopadhyay et al. 2012). In present study, band 10 of TIRS sensor with the details of acquisition provided in table 2 has been used for coal fire mapping. The spectral domain of the band is known for its maximum transmittance (Chatterjee et al. 2007; Martha et al. 2010). The data are freely accessible through USGS portal (Landsat 8 download source: http://landsatlook.usgs.gov).

Landsat-8/9 data are available in GeoTiff format and the data are converted to top of the atmosphere spectral radiance using the radiance rescaling factors provided in the metadata file, using equation 1.

$$L_\lambda = M_L Q_{cal} + A_L \text{ …….. (1)}$$

Where:

L_λ = Spectral radiance (Watts/ (m^2 * srad * μm)).

M_L = Band-specific multiplicative rescaling factor from the metadata.

A_L = Band-specific additive rescaling factor from the metadata.

Q_{cal} = Quantized and calibrated standard product pixel values (DN).

Once the spectral radiance (L_λ) for Landsat-8/9 band 10 data is generated, it is possible to calculate radiant (brightness) temperature directly using equation 2. Planck's radiation function (Planck, 1914) forms the basis of radiant temperature derivation from spectral radiances and the theory is discussed in detail in existing literature (Gupta, 2003).

$$T_R = K_2 / \ln ((K_1 / L_\lambda) + 1) \text{…….. (2)}$$

T_R = Radiant (brightness) temperature,

K_1 = Calibration constant (1260.56 K),

K_2 = Calibration constant (666.09 watts/ (m^2 *srad*μm)),

L_λ = Spectral radiance

4.1.2 Thresholding of radiant temperature image

Once the Landsat-8/9 data are converted to radiant temperature image, the next step was to segregate fire pixels from the background, which requires the estimation of the cut-off temperature (Roy et al. 2015). This has been attempted by the statistical analysis of sensor derived radiant temperature to delineate clusters (in the scatter-plot) indicative for fire and non-fire pixels. Mean and maximum radiant temperatures are derived from randomly sampled uniform sized pixel blocks distributed in entire spatial extent of Barakar Formation (Figure 3) known for fire bearing coal seams. The pixel block sizes are chosen to adequately represent the overall areal extent of the coalfield and homogeneously encompass all the mining blocks (27x27 pixels for Landsat-8/9, Figure 3). The maximum temperature value recorded in each representative area, derived from each of the datasets, is plotted against the mean temperature. The maximum temperature represents that of fire (wherever present), whereas the mean temperature represents the average background temperature, for normalization. The fire and background populations show considerable variance, separating coal fire and background radiant temperatures. The cut-off temperature derived is the maximum temperature of the background cluster, above which all temperatures represent coal fires. In the case of the Landsat-8/9 data used in this study, the cut-off temperature was determined for individual years from its respective Landsat images which came around 30.5°C for 2023 and 28°C for 2024 as shown in figure 4.

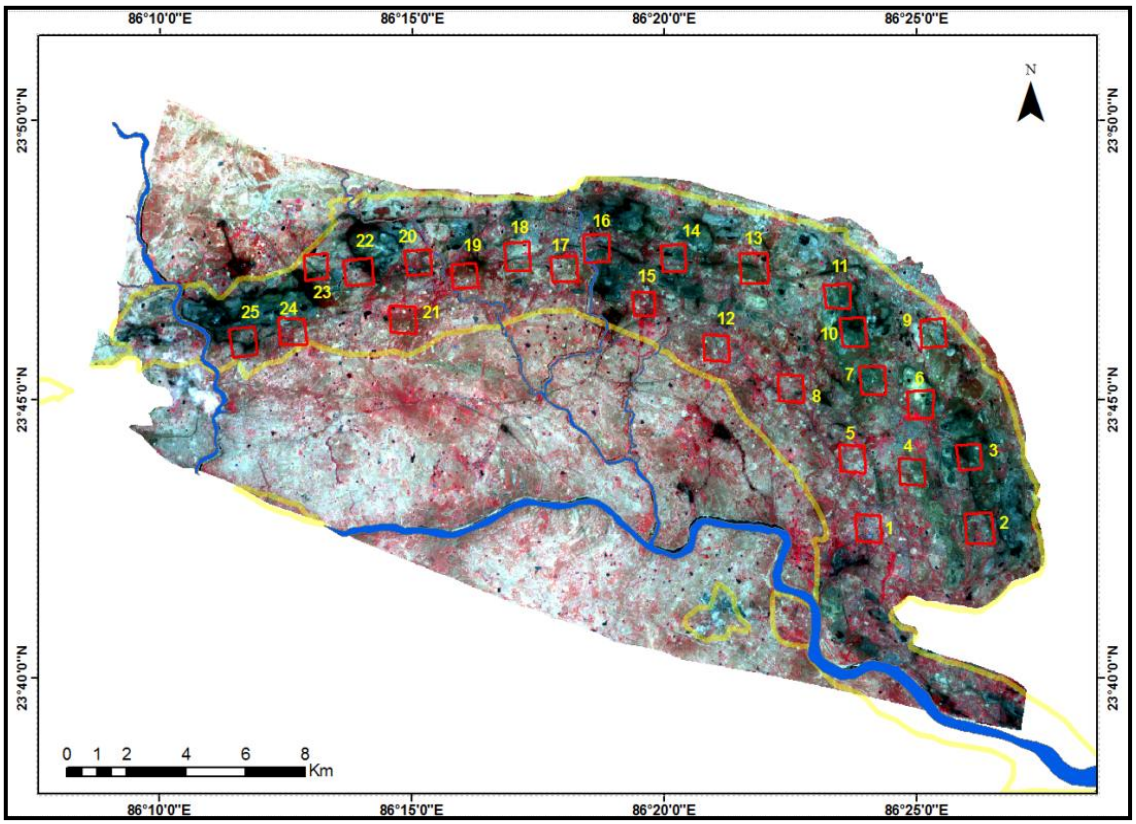


Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

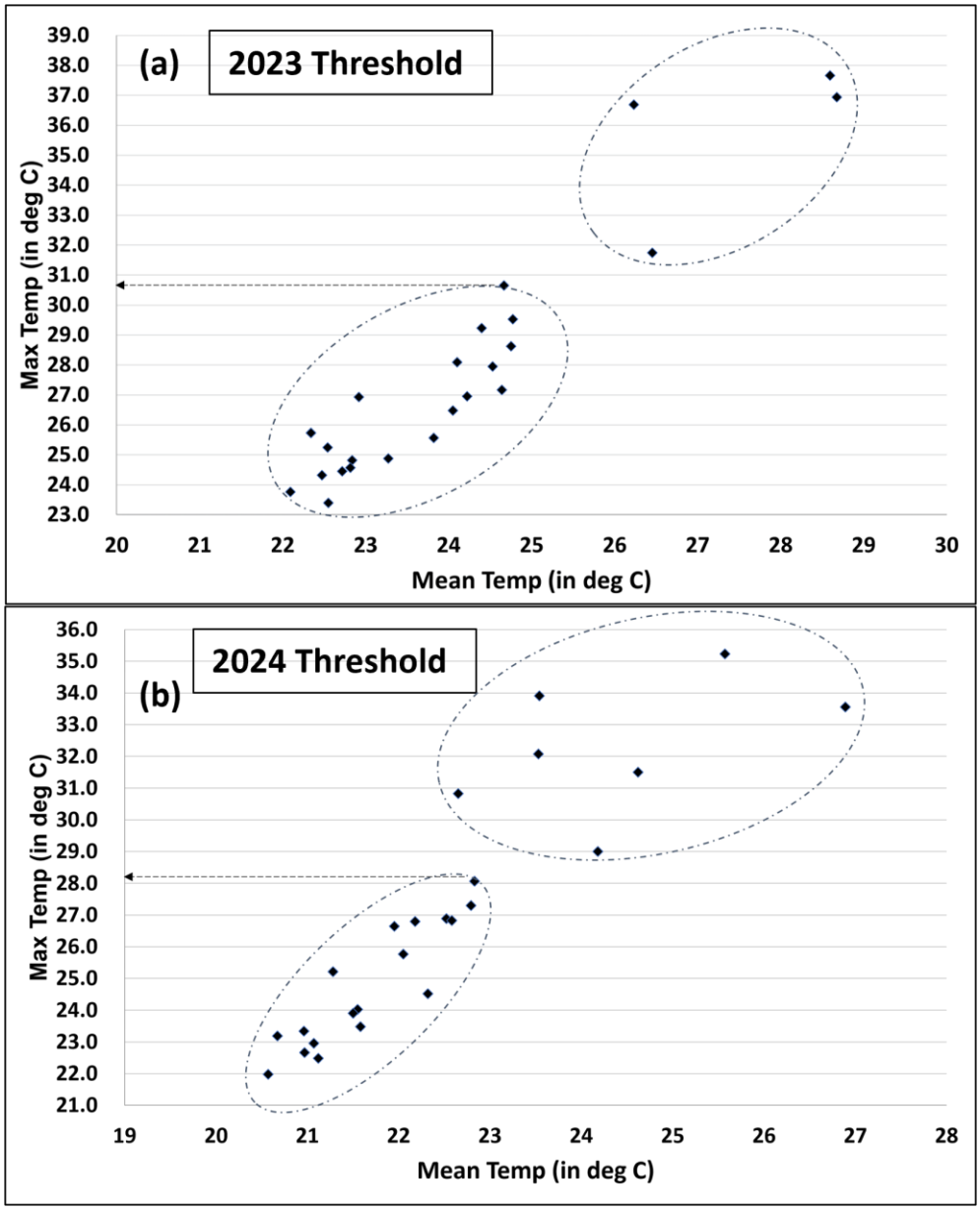


Figure 4. Maximum temperature plotted against mean temperature for various locations for 2023 and 2024; cluster separation observed around (a) 30.5°C for 2023 and (b) 28°C for 2024 (marked with arrow).

4.1.3 Medium-Resolution SWIR/NIR-based fire area identification.

The SWIR 1, 2 and NIR bands of Landsat-9 data for the year 2023 and 2024 were considered to detect small size coal fires that weren't identified through the Radiant Temperature as the TIRS band resolution is 100m. Based on Wein's displacement law distribution of energy, particle with higher energy emits radiation with peak at higher wavelengths hence the DN values for SWIR and NIR bands for fire pixels will look darker compared to the surrounding areas and when set to fire colour composite with

SWIR-2, SWIR-1 and NIR combination can be identified as red or orange pixels from the image. The cluster of pixels was then digitized manually.

4.1.4 Surface Fire Temperature estimation using Thermal Sensor

The validation of the surface fire temperature estimated from the satellite platforms was carried out using handheld thermal infrared imager which captured heat map of an area and provided approximate surface temperature and temperature difference using inverse square law. Important details of the instrument are given in the table 3.

Table 3: Details of the handheld thermal infrared imager.

Description	Value
Make	Fluke
Model	Ti 300
Detection type	Infrared / emitted radiation
Operating wavelength	8-14 µm
Field of View (H * V)	24 * 17 deg
Temperature measuring range	-20 to +650 deg C
Accuracy	±1 deg C

The images are captured by aiming the instrument (Figure 5) at the specific spot and taking a snap of the area. The captured thermal images during the field work were taken by reaching the closest proximity of the pre-field identified areas. The captured image gives details of the fire temperature at that spot. The optical image is also captured by the instrument along with the thermal image of a focused area.



Figure 5: Left image shows the front portion and right image shows the rear portion of the Fluke Ti300 hand held thermal imager.

4.2 Methodology for Subsidence Detection

4.2.1 Processing of ALOS-PALSAR 2 Data

Differential Interferometric SAR (DInSAR) techniques consist of combination of two SAR images of the same area acquired from slightly different positions (Figure 6).

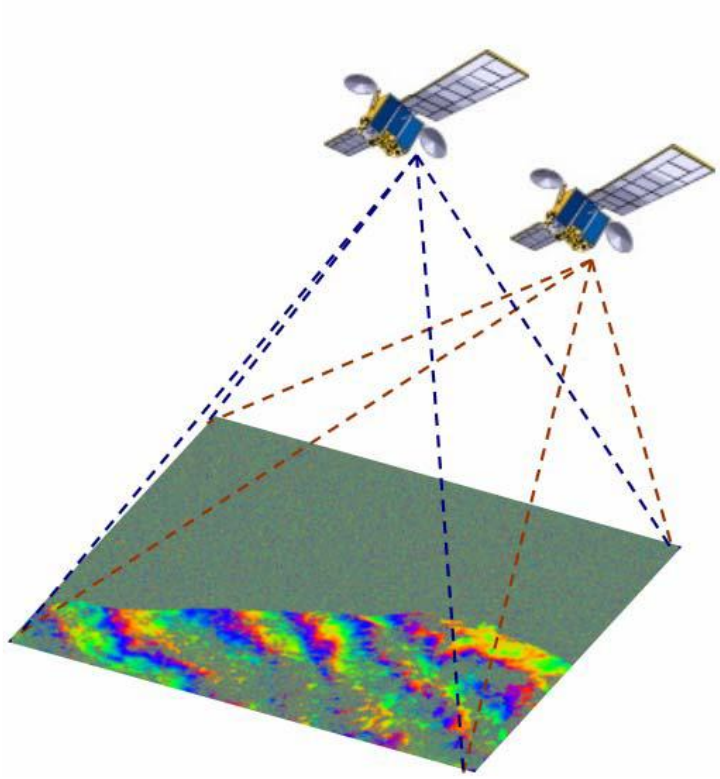


Figure 6. DInSAR acquisition scheme.

The result of this combination provides a new image, known as 'interferogram', whose phase component is formed by the following term:

$$\Delta\Phi Int = \Phi Topo + \Phi Mov + \Phi Atm + \Phi Noise \quad (3)$$

where, ΦTopo denotes the topographic component, ΦMov denotes the terrain deformation/ displacement component, ΦAtm is the noise component and ΦNoise is the thermal noise.

Topography, atmospheric effects and thermal noise needs to be removed or optimized to obtain precise measurements of terrain movement. When working with classical DInSAR interferograms (combination of two SAR images) the main problem is the presence of atmospheric artefacts, since there is no way to cancel them without a priori information. On the other hand, the term related with topography can be cancelled out using and external Digital Elevation Model (DEM) and the orbital ephemeris from the SAR acquisitions, considering no height errors on the DEM.

$$\Delta\Phi dif = \Phi ErrorTopo + \Phi Mov + \Phi Atm + \Phi Noise \quad (4)$$

Since the coal mine area is very dynamic in terms of its surfacial changes (open cast mine, abandoned mine, fire affected waste/reclaimed land, over burden dumps) over time, it is proposed to utilize an advanced DInSAR technique. It is a recent remarkable improvement in SAR differential interferometry that has led to an innovative approach based on the use of a large dataset of SAR images over the same area to overcome the intrinsic limitations of conventional DInSAR in terms of temporal and geometrical decorrelation as well as atmospheric disturbances (Carnec et al., 1996; Bürgmann et al., 2000).

Broad work flow diagram for generating land subsidence map using satellite based DInSAR technique is shown in Figure 7.

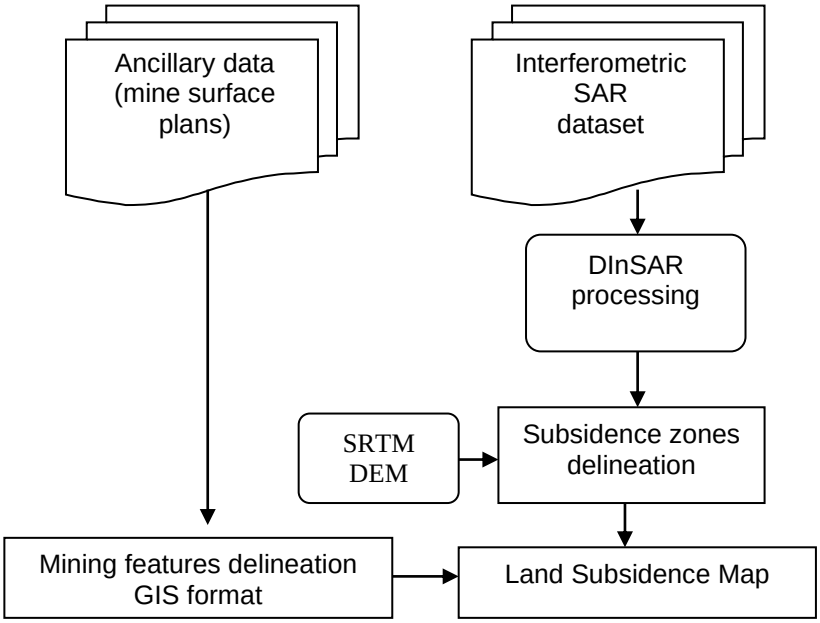


Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

4.2.2 Identification of subsidence zones through processed Interferograms

In the present study, 7 sets of ALOS-PALSAR L-band microwave data (as mentioned in table 1) were procured. The datasets were paired into master-slave pairs. The interferograms for the long temporal baselines include data pairs of time difference of ~ one year were produced. The short temporal baselines could not be carried out due to satellite offset. The figure 8 shows the interferograms pairs produced.

		SLAVE IMAGE				
		27 February 2021	11 November 2021	26 February 2022	10 November 2022	25 February 2023
MASTER IMAGE	27 February 2021					
	11 November 2021					
	26 February 2022					
	10 November 2022					
	25 February 2023					
	07 December 2023					
	24 February 2024					
		Satellite Offset				
		Interferogram produced				

Figure 8. ALOS-PALSAR - 2 Master-Slave pairs long temporal base line processing

The master-slave pairs of long temporal baseline (approximately one year as shown in figure 8) will incorporate terrain changes due to mining activities as well, as long-term ground subsidence from underground mining, settling of old Overburden dump and subsidence due to mining. The figure 9 shows an example of the identifiable subsidence area through the interferogram.

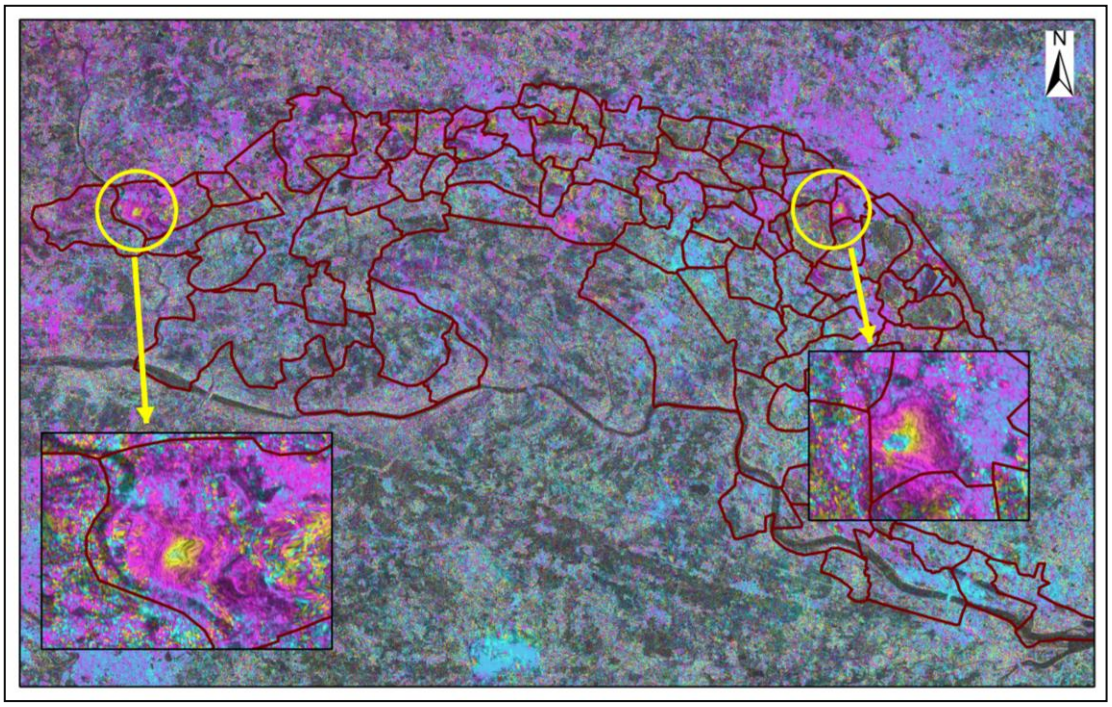


Figure 9. Fringe patterns generated from long baseline processing (e.g. Master: 26 February 2022 Slave: 27 February 2021).

The results from the long baseline processing can be compared and zone where fringes have been developed due to terrain changes due to mining excavation and dumping, can be systematically identified and demarcated. The remaining fringes from the long temporal baseline processing will then indicated towards zones where subsidence has taken place. Using this, a subsidence map of the Jharia Coalfield was generated.

CHAPTER V

FIELD WORK

Field work for verification of the coal fire locations for 2023 and 2024 and the subsidence points generated from 2022 to 2024 as identified by the satellite data was carried out from 15 to 18 December 2023 and 22 to 25 February 2025, respectively. NRSC further independently and physically verified both the coal fire and the subsidence locations. A total of 53 coal fire points for 2023, 54 coal fire points and 30 subsidence locations for 2024 were identified from the satellite data analysis (figure 10-11). The surface temperature for the coal fire areas was captured using the handheld sensor. Specific evidence of subsidence around the active mine areas and old Overburden dumps was identified to verify the subsidence map, which is shown in the result section.

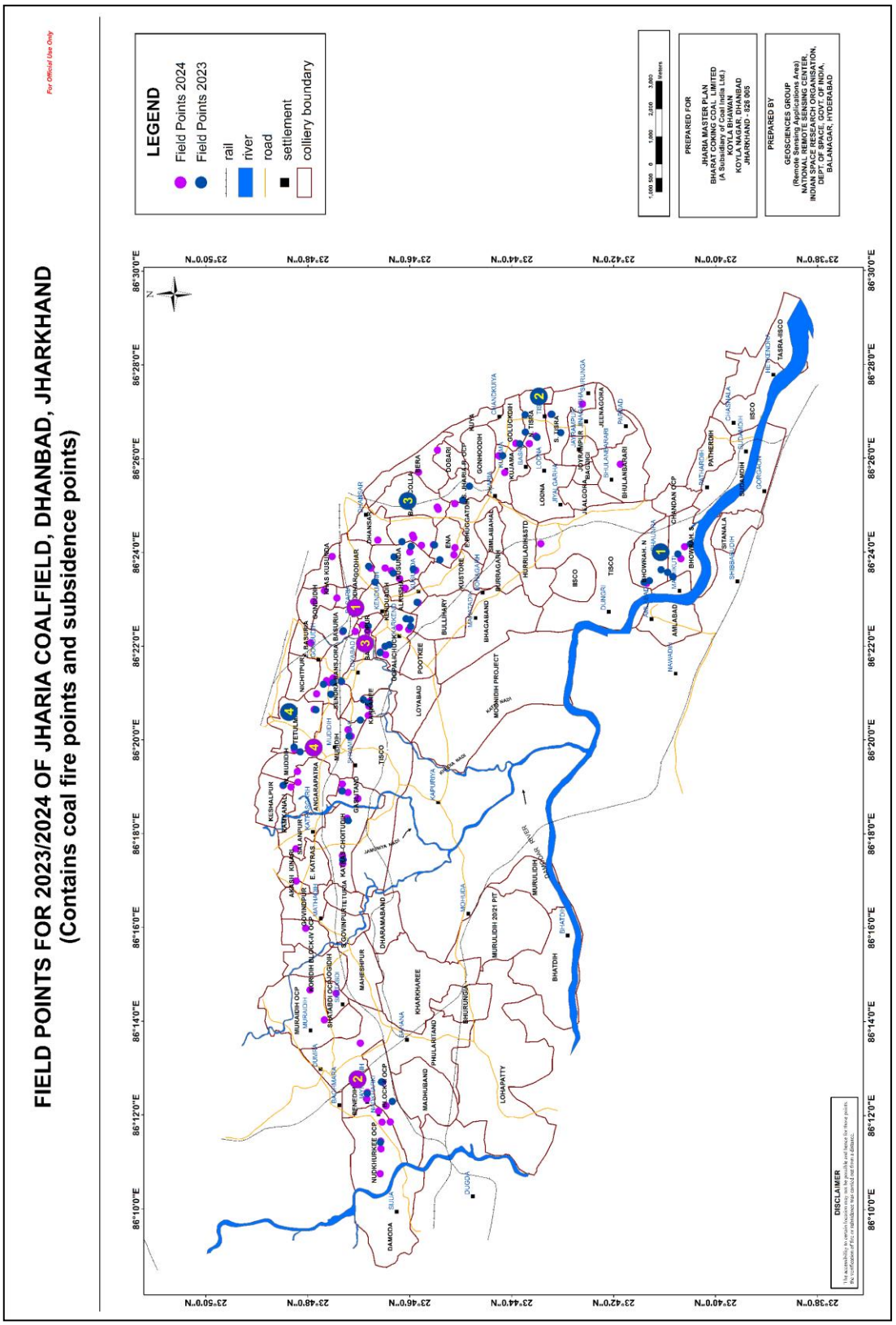


Figure 10. Field data points for coal fire and subsidence (only for 2024) verification for 2023 and 2024.

Fire location observations:

1. The 100+ fire locations were visited during the field for 2023 and 2024; all the points were verified and classified as Overburden dump Fire and Active Mine Fire. Accordingly, the polygon associated with the field point was assigned its particular class.
2. Upon physically reaching the fire location, the fire area could easily be identified due to large fissures, cracks, carbonated rocks or through CMB, CO, CO2 gases smell, and by visible blazing fire (burning fire) in the active mining areas. For locations at a distance, the fire could be identified from the change in the refraction due to the emitting gasses or through the handheld thermal sensor.
3. Largely the extent of fire in and around large Overburden dump areas such as Kusunda, Bhowrah, Block-II, Gopalichuck, etc., identified in 2023 and 2024, have remained approximately the same as seen during the field. The blazing fire inside the active mining areas of ENA, Basjuria, Bhowrah, etc, was found only in 2024. The blazing fire locations, such as Benedih/Block-II OCP, Mudidih, etc, identified during the 2023 field visit were still persisting.
4. As shown in the results section, the fire area decreased as compared to 2023 in 2024, while based on the field observation.

Subsidence location observations:

1. Subsidence locations identified from the satellite data are difficult to verify in the field unless there are tell-tale signatures like large cracks or fissures on the ground, bending of the trees, or damage to anthropogenic constructions like vertical cracks on building cracks, etc.
2. Out of the 30 identified subsidence locations from the interferograms produced through the ALOS-PALSAR-2 SLC pairs of microwave data. The identified location can be categories into three categories as; old Overburden dump regions, new Overburden dump regions and active mining area or edge of the active mining area.
3. The two main areas of subsidence, as seen from Figure 9, where subsidence is occurring on a pervasive scale, were identified in the old Overburden dump area of Nudkhurkee OCP and the old Overburden dump area of Dhansar,

where the bending / slanting trees due to the slow settling of the dumped material could be observed. Similar features to Nudkhurkee OCP old Overburden dump could be identified in the other regions of old or new Overburden dump areas; a few field photographs are shown in section 6.2.

4. The slanting trees and cracks on the ground could be identified at the edge of the active mine regions, where at one of the identified points in the Kankanee block.
5. Three other locations where subsidence is seen from microwave data fall within the mining lease of TISCO and IISCO and, hence, are not under the purview of BCCL mining authorities.

CHAPTER VI

RESULTS

6.1 Coal Fire Maps and Mine-Wise fire area statistics

The Landsat images of 2022 to 2024 used to prepare the coal mine fire area maps to indicate thermal anomalies as identified through a 100m spatial resolution TIRS band and 30m spatial resolution SWIR 1/2 and NIR band. The anomalies are identified based on the surrounding areas; hence, any small fires through fissures with minor differences in temperature as compared to the surroundings go undetected, or any fire with a size lower than the detectable limit also goes undetected. A few other limitations of the methodology are mentioned in Chapter 8. The Coal fire maps, as shown in Figure 11-13 for 2022 to 2024 in comparison to previous similar studies, show the trend in shift of coal fire zones.

To understand the dynamic spatial extent of the fire pockets, a total fire area comparison between the 2020 block-wise fire area distribution and distribution for the subsequent years is shown in Table 4. The table highlights the year-on-year increment and decrement by assigning a red or green color to the cell. The red indicates an increase in the total fire area for a block as compared to the previous year, and the green indicates a decrease in the total fire area for a block as compared to the previous year. The total fire area was 1.85 sq.km, 4.54 sq.km, 5.00 sq.km, and 3.91 sq.km for 2020,2022, 2023, and 2024 respectively.

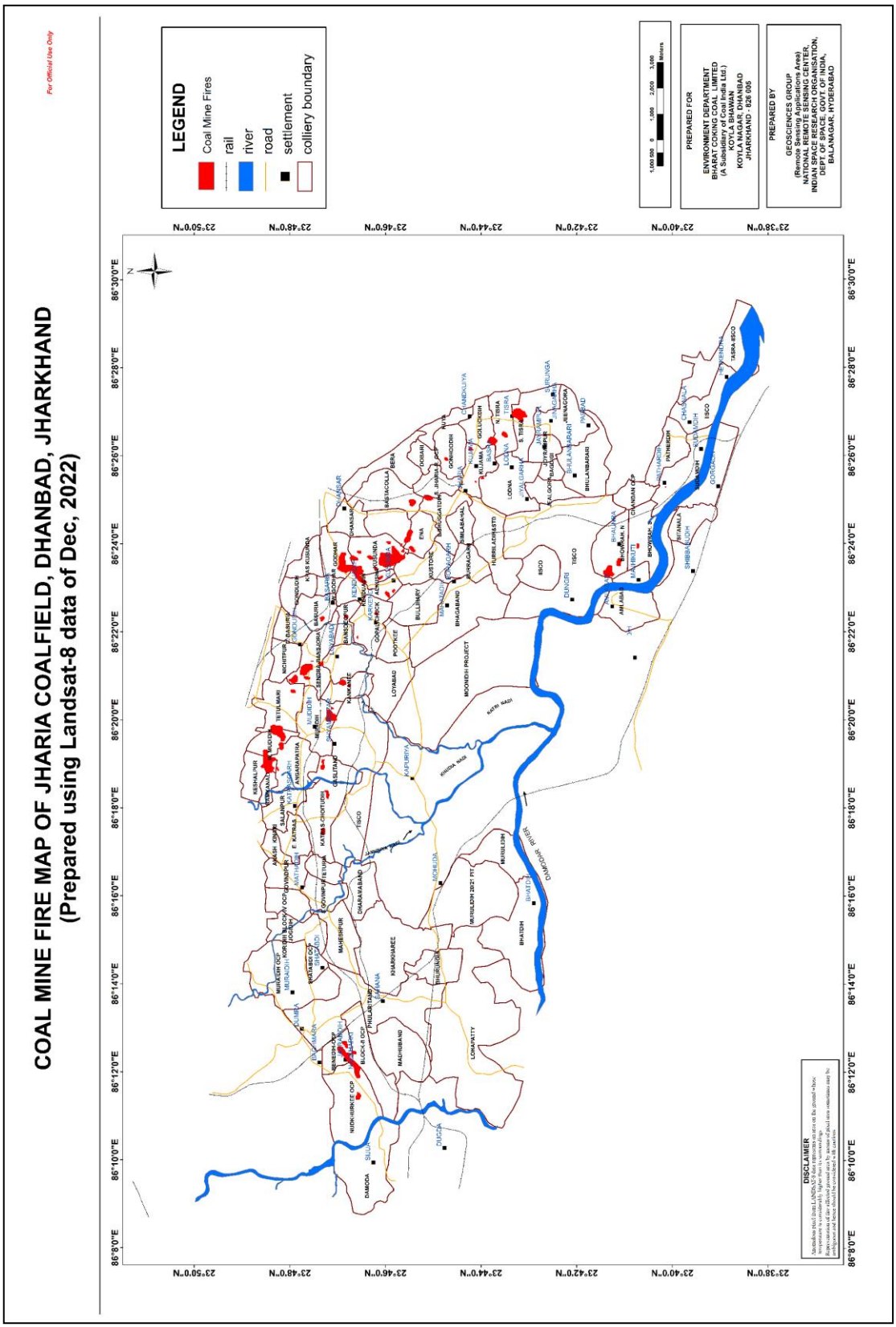


Figure 11. Coal fire map of the Jharia Coalfield (from Landsat-8 Data of Dec 2022)

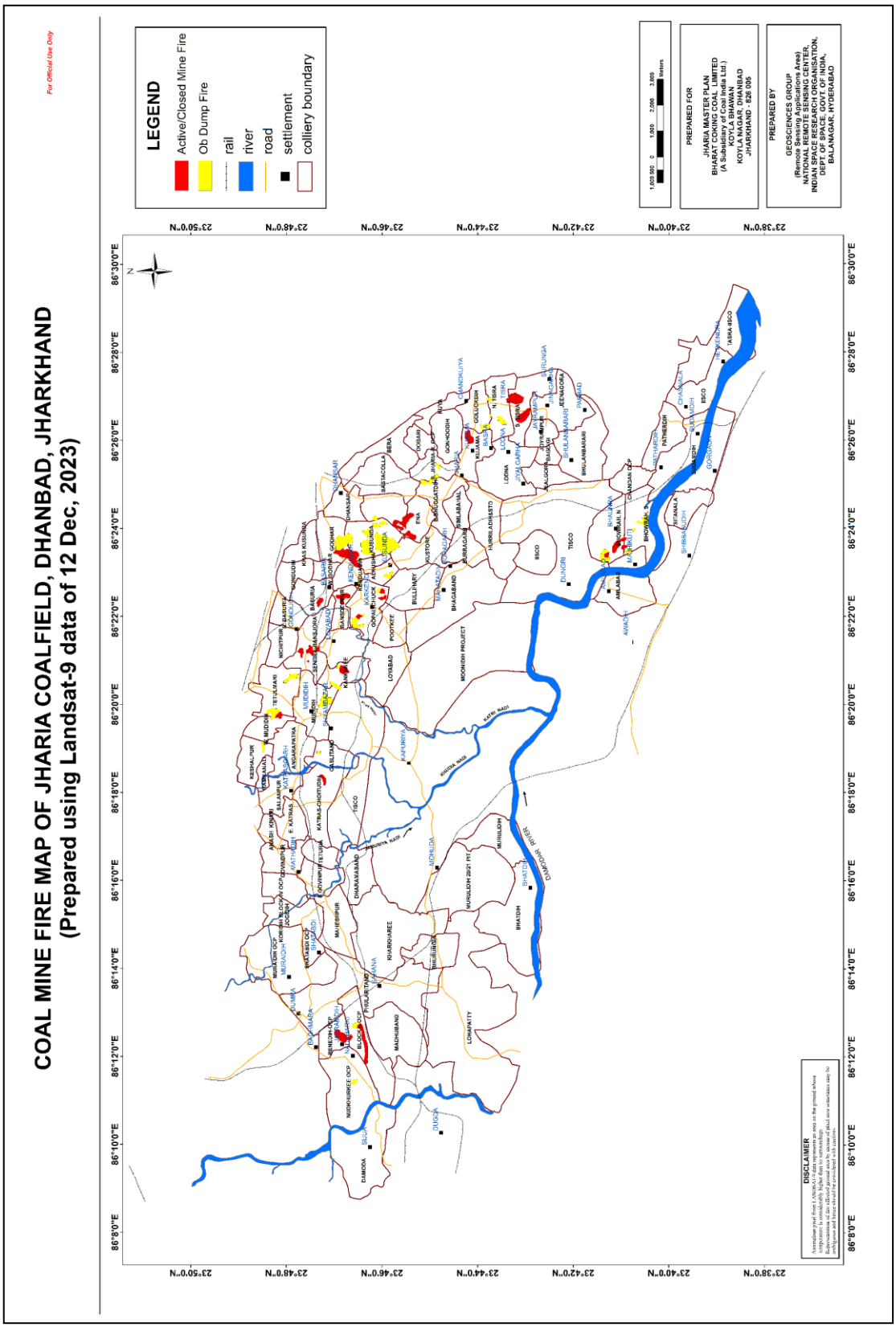


Figure 12. Coal fire map of the Jharia Coalfield (from Landsat-9 Data of Dec 2023)

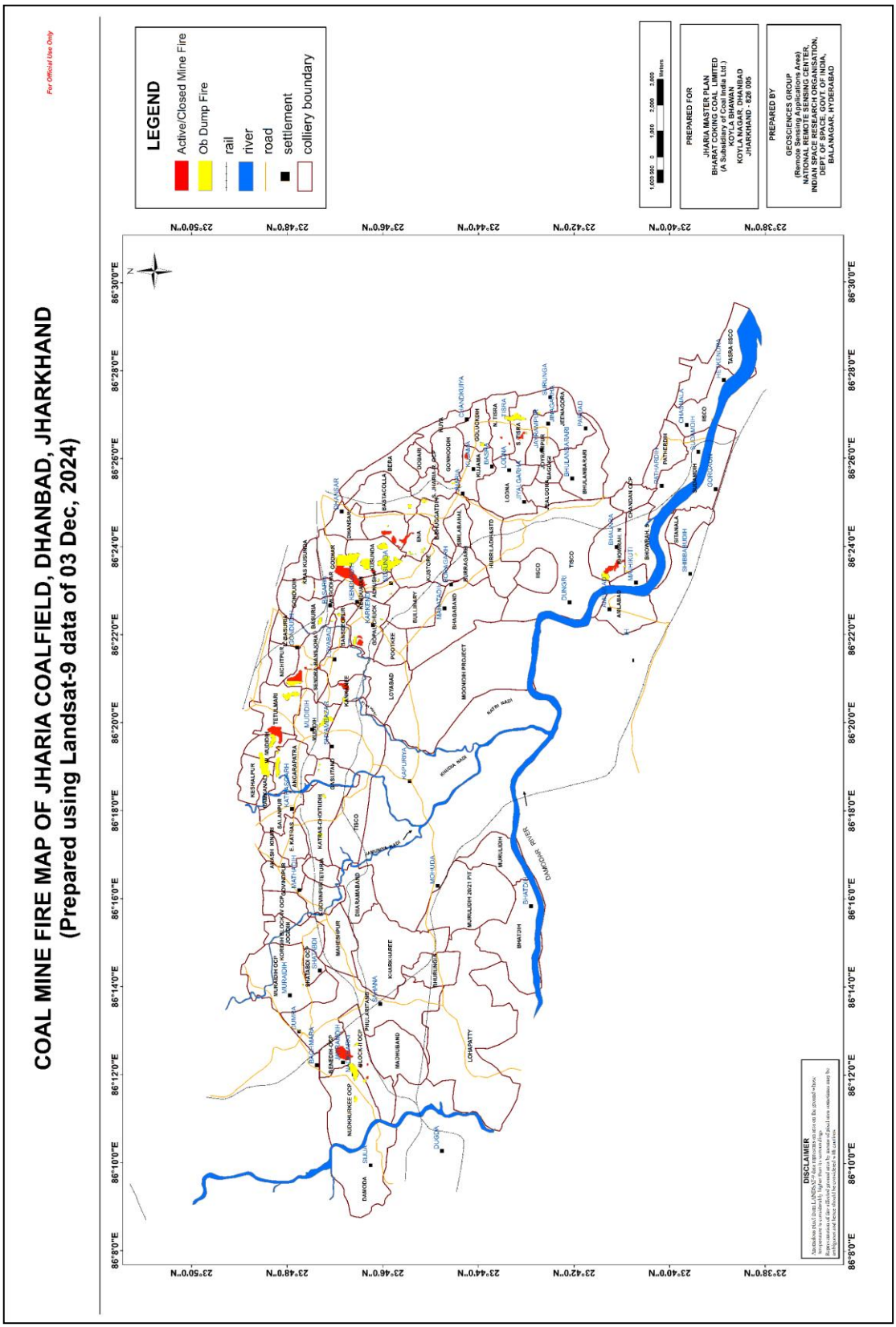


Figure 13. Coal fire map of the Jharia Coalfield (from Landsat-9 Data of Dec 2024)

Based on the figure 11 and 12, cardinal direction-wise fire zones distribution is as follows:

- For the coal fire map of 2023, the eastern side of the covering regions such as Jharia OCP, Kujama, Tisra (North and South), and Bhowrah (North and South) contains large patches of coal fire areas and regions with high increase in fire area in comparison to 2020 and 2022.
- The western side of Nudkhurkee OCP, Block-II OCP, and Benedih OCP, with fire patches covering both the active mine and Overburden dump areas, shows a shift from the northern region to the south region, which may be indicative of a shift in the mining zone. The fire patch area for the western side has remained approximately similar in comparison to 2022 but has primarily increased as compared to 2020.
- The North-Eastern side from Kusunda, Ena, covering Godhar, Alkusa till Basuria and Bansdeopur, etc., is the most significant contributor to the total coal fire area for the Jharia coal mines, with most portions seeing a significant increase in fire patches in comparison with 2022 and a very high increase in regions of Gopalichuck and Kusunda. The portion has remained the largest contributor for the years 2020 and 2022 as well.
- The Northern side from Loyabad to Katras, consisting of areas such as Sendra-Bansjora, Mudidh, Keshalipur, and Katras, sees scattered small to large fire patches of the coal fire area. The total coal fire area has slightly decreased, specifically for West Mudidh and Keshalipur, but the small patches have scattered even further in comparison to 2022.

Table 4: The tables show Year on Year mine wise comparison for total fire area for 2022-2024, where red indicates increase in fire area and green indicates decrease in fire area compared to previous year. Zero indicates no fire or fire is below the detection resolution of Landsat images.

S.I.	COLLIERY AREA NAME	FIRE AREA 2020 (SQ. KM.)	FIRE AREA 2022 (SQ. KM.)	FIRE AREA 2023 (SQ. KM.)	FIRE AREA 2024(SQ. KM.)
1	AKASH KINARI	**0.000**	**0.000**	**0.000**	**0.000**
2	ALKUSHA	**0.046**	**0.073**	**0.022**	**0.066**
3	AMLABAD	**0.000**	**0.000**	**0.003**	**0.000**

4	ANGARAPATRA	**0.036**	**0.083**	**0.000**	**0.116**
5	BAGDIGI	**0.000**	**0.000**	**0.000**	**0.000**
6	BANSDEOPUR	**0.000**	**0.052**	**0.123**	**0.044**
7	BARAREE	**0.040**	**0.000**	**0.000**	**0.000**
8	BASTACOLLA	**0.000**	**0.080**	**0.000**	**0.023**
9	BASURIA	**0.012**	**0.000**	**0.058**	**0.032**
10	BENEDIH OCP	**0.020**	**0.256**	**0.168**	**0.208**
11	BERA	**0.000**	**0.000**	**0.000**	**0.000**
12	BHAGABAND	**0.000**	**0.000**	**0.000**	**0.000**
13	BHATDIH	**0.000**	**0.000**	**0.000**	**0.000**
14	BHOWRAH. N	**0.006**	**0.203**	**0.275**	**0.196**
15	BHOWRAH. S	**0.023**	**0.027**	**0.156**	**0.013**
16	BHURUNGIA	**0.000**	**0.000**	**0.000**	**0.000**
17	BLOCK-II OCP	**0.034**	**0.065**	**0.285**	**0.086**
18	BULLIHARY	**0.000**	**0.003**	**0.000**	**0.000**
19	BURRAGARH	**0.000**	**0.000**	**0.000**	**0.000**
20	CHANDAN OCP	**0.000**	**0.000**	**0.000**	**0.000**
21	DAMODA	**0.000**	**0.000**	**0.000**	**0.000**
22	DHANSAR	**0.000**	**0.000**	**0.000**	**0.000**
23	DHARAMABAND	**0.000**	**0.000**	**0.000**	**0.000**
24	DOBARI	**0.000**	**0.000**	**0.000**	**0.000**
25	E. BASURIA	**0.000**	**0.000**	**0.000**	**0.000**
25	E. KATRAS	**0.000**	**0.000**	**0.000**	**0.000**
26	E.BHUGGATDIH	**0.020**	**0.054**	**0.053**	**0.024**
27	ENA	**0.004**	**0.115**	**0.335**	**0.203**
28	GASLITAND	**0.156**	**0.079**	**0.018**	**0.009**
29	GODHAR	**0.132**	**0.299**	**0.353**	**0.374**
30	GOLUCKDIH	**0.000**	**0.051**	**0.062**	**0.022**
31	GONDUDIH	**0.000**	**0.000**	**0.000**	**0.013**
32	GONHOODIH	**0.001**	**0.029**	**0.000**	**0.000**
33	GOPALICHUCK	**0.000**	**0.082**	**0.255**	**0.107**
34	GOVINDPUR	**0.000**	**0.000**	**0.000**	**0.000**
35	HURRILADIH&STD	**0.000**	**0.000**	**0.000**	**0.000**
36	IISCO	**0.000**	**0.000**	**0.000**	**0.000**
37	INDUSTRY	**0.000**	**0.000**	**0.000**	**0.000**
38	JEALGORA	**0.000**	**0.000**	**0.000**	**0.000**
39	JEENAGORA	**0.000**	**0.000**	**0.000**	**0.000**
40	JOGIDIH	**0.000**	**0.000**	**0.000**	**0.000**
41	JOYRAMPUR	**0.011**	**0.000**	**0.000**	**0.000**
42	KANKANEE	**0.057**	**0.084**	**0.140**	**0.090**
43	KATRAS-CHOITUDIH	**0.214**	**0.090**	**0.067**	**0.038**
44	KENDUADIH	**0.001**	**0.133**	**0.158**	**0.110**
45	KESHALPUR	**0.134**	**0.232**	**0.040**	**0.177**
46	KHARKHAREE	**0.000**	**0.000**	**0.000**	**0.000**
47	KHAS KUSUNDA	**0.000**	**0.000**	**0.000**	**0.000**
48	KORIDIH BLOCK-	**0.000**	**0.000**	**0.000**	**0.000**

	IV OCP				
49	KUJAMA	**0.000**	**0.026**	**0.123**	**0.029**
50	KUSTORE	**0.014**	**0.033**	**0.039**	**0.021**
51	KUSUNDA	**0.399**	**0.858**	**1.030**	**0.711**
52	KUYA	**0.000**	**0.000**	**0.000**	**0.000**
53	LODNA	**0.000**	**0.000**	**0.000**	**0.000**
54	LOHAPATTY	**0.000**	**0.000**	**0.000**	**0.000**
55	LOYABAD	**0.000**	**0.006**	**0.003**	**0.000**
56	MADHUBAND	**0.000**	**0.000**	**0.000**	**0.000**
57	MAHESHPUR	**0.000**	**0.000**	**0.000**	**0.000**
58	MOONIDIH PROJECT	**0.000**	**0.000**	**0.000**	**0.000**
59	MUDIDIH	**0.220**	**0.197**	**0.194**	**0.109**
60	MURAIDIH OCP	**0.006**	**0.000**	**0.000**	**0.009**
61	MURULIDIH	**0.000**	**0.000**	**0.000**	**0.000**
62	MURULIDIH 20/21 PIT	**0.000**	**0.000**	**0.000**	**0.000**
63	N. TISRA	**0.031**	**0.097**	**0.123**	**0.041**
64	NICHITPUR	**0.000**	**0.000**	**0.000**	**0.000**
65	NUDKHURKEE OCP	**0.000**	**0.400**	**0.039**	**0.154**
66	PATHERDIH	**0.000**	**0.000**	**0.000**	**0.000**
67	PHULARITAND	**0.000**	**0.000**	**0.000**	**0.000**
68	POOTKEE	**0.000**	**0.000**	**0.000**	**0.000**
69	RAMKANALI	**0.000**	**0.011**	**0.000**	**0.016**
70	S. JHARIA-R. OCP	**0.010**	**0.005**	**0.085**	**0.020**
71	S. TISRA	**0.021**	**0.210**	**0.367**	**0.157**
72	S.GOVINDPUR	**0.000**	**0.000**	**0.000**	**0.000**
73	SALANPUR	**0.000**	**0.000**	**0.000**	**0.000**
74	SENDRA-BANSJORA	**0.110**	**0.350**	**0.152**	**0.248**
75	SHATABDI OCP	**0.005**	**0.000**	**0.000**	**0.000**
76	SIMLABAHAL	**0.000**	**0.000**	**0.000**	**0.000**
77	SITANALA	**0.000**	**0.000**	**0.000**	**0.000**
78	SUDAMDIH	**0.000**	**0.000**	**0.000**	**0.000**
79	TASRA-IISCO	**0.000**	**0.000**	**0.000**	**0.000**
80	TETULMARI	**0.011**	**0.000**	**0.232**	**0.253**
81	TETURIA	**0.000**	**0.000**	**0.000**	**0.000**
82	TISCO	**0.000**	**0.000**	**0.000**	**0.004**
83	W. GODHAR	**0.000**	**0.000**	**0.000**	**0.002**
84	W. MUDIDIH	**0.085**	**0.265**	**0.050**	**0.192**
	Total	**1.85**	**4.54**	**5.00**	**3.91**

The classification of the coal fire area was based on field observation of whether the fire existed in the open cast mining areas/ old mining areas or the overburden dump of the active mine area. The larger patches of anomalies identified

by the Landsat images were meticulously separated from mine fires or Overburden dump fires after the field. The classified maps of 2023 and 2024 are shown in Figures 12 and 13. The spatial extent statistics and block-wise fire distribution for the separate classes of mine fire and Overburden dump fire for 2023 and 2024 are also shown in Tables 5 and 6, respectively. The bar graph-based statistical figure for block-wise increment and decrement of the fire area of the two classes is shown in Figures 14 and 15.

Table 5: Mine-wise area under coal fire classified in two classes of mine fire and Overburden dump fire for 2023 (grey cells in the table indicate the area has no fire or the fire is below detection resolution of satellite).

S.I.	Mine Area Name	Mine Fire (sq. km)	Overburden Fire (sq. km)
1	ALKUSHA	0.020	0.002
2	AMLABAD		0.003
3	BANSDEOPUR	0.123	
4	BASURIA	0.058	
5	BENEDIH	0.168	
6	BHOWRAH. N	0.161	0.115
7	BHOWRAH. S	0.023	0.133
8	BLOCK-II	0.242	0.043
9	E.BHUGGATDIH		0.053
10	ENA	0.307	0.028
11	GASLITAND		0.018
12	GODHAR	0.139	0.214
13	GOLUCKDIH		0.062
14	GOPALICHUCK	0.105	0.150
15	KANKANEE	0.089	0.051
16	KATRAS	0.056	0.012
17	KENDUADIH	0.096	0.062
18	KESHALPUR		0.040
19	KUJAMA	0.123	
20	KUSTORE		0.039
21	KUSUNDA	0.109	0.922
22	LOYABAD	0.002	0.000
23	MUDIDIH		0.194
24	N. TISRA	0.015	0.107
25	NUDKHURKEE	0.002	0.037
26	S. JHARIA		0.085
27	S. TISRA	0.367	
28	BANSJORA	0.152	
29	TETULMARI	0.013	0.219
30	W. MUDIDIH	0.036	0.014
	Total	**2.41**	**2.60**

Table 6: Mine-wise area under coal fire classified into two classes of mine fire and Overburden dump fire for 2024 (grey cells in the table indicate the area has no fire or the fire is below detection resolution of satellite).

S.I.	Mine Area Name	Mine Fire (sq. Km)	Overburden Fire (sq. Km)
1	ALKUSHA	0.060	0.006
2	ANGARAPATRA		0.116
3	BANSDEOPUR	0.021	0.023
4	BASTACOLLA		0.023
5	BASURIA		0.032
6	BENEDIH-OCP	0.203	0.005
7	BHOWRAH. N	0.127	0.069
8	BHOWRAH. S		0.013
9	BLOCK-II OCP	0.040	0.046
10	E.BHUGGATDIH		0.024
11	ENA	0.169	0.034
12	GASLITAND		0.009
13	GODHAR	0.185	0.189
14	GOLUCKDIH		0.022
15	GONDUDIH		0.013
16	GOPALICHUCK	0.058	0.049
17	JEENAGORA		0.001
18	KANKANEE	0.074	0.016
19	KATRAS-CHOITUDIH		0.038
20	KENDUADIH	0.105	0.005
21	KESHALPUR		0.177
22	KUJAMA	0.029	
23	KUSTORE		0.021
24	KUSUNDA	0.056	0.655
25	MUDIDIH		0.109
26	MURAIDIH OCP		0.009
27	N. TISRA	0.012	0.028
28	NUDKHURKEE OCP		0.154
29	RAMKANALI		0.016
30	S. JHARIA-R. OCP	0.006	0.014
31	S. TISRA	0.033	0.124
32	SENDRA-BANSJORA	0.157	0.091
33	TETULMARI	0.130	0.123
34	TISCO		0.004
35	W. GODHAR		0.002
36	W. MUDIDIH	0.066	0.127
	Total	**1.53**	**2.38**

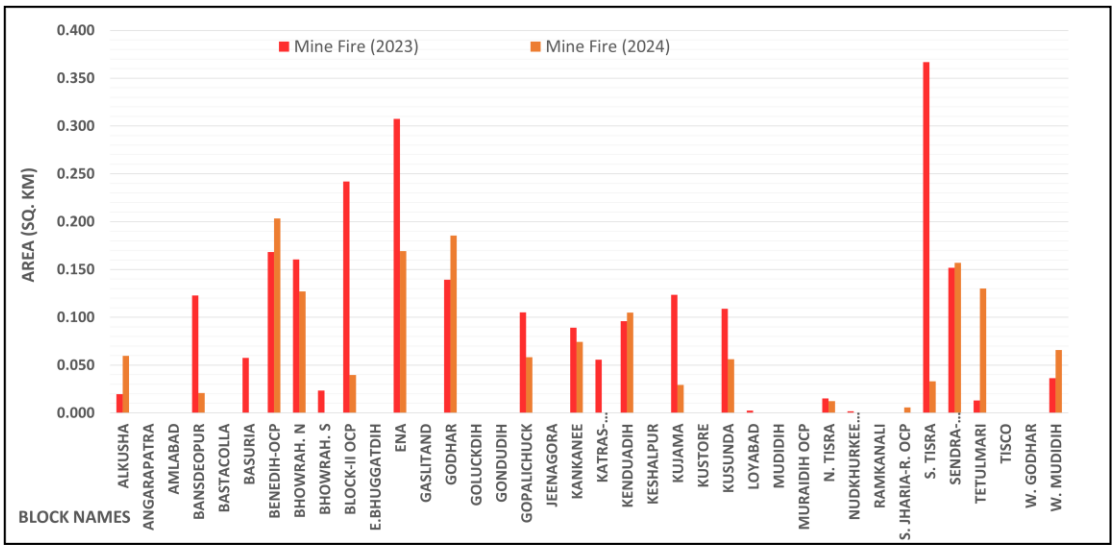


Figure 14. Block-wise comparison between 2023 and 2024 of Mine fire area.

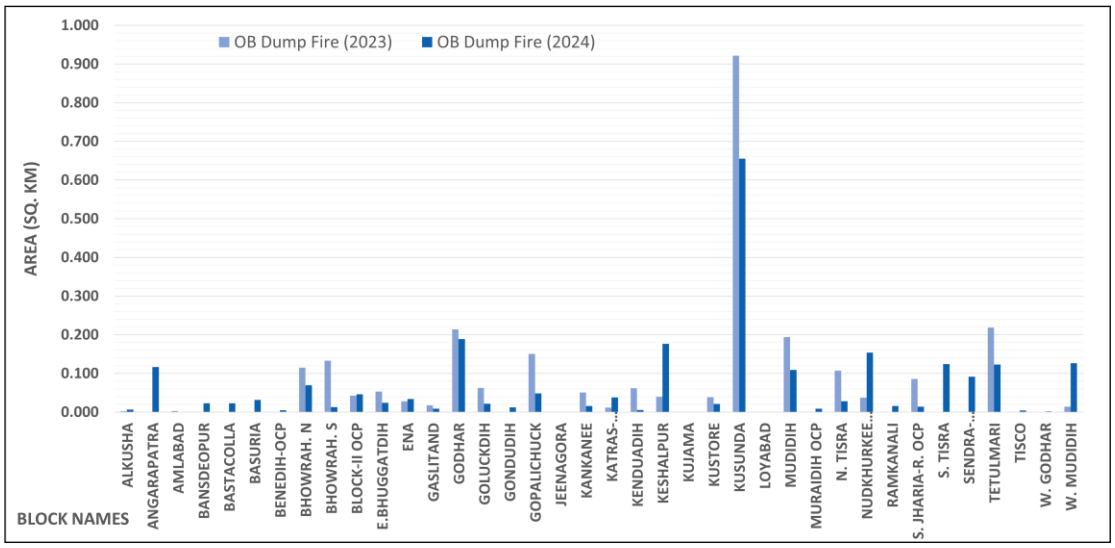


Figure 15. Block-wise comparison between 2023 and 2024 of Overburden dump fire area.

A similar cardinal direction-wise analysis of 2024 in comparison to 2023 provides a larger picture while at the same time allowing for focused analysis of the portions, with further distribution of fire area to two classes enabling us to provide further details on the regions of increasing and decreasing fire which helps the user in area-wise objective specific mitigation strategy.

- The eastern side of the mining extent has seen a significant decrease in overall fire area, number of fire patches, and specifically active mine fire from 2023 to 2024, with a significant decrease in active mine fire area for South Tisra Block, the Bhowrah active mining fire area regions and extent is approximately unchanged from 2023 to 2024.

- The western side has also seen a decrease in total fire area and active mine fire portions but an increase in the Overburden dump fire for the Nudkhurkee OCP block, which is part of a single mining area covering the Benedih OCP and Block-II OCP as well.
- The north-eastern side, while still being the highest contributor to the total fire area, has seen a slight decrease in the extent, specifically in the active mine fire areas due to Basuria and Bansdeopur blocks. At the same time, the Kusunda, Ena, and Gopalichuck portions have remained mainly similar for both classes.
- The northern portion has seen a significant increase in approximately all the parameters about coal mine fires, including the number of blazing fires in active mines, total mining area, and the extent to the two separate classes of mine fire. Although the northern portion was always the second largest contributor to the total mine fire area for the Jharia coalfield, the increase has made its contribution comparable to that of the north-eastern side, which was not observed in previous years—a large portion of Overburden dumps fire in the regions of Keshalpur, West. Mudidh and Angartapatra and the newly identified active mine fire regions of Sendra-Bansjora are the few key changes from 2023. The Overburden dump fire area of Mudidh and the active mine fire area of Kankanee have primarily remained as they were in 2023.

The ground temperature measurements for the fire area were taken for both years using the handheld thermal sensor, and the sensed temperature for a few of the Overburden dump fire and mine fire areas are shown in figures 16 and 17 for 2023 and 2024, respectively with the respective field location shown in figure 10. The surface temperature reading was taken for most of the fire locations using the handheld thermal sensor, where the Overburden dump fire temperature ranged from 100° to 500° C degrees. In comparison, the mine fire either contained only fissures/ cracks where the temperature ranged from 300° to 500°C or fissures/cracks along with blazing fire where the temperature was very high, surpassing the detectable limit of 650° C of the temperature for few locations.

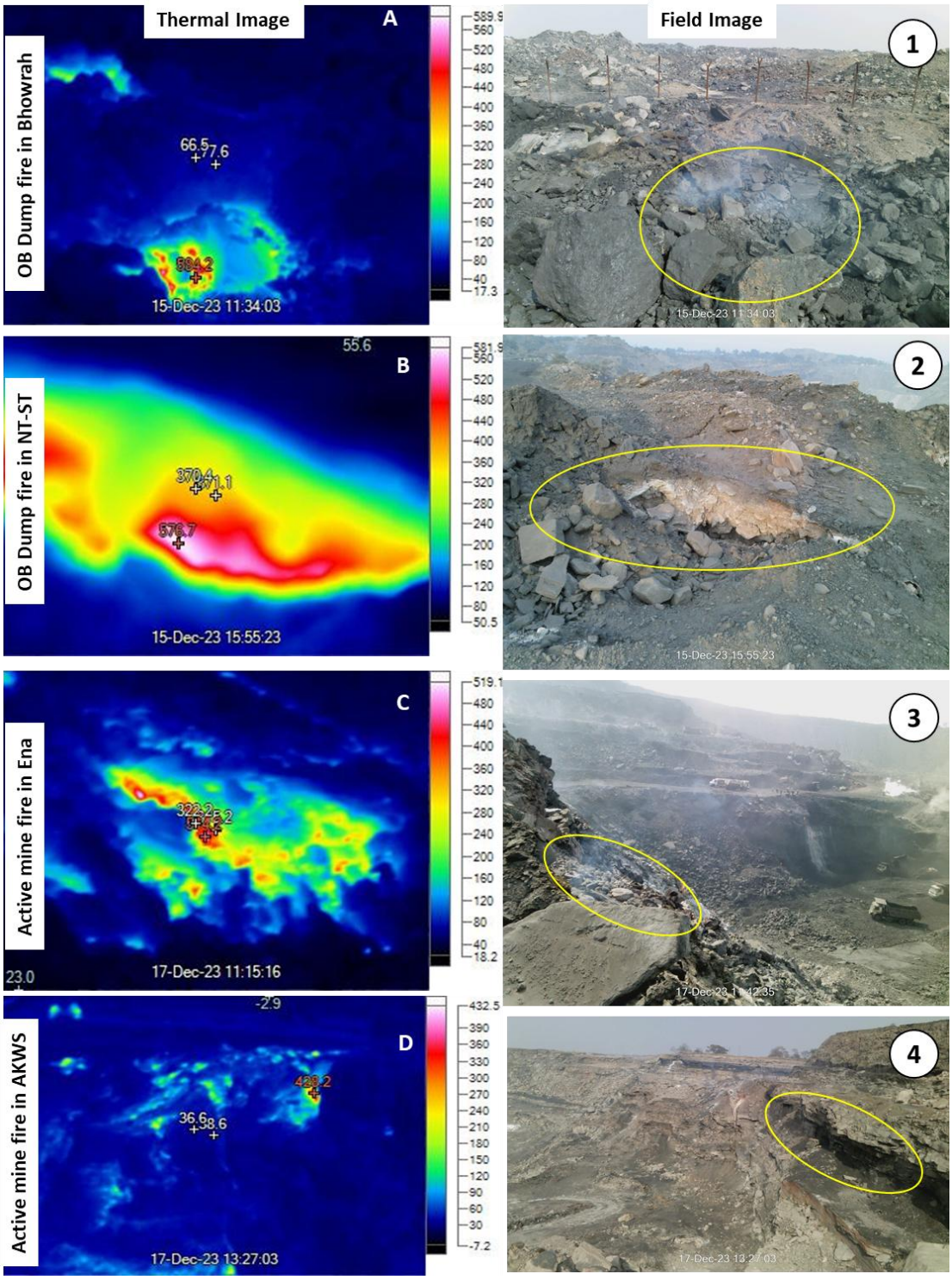


Figure 16. Thermal images and ground photographs from field survey for 2023 (yellow polygon shows the location from where thermal measurements are taken).

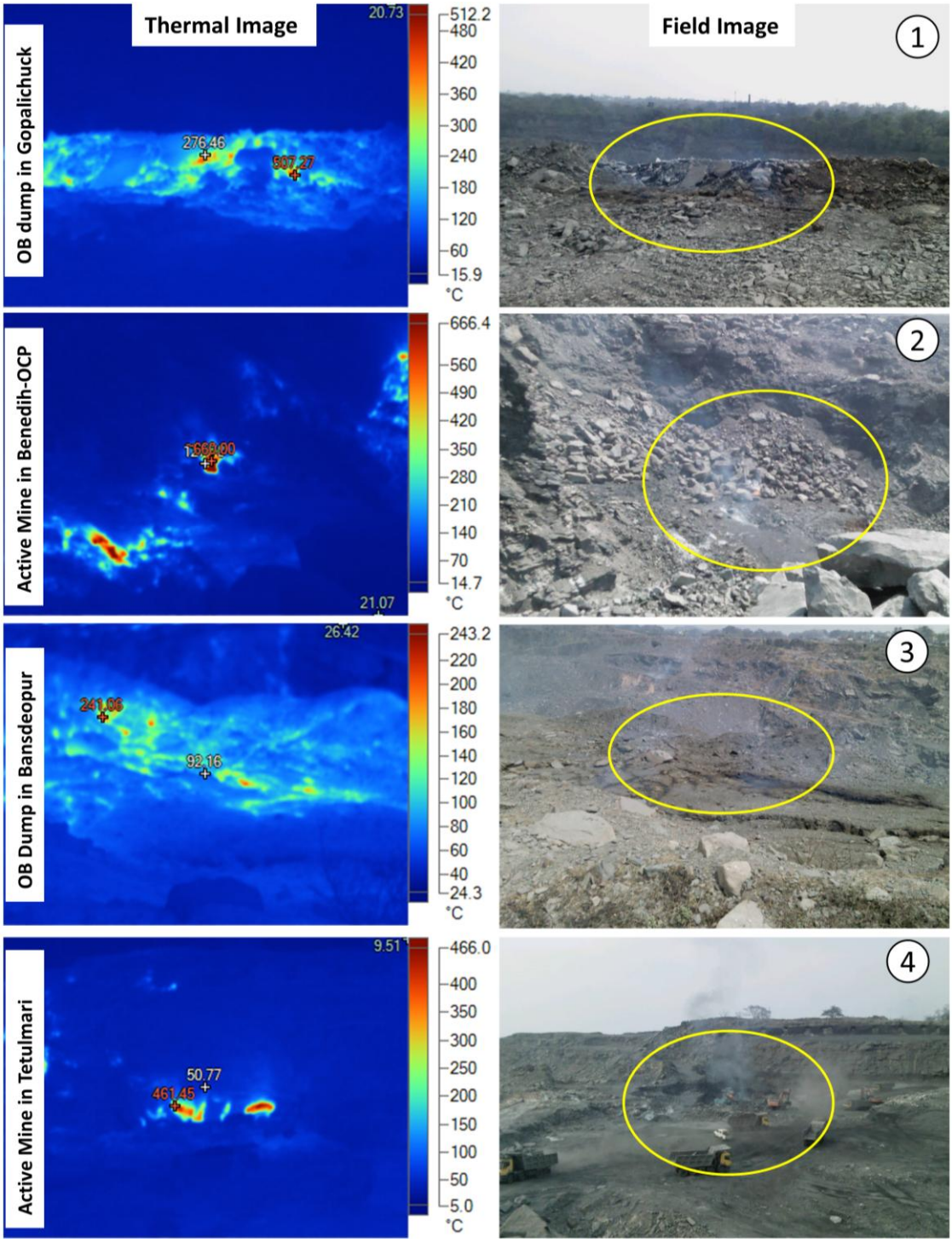


Figure 17. Thermal images and ground photographs from field survey for 2024 (yellow polygon shows the location from where thermal measurements are taken).

6.2 Subsidence Maps and Field images

The interferogram pair-by-pair processing for the seven acquired ALOS-PALSAR-2 L Band SLCs was carried out, and through the visual interpretation of the interferograms, the possible subsidence area was identified. The ground-based signature could be identified for the areas of Basuria, ENA, Dobari, and Nudkhurkee OCP as the bending of the treeing at the edge of the mine or settling of old Overburden dump or fall of loose material from Overburden dump areas. A few field photographs are shown in Figure 18, and the Jharia subsidence map is in Figure 19.



Figure 18. Field photographs for identified ground evidence for the subsidence areas for four different locations with (a) showing slanting trees, (b) showing falling of loose material, (c) edge of the mine slanting trees and (d) showing large crack due to mining activities.

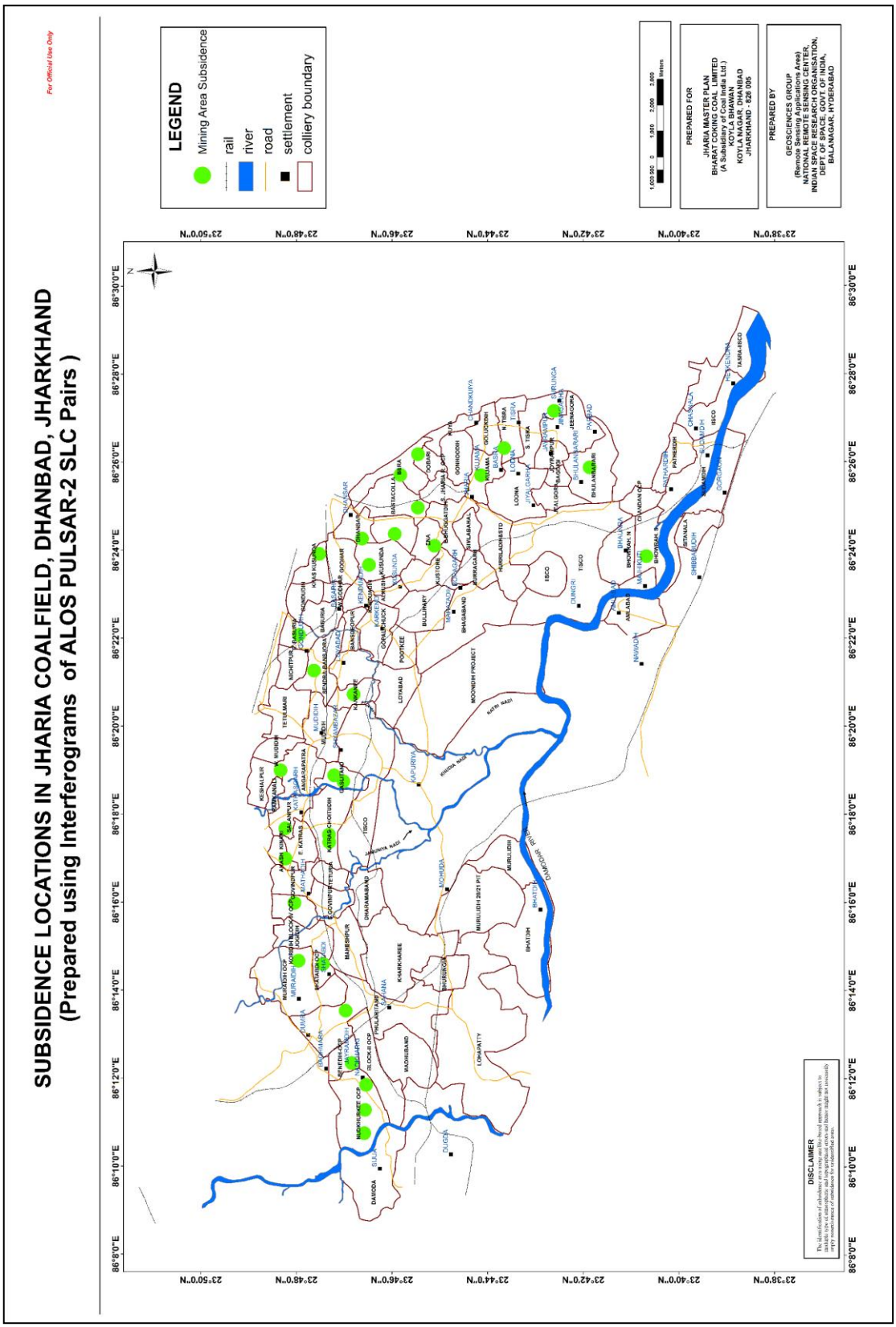


Figure 19. Subsidence map of the Jharia Coalfield (from ALOS PALSAR-2 data)

CHAPTER VII

DISCUSSION AND CONCLUSIONS

7.1 Discussion

7.1.1 Coal fire analysis

The present status of the fire in the Jharia Coal Fields for the period of 2022 to 2024 shows an increase in fire area for 2022 in comparison to 2020 (although field verification was not carried out in 2022) and an increase for 2023 in comparison to 2022 in approximately 0.5 sq. km where the cardinal direction-wise fire zones distributions were analysed in section 6.1. The identification of two classes in mine fire areas and overburden dump fire areas allowed for a deeper look into the areas of increment and decrement, which were analysed for the years 2023 and 2024, as shown in Figures 14 and 16. There is a decrease in total fire area of approximately 1.0 sq. km for 2023 and 2024 and a decrease in fire area in the two subclasses as well.

The identification of anomalous pixels from the Landsat images has changed from the previous analysis, where the coarse resolution of 100m x 100m of TIRS bands was solely used by converting it into radiant temperature through Planck's radiation function to using the fire color composite of medium resolutions of 30m x 30m bands of SWIR and NIR bands to identify the bright pixels indicative of fire along with the previous methodology. The change in the strategy has allowed for the identification of areas with fire patches covering smaller spatial extent while validating the identified areas through both methodologies for each other. As the identifiable overall resolution decreased, the total identified areas of coal fires increased, contributing to the increase in overall fire from previous years.

All the fire areas identified were field verified, and the accuracy of identification through satellite imagery is still consistently very high, strengthening the outcomes of the methodology for the identification of fire areas. The Fluke Ti300 thermal sensor provides a temperature estimate of the identified fire zones and a causative relationship between the satellite-measured temperature and the actual surface temperature.

7.1.2 Subsidence analysis

An attempt to identify subsidence zones in the Jharia Coalfield was also carried out using ALOS-PALSAR-2 L-band microwave data using a differential interferometric technique. Seven scenes of PALSAR-2 data spanning 2021 to 2024 were used to identify the subsidence in the region and separately identify them from the terrain changes due to mining. Verifying the subsidence zones as seen from data is difficult as it requires visible signatures of subsidence in the form of cracks on the ground and damage to anthropogenic structures. In this study, data analysis and consequent field verification resulted in identifying a few subsidence areas within the BCCL mine boundary. The two main areas of subsidence lie in the old Overburden dump area of Nudkhurkee OCP and the old Overburden dump area of Dhansar, while the other subsidence point lies in the active mine areas or Overburden dump areas; no subsidence was identified in the human habitation zones. No quantitative estimates of the subsidence have been carried out in the study.

7.2 Conclusions

The change in the areal extent of fire as identified by the Landsat images and block-wise distribution calculated for 2023 and 2024 and compared with old data of 2020 and non-verified maps of 2022, where an increase in the fire area for 2023 was majorly contributed by the north-eastern and easter sides and decrease for 2024 was due to eastern side while the central area of focus being the northern side due to substantial increase in the fire area from 2023 to 2024. The persistent coal fire zones from 2022 to 2024 in the North-eastern sides were also identified and verified during the field.

The accuracy of the generated maps, as verified from the field, was very high, and the causative relationship between the temperature measurement from the handheld thermal sensor and the identified higher fire pixel anomalies was satisfactory, with a higher degree of anomalies relating to the higher measured temperatures on the surface. The results section also discussed the temperature range for Overburden dump areas and active mine fire areas.

No subsidence was observed in the human habitation zones, and the main areas of subsidence do not seem to have consequences of the near settlements, while

the active mining area subsidence and new Overburden dump subsidence can be of concern for the mining area personnel due to constant failure of the loose material

Note: *The minimum mapable unit from satellite image it 30m by 30m or 0.0009 km^2.* *Estimations of fire extent (in terms of sq.km.) for the present study carried out for 2023-2024. They may differ from the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal extent of fire. Hence, they should not be quoted as fire area on the ground.*

CHAPTER VIII

LIMITATIONS

Delineation and mapping of coal fire from thermal data of remote sensing platforms carries with it some inherent limitations which needs to be understood in order to decipher the results obtained from it. This will assist is deducing the correct information and remove any ambiguity associated with the results. The key limitations of the data and the results obtained are as follows:

1) An anomalous pixel from LANDSAT data represents an area of 30m x 30m for the fire area composite and 100m x 100m for TIRS bands based radiant temperature (resampled to 30m x 30m spatial resolution) on the ground whose temperature is considerably higher than its surroundings. This can be attributed to two circumstances, namely the area has a very high intensity fire located within a smaller pocket or there are a number of low intensity fires spread across it. In both the mentioned cases the actual areal extent of the fire on the surface differs, but appears as a single anomalous pixel in the data. Hence, representation of fire affected ground area by means of pixel area is ambiguous and hence should be considered with caution.

2) There are locations as observed during the fieldwork, where coal seams are affected by active fires along vertical/semi-vertical sections of open cast mines. In such cases, the actual areal expression of the fire affected area as seen by the sensor changes considerably and the representation from the same is not accurate.

3) As discussed in section 4.1.2, thresholding the data to separate the fires from the non fire areas, is a statistical technique. However, this method is dependent on how the temperature of non-fire background area is distinctive from the fire temperature.

4) The background temperatures vary with the time of the day when the data are collected, topography, and season of the year when the data is acquired. Night-time data has lower background temperature as compared to day-time. Similarly a data collected in October-November will have a considerably lower background temperature than that collected in May-June due to seasonal temperature variations. Hence, identification of the background temperature range becomes essential in

estimation of threshold temperature and the same varies depending upon the discussed controlling factors.

6) Due to the mitigation measures taking place in various mines, it is seen that in a number of places the fire affected seam is excavated and dumped as overburden. However, these overburden dumps retains the excavated burning coals and thus are seen to have active fires occasionally. There lies a possibility that the same will be identified as anomalous pixels and hence, although the fire is not a part of any active coal seam, it will be included as a fire affected area in the final map.

7) Considering the precision of DInSAR data for different wavelengths, topographic and atmospheric errors, slow subsidence rates may not be detected. Further, the displacement measured is along the line of sight of the sensor and not vertical displacement.

8) Temporal decorrelation and noise due to adverse land use and land cover may affect DInSAR based detection and monitoring of land subsidence. Changes vegetation pattern over time can cause significant decorrelation between the master and slave image, thus producing a very low coherent output. Under such conditions, subsidence information may not be retrieved

9) Verification of the subsidence zones as detected from the interferometric technique is sometimes difficult due to lack in observable signatures of subsidence such as cracks on the ground and damage to anthropogenic structures.

Therefore, in quantitative estimation of fire affected areas and areas denoted as subsidence, the above-mentioned limitations need to be taken into account diligently, as it is inevitable that the area estimate will not define the actual fire/subsidence affected area on the ground. However, the areal extent estimated from the data can be "like to like" compared to earlier estimates of similar studies to understand the change and dynamism of the fire in terms of area affected and spatial disposition.

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भारत कोकिंग कोल लिमिटेड
(एक मिनीरत्न कंपनी)
(कोल इण्डिया लिमिटेड की एक अनुषंगी कंपनी)
(भारत सरकार का उपक्रम)

बीसीसीएल
BCCL
भारत कोकिंग कोल लिमिटेड
Bharat Coking Coal Limited

Bharat Coking Coal Limited
(A Miniratna Company)
(A Subsidiary of Coal India Limited)
(A Government of India Undertaking)

बोर्ड सचिवालय/Board Secretariat

Annexure-I

पत्रांक : बीसीसीएल/सीएस/एफ-1(A)/316 (H)

दिनांक: 07.07.2025

सेवा में,

महाप्रबंधक(परियोजना व योजना)
बीसीसीएल, कोयला भवन, धनबाद।

विषय: **Certified copy of Minutes of 425th Board Meeting held on 25.06.2025.**

Dear Sir,

We send herewith certified copy of Minutes of Item No. 425.6C of 425th Meeting of the Board of Directors of Bharat Coking Coal Limited held at Regd. Office, Koyla Bhawan, Dhanbad on 25.06.2025 for taking necessary action at your end.

You are requested to send the Action Taken Report (ATR) on the above, duly approved by the concerned Director, for placing before the next Board Meeting as per the format given below. Soft copy of the same in MS word format to the mail id cos.bccl@coalindia.in .

Format of ATR:

Department:			
Item No.	**Subject**	**Decision of the Board**	**Action Taken**

भवदीय,

Encl: As above

बी.के.पारूई
कंपनी सचिव

भा0 को0 को0 लि0
312/L
7-7-25
महाप्रबंधक (यो0 एवं बही)

Approved

Item No.425.6C

Approval of Mining Plan along with Mine Closure Plan of Damoda Colliery (As Cluster-I), Barora Area.

Background:-

Damoda Colliery is located in the North-Western part of Jharia Coalfield. It is under the administrative control of Barora Area of BCCL. Damoda Colliery is a part of Damoda coal Block, located in the western Jharia Coalfield. The coal block lies between Latitude 23°45'30" to 23°47'0" (N) and Longitude 86°9'00"to 86°11'00" (E). Damoda Colliery is situated in the Cluster-I of BCCL.

Previously, a Mining Plan along with Mine Closure Plan of Damoda Colliery, Barora Area has already been approved in the 372th BCCL Board dated 07.01.2021 for implementation of guidelines issued by Ministry of Coal, Govt. of India vide letter no. 55011-01-2009-CPAM dated 7th January, 2013.

Purpose & Scope of the Report:

The purpose/ objective of the preparation of this revised mining plan is as follows:

1. To comply the statutory requirement as per the Rule 22A of Mineral Concession (Amendment) Rules 2020.
2. To comply the Guidelines for Preparation of Mining Plan and Mine Closure Plan for Coal and Lignite Blocks 2025 – reg. vid F No CPAM 34011/28/2019 CPAM [E343762] dated 31st January, 2025
3. To facilitate amendment in Environmental Clearance of Damoda Colliery due to proposed setting up of OB to Sand conversion plant.

The matter was placed before the ESC (Tech.) meeting held on 10.06.2025 and the committee has recommended to put up the proposal before Board for approval.

Decision:-

During deliberation, the Board was apprised that previously, a Mining Plan along with Mine Closure Plan of Damoda Colliery, Barora Area was approved in the 372nd BCCL Board meeting held on 07.01.2021.

In order to facilitate amendment in Environmental Clearance of Damoda Colliery for proposed setting up of OB to Sand conversion plant, this revised Mining Plan along with Mine Closure Plan of Damoda Colliery, Barora Area has been prepared.

During deliberation it was explained by the department that the OB to Sand conversion plant mentioned under proposal is the first of its kind of plant to be installed in BCCL and not much has been revealed by the awardee contractor about the technology involved therein.

However, in reply to a query to the CMD, it was stated by the department that among other CIL subsidiaries, OB to Sand conversion is presently being done in NCL and ECL (Kajora Area) respectively.

Certified to be True Copy

B. K. Paru
Company Secretary
Bharat Coking Coal Limited
Koyla Bhawan
[illegible]005

The Board was further apprised that while handing over the OB to the plant operator for conversion, necessary royalty would be paid by the operator to the state Government as per legal requirement and after conversion of OB to sand, the plant operator shall be the owner of the said sand and would be at liberty to sell or otherwise deal with the sand as per their requirement.

Board was further apprised that boundary of the area where the said plant will be operated has been earmarked and there will be no overlapping of area for operation of the mining and mining activities of the colliery.

After deliberation the recommendation of Empowered Sub-Committee (Tech.) for Mining Plan along with Mine Closure Plan of Damoda Colliery, Barora Area having Peak Capacity 1.17 MTPA, ML area- 575.00 Ha, Project area 316.69 Ha, balance Life of 09 years with total Mine Closure cost being ₹51.87793 Crs, (including already deposited amount ₹13.2028 Crs.). It also includes the proposed OB to Sand Plant (1.10 MTY Feed) within the proposed leasehold of Damoda Colliery was approved by the Board.

Action:- GM (P&P)

Certified to be True Copy

B. K. Parui
Company Secretary
Bharat Coking Coal Limited
Koyla Bhawan
Dhanbad- 826005

बोर्ड सचिवालय/Board Secretariat

Dated: 21.10.2025

Extracts of Minutes of FDs Meeting (36th of 2025) held on 11.10.2025.

2A. Proposal for approval for Head-wise re-distribution of Mine closure cost to allocate minimum 25% amount under "Sustainability Head" keeping all other aspects of the approved mining plan & Mine Closure Plan intact for compliance of provision of Para 3.5.5 (ii) of the Guidelines for Preparation of Mining Plan and Mine Closure Plan for Coal and Lignite Blocks, 2025.

In view of the decision of the Board by delegating the power to the D(T)P&P, BCCL for minor modification of the document as approved by the Board such as Mine Closure cost, ratification of some minor clerical mistake, etc. while keeping major aspect intact and subsequent information to Board for such modification in the approved document, the proposal for Head-wise re-distribution of Mine closure cost to allocate minimum 25% amount under "Sustainability Head" keeping all other aspects of the approved mining plan & Mine Closure Plan intact for compliance of provision of Para 3.5.5 (ii) of the Guidelines for Preparation of Mining Plan and Mine Closure Plan for Coal and Lignite Blocks, 2025 being minor modification for the following mines was approved by CFDs as placed before it with the directive that the same may be intimated to the Board through ESC.

1. For Damoda Colliery, Amount proposed allocated under Sustainability Clause is revised to ₹13.28586 in place of earlier allocated amount of ₹12.1391730. The total Mine closure cost remains unchanged i.e. ₹51.877929 Crs.

2. For Amalgamated Sudamdih Patherdih Colliery, Amount proposed allocated under Sustainability Clause is revised to ₹35.2402 in place of earlier allocated amount of ₹27.7693. The total Mine closure cost remains unchanged i.e. ₹140.6159 Crs.

21/10/25

(B.K Parui)
Company Secretary

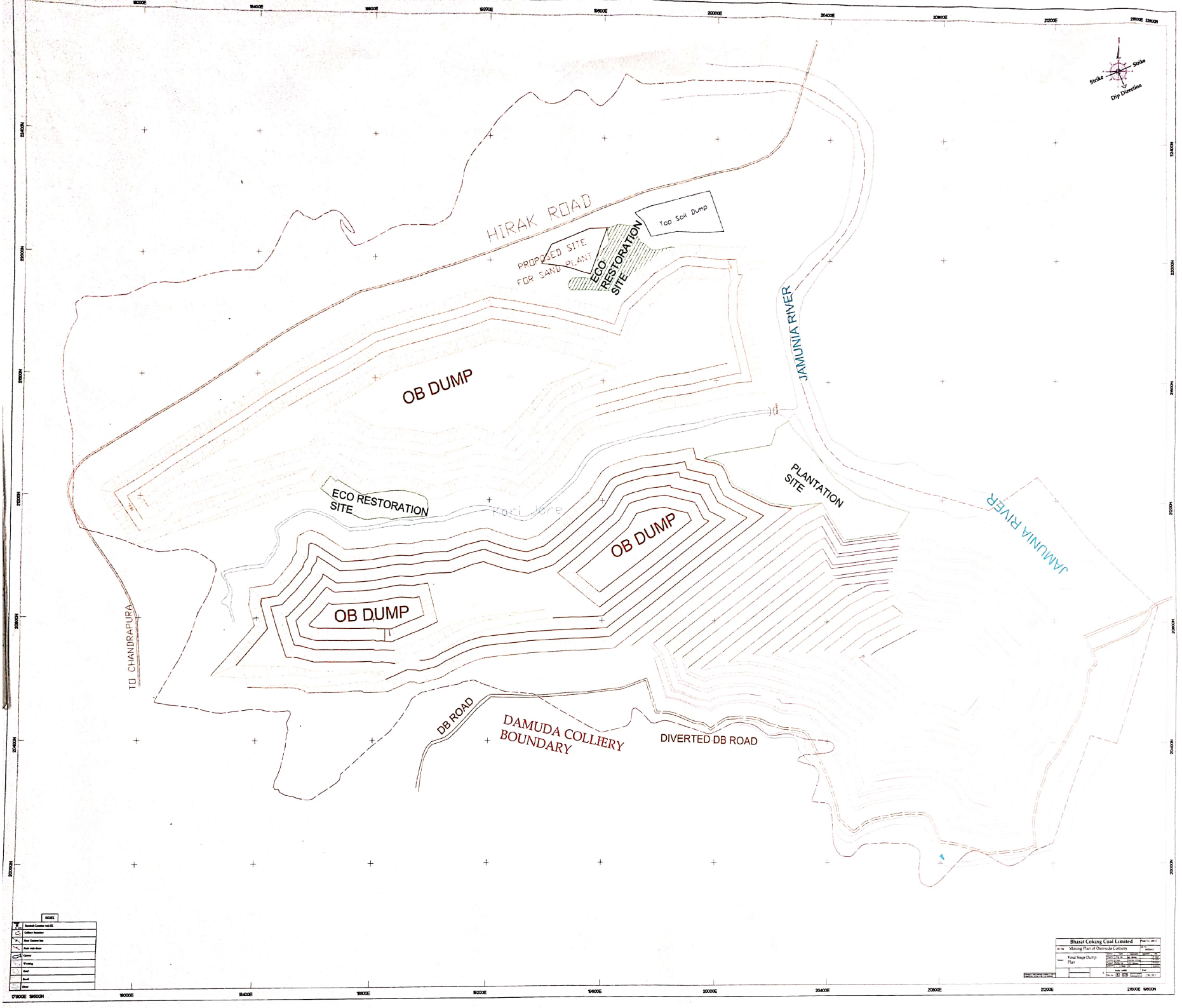
HoD (P&P)

*An Action Taken Report (ATR) on the above decision should be submitted to this office within 15 days from the date of issue of this extract.

Kindly provide the ATR in the below given format duly signed by the concerned Director. Soft copy of the same may also be sent in the (ms-word format) to the mail id cos.bccl@coalindia.in.

Date of FD's meeting	Item No.	Subject	FD's decision	Action taken in detail
11.10.2025	2A.			

भारत कोकिंग कोल लिमि. 10389 21/10/25 बोर्ड सचिवालय विभाग


HIRAK ROAD
PROPOSED SITE FOR SAND PLANT
ECO RESTORATION SITE
Top Soil Dump
OB DUMP
JAMUNIA RIVER
PLANTATION SITE
ECO RESTORATION SITE
OB DUMP
OB DUMP
JAMUNIA RIVER
TO CHANDRAPURA
DB ROAD
DAMUDA COLLIERY BOUNDARY
DIVERTED DB ROAD
Strike
Strike
Dip Direction
Bharat Coking Coal Limited
Mining Plan of Damuda Colliery
Final Stage Dump Plan

3.1.7 Tentative Coal production Plan "MT"

Year	Calend-ar Year	Coal	Jhama	O.B. in terms of insitu	Avg. SR
		M.Tes	M.Tes	Mcum	Cum/t
Before Year 1		0.83		2.33	
Y-1	2025-26	0.6	3.1	10.76	17.92
Y-2	2026-27	0.7	3.62	12.55	
Y-3	2027-28	0.9	4.66	16.13	
Y-4	2028-29	0.9	4.66	16.13	
Y-5	2029-30	0.9	4.66	16.13	
Y-6	2030-31	0.9	4.66	16.13	
Y-7	2031-32	0.9	4.66	16.13	
Y-8	2032-33	0.9	4.66	16.13	
Y-9	2033-34	0.54	2.79	9.68	
Sub Total		7.24	37.47	129.77	
Total		8.07	37.47	132.10	

Note: Calendar Plan/Production Plan for the entire life of the mine.

3.1.8	Peak/Rated Capacity - By OC - By UG - Overall	By OC- 0.9 Mtpa By UG- Nil Overall- 0.9 Mtpa (Rated Capacity) Overall- 1.17 Mtpa (Peak Capacity)
3.1.9	Life of the mine: - By OC - By UG - Overall	By OC- 9 years By UG- Nil Overall- 9 years
3.1.10	Whether the proposed external OB dump site is coal/lignite bearing: If so,	Proposed external OB dump site is lying within non coal bearing area

Annexure-III

CSR Booklet

Barora Area

Bharat Coking Coal Limited

Contents

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2.0 SCOPE 2
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5.0 STATUS OF CSR ACTIVITIES 3
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5.2 Details of Civil work ,Medical Camps, CSR Clinics & Awareness Programme 3
5.3 COVID Prevention related Activities 5
5.4 CSR Activities at BCCL Level 6
6.0 COAL TRANSPORTATION PLAN 7
7.0 REHABILITATION AND RESETTLEMENT PLAN 8

1.0 INTRODUCTION

Coal India has adopted CSR as a strategic tool for sustainable growth. For Coal India in the present context, CSR means not only investment of funds for Social Activity but also Integration of Business processes with Social processes. Even much before the issue of CSR became global concern; Coal India was aware of its Corporate Social Responsibility and was fulfilling the aspiration of the Society through well-defined "Community Development Policy" within the periphery of 8 Kms. of the Project sites. This has resulted into a harmonious relationship between Coal India and the peripheral Communities. Coal India has identified land outsee, PAP and those staying within the radius of 25 Kms of the Project as primary beneficiaries. Poor and needy section of the society living in different parts of India is second beneficiaries. For carrying out CSR activities, 80% of the budgeted amount are be spent within the radius of 25 Km of the Project Site/Mines/Area HQ/Company HQ and 20% of the budget to be spent within the States in which operating.

2.0 SCOPE

As per Schedule VII of New Companies Act 2013 the following should be the Scope of Activities under Corporate Social Activities:

1) Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.
2) Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently able and livelihood enhancement projects.
3) Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups.
4) Ensuring environmental sustainability, ecological balance, protection of Flora and Fauna, animal welfare, agro-forestry, conservation of natural resources and maintaining quality of soil, air and water.
5) Protection of national heritage, art and culture including restoration of buildings and sites of historical importance and works of art; setting up public libraries, promotion and development of traditional arts and handicrafts.
6) Measures for the benefit of armed forces veterans, war widows and their dependents
7) Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic Sports.
8) Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women.
9) Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government.
10) Rural development projects.

3.0 SOURCE OF FUND

The fund for the CSR should be allocated based on 2% of the average net profit of the Company for the three immediate preceding financial years or Rs. 2.00 per tonne of Coal Production of previous year whichever is higher.

4.0 ACTION PLAN FOR CORPORATE SOCIAL RESPONSIBILITY

CSR activities are mainly taken at corporate level.

5.0 STATUS OF CSR ACTIVITIES

5.1 Details of CSR expenditure made at M/s BCCL Level:

FY	Expenditure (In Cr.)
2020-21	6.21
2019-20	6.46
2018-19	1.43
2017-18	2.74

5.2 Details of Civil work ,Medical Camps, CSR Clinics & Awareness Programme under taken at area level:

Civil work

S. N.	Details	Award value (In Lac)	Remarks
1	Construction of PCC road at Gonduadih west under Mohanpur village (from Khalil Mahto home to Primary school).	3.98	25.01.2015 to 24.03.2015 (60 days)
2	Construction of Janaja shed at Ramakunda west under Amtand village	3.15	15.10.2014 to 14.12.2014 (60 days)
3	Construction of 1 no. chhathh ghat at Muraidih colony, Hirak road river side	3.01	15.10.2014 to 14.12.2014 (60 days)
4	Construction of Janaja shed at Muraidih colony near river of Hirak road	0.46	31.03.2014 to 29.04.2014 (30 days)
5	PCC Road jhunu Rajwar House to Tarkeswar Gope House at Bakaspura Village Luti Pahari (Jhunu Tarkeshwar)Road Length:-	2.30	This is benefiting to approx. 200 families in this locality by all-weather connectivity.
6	Making PCC Path from Manoj Matha House to Sahabuddin Ansari house at Ghunghusa Village (Mahato Shahbhuddin)	1.85	This is benefiting to approx. 300 families in this locality by all-weather connectivity
7	Steps for Ghat at sarbandh near hirak chowk under B-II Area	2.67	This will ease in performing rituals by local villages of Dumara ,harina & Bada pandeydih.
8	Cutting of earth from pond at Chaudhary bandh at Harina Basti,under B-II Area	19.22	This is benefiting to approx 5000 persons in this locality. This pond is used for multipurpose like irrigation,water for

			households drinking water for animals etc.it will also maintain the water leval in locality.
9	Drinking Water pipe line works in hadi basti at Bhamkanali.	0.44	This is benefiting to approx. 150 families in this locality
10	Rep/Maint of Hand pump at Bara pandeydih (08 Nos).	0.26	This is benefiting to approx. 500 persons in this locality
11	Development work at rehabilitation site at Bhimkanali.	6.45	This is benefiting to approx. 500 persons in this locality
12	Construction of community hall at Bara Pandeydih Village	11.9	This is benefiting to approx. 1000 persons in this locality
13	Rep. Of Main road & Drain at Bakashpura rehabilitation site.	9.71	This is benefiting to approx. 1500 persons in this locality
14	Engagement of tankers for drinking water supply in nearby villages	1.9	This is benefiting to approx. 2000 families in Viallages like Benidih Baghmara, Luttipahadi, Harina, Kessurgarh, Rathtand, Nudkhurkee,Pinalgarhia,Mandra.
15	Engagement of departmental tankers for drinking water supply in nearby villages as on need base.	-	This is benefiting to approx. 2000 families in Viallages like Benidih Baghmara, Luttipahadi Kessurgarh, Madhuban Etc.

S.N.	Details	Award value (In Lac)	Remarks
1	Construction and maintenance for 5 years of toilets in Government schools in Gumla District under Swachh Vidyalaya Abhiyan. 125 toilets in 69 schools were constructed.	191.67	This is benefiting to approx. 7500 students
2	Construction and maintenance for 5 years of toilets in Government schools in Bokaro District under Swachh Vidyalaya Abhiyan. 179 toilets in 181 schools were constructed.	1702.98	This is benefiting to approx. 10000 students

Health: Medical Camps, CSR Clinics & Awareness Programme:

Medical Camps	Beneficiaries	Amount (in Rs.)
2014-15	5144	58095.75
2015-16	3397	38352.13
2016-17	595	30320.00
2018-19	789	30320.00
2019-20	310	-

CSR Clinic:

Year	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Total no patients	1660	1301	1895	1293	1305	810	910	800

SN	**Health Awareness Programme**	**Amount (in Rs.)**
1	Nasa Mukti Abhiyan	10000.00
2	Blood Pressure Detection	5000.00
4	Aids Awareness Programme	5000.00
5	Eye Checkup camp	25000.00

5.3 COVID Prevention related Activities (2020-21):

Type	No of beneficiaries	Hand wash	Mask
Hand wash and Mask Distribution	500	450	500
Blood sugar strips	124	NA	NA

5.4 **CSR initiatives and expenditure FY 2021-22 _BCCL**

CSR initiatives and expenditure FY 2021-22 _BCCL		
FY 2021-22		
Sl No	**Particulars**	**Expenditure incurred(in Rs. Lakh)**
1	Depository mode Financial assistance to D.C., Dhanbad for combating COVID-19 situation in Dhanbad	100.00
2	Depository mode Financial assistance to Jharkhand State Disaster Mitigation Fund for distributing home isolation kits to COVID-19 patients	25.00
3	Procurement of masks & hand wash/ sanitizers for distribution amongst public for combating COVID-19	0.72
4	Fooding through Administration department for Doctors and Frontline workers at Covid Ward, CHD, Dhanbad and other miscellaneous COVID-19 expenditure like temporary contract of doctor etc.	36.45
5	Additional financial liability on submission of fresh bills for the work "Boarding and lodging of doctors and paramedical staff engaged in COVID-19 Hospital, CHD"	22.62
6	Cleaning and sanitization of temporary quarantine centres for doctors and paramedic staff engaged in treatment of COVID 19	2.15
7	Training of Youths in Various Plastic Engineering Courses through Central Institute of Plastics Engineering and Technology (CIPET)	14.00
8	Development of 500 Nos. of Aanganwadi Centres in Dhanbad	75.00
9	SVA Survey Expenditure (All Areas)	6.96
10	Distribution of blankets during winter season	3.58
11	Submission of fresh bills for project "Training of mining sirdar for SC/ST PAPs" by PB Area	3.26
12	Submission of fresh bills for "Operation of COVID quarantine centre" by Bastacolla Area	3.80
13	Upgradation of public toilets and approach road in Central Hospital, Dhanbad	3.15
14	Submission of final bills for "Gymnasium at Ambedkar Academy, Dhanbad"	2.35
15	Reversal of Financial Liablity (medical camps)	8.52
16	Amount for Aanganwadi deposited in Unspent CSR Account	188.50
17	Amount for CIPET deposited in Unspent CSR Account	14.00
	Total	**493.02**

6.0 COAL TRANSPORTATION PLAN:

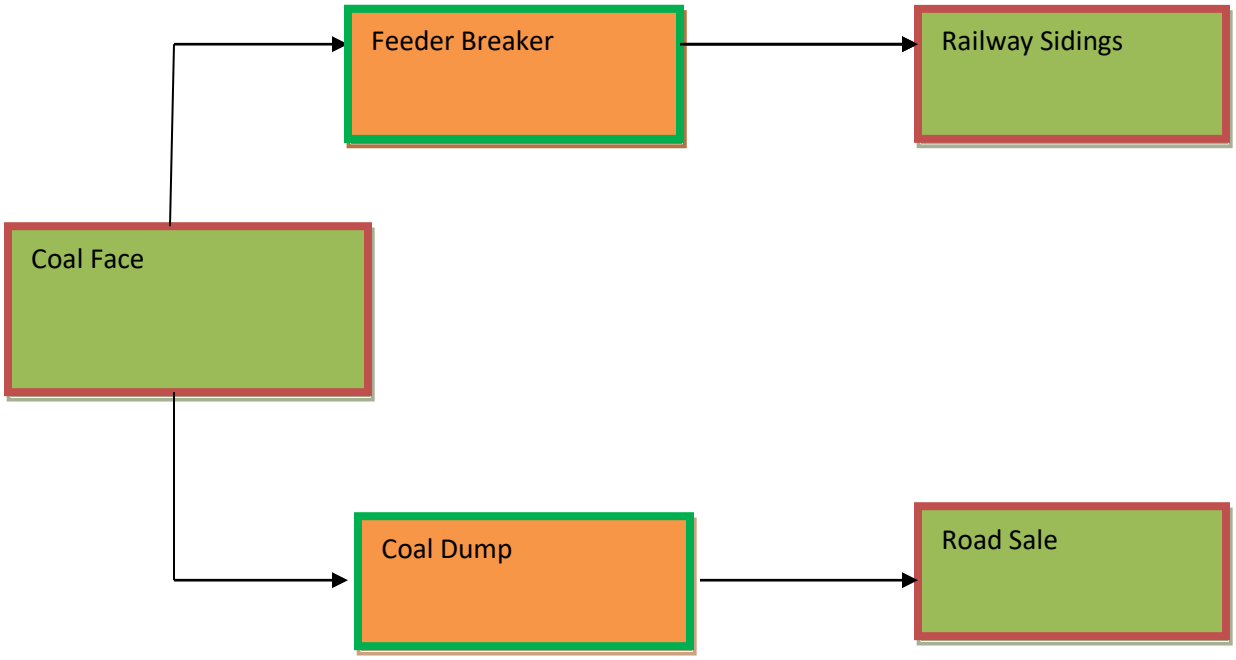


Fig: Coal transportation route

7.0 REHABILITATION AND RESETTLEMENT PLAN:

REHABILITATION AND RESETTLEMENT POLICY OF COAL INDIA LTD 2012.

Preamble

The location and quality of coal reserves, and their distance from major consumers determines to a great extent the selection of mine sites. For reserves that are close to the surface, opencast mining has proven to be the most efficient mining method. Opencast mines require relatively large areas of land. Population growth, particularly in India's eastern region, has made it increasingly difficult for the subsidiary coal companies to acquire the land they need for expanding their operations under the present Resettlement and Rehabilitation policy,2008 of Coal India.

The resettlement and rehabilitation policies followed by the subsidiary companies have evolved over time and undergone numerous changes in response to changing circumstances. As and when the Central or State Governments enact amendments to the Land Acquisition Act, issue new guidelines for resettlement and rehabilitation, as per its requirement Coal India reviews and modifies its resettlement and rehabilitation policy taking into account the changing conditions in coal producing areas.

In addition to compensation for land coal companies provide Rehabilitation and Resettlement (R&R) package for project affected persons to compensate for loss of livelihood. Apart from compensation for house site, house, trees, cow shed, cost of shifting etc., employment is also provided to land oustees. In addition to this, efforts are made to rehabilitate them by construction of houses, building roads, streets, schools, providing water etc. wherever feasible . However, demand for both more land compensation and better R&R package has been raised by project affected persons and has been highlighted in various Parliamentary Committees. Coal Companies often have to face representations and agitations by these land oustees who obstruct the smooth working of existing mines and come in the way of expansion of new projects.

In the past, subsidiaries found it relatively easy to acquire land, if they were able to offer employment. Partly because of this practice, subsidiaries have built up a largely unskilled labour force beyond their needs. This has contributed to the heavy losses and many mines are incurring and has also affected their efficiency and viability. The subsidiaries may still need to hire people in selected locations and continue to give preference to those whose livelihood will be affected by coal mining operations. However, increasingly subsidiaries will need to develop other ways and means to compensate land owners and others adversely affected by their projects and give them the option to choose which method of compensation best suits their needs. Greater emphasis will also need to be given to community requirements like schools, hospitals etc. Only proper resettlement and rehabilitation will elicit the required cooperation of project affected people, and make it possible for Coal India to acquire the land it needs to fulfill the ever increasing demand of coal for the economic development of the Country.

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The purpose of the Resettlement and Rehabilitation Policy 2012 is to revise and provide greater flexibility to the basic principles for the resettlement and rehabilitation of people affected by coal mining projects i.e. Project Affect People (PAPs). It attempts to consolidate the different resettlement and rehabilitation practices that are being followed by subsidiaries as per the different State land Acquisition Acts and various decisions of the Coal India Board and to modify the Policy of 2008 so as to give the Board of the subsidiary Companies greater flexibility to deal more effectively with resettlement and rehabilitation issues and determine the rehabilitation packages best suited to local needs in line with this policy. The provisions of the National Rehabilitation and Resettlement Policy, 2007 and the Land Acquisition, Rehabilitation & Resettlement Bill, 2011 have also been kept in mind while framing the policy.

While Coal India's basic philosophy for compensating land-losers and other project-affected people remains substantially unchanged, the revised policy emphasizes the need to cultivate and maintain good relationships with the people affected by Coal India's projects starting as early as possible; it also underscores that the subsidiaries have a responsibility towards the land oustees whose livelihood is often taken away. On the other hand, subsidiaries need to protect themselves more effectively against unjustified claims, redundant manpower and swelling Wage Bills. To this end, the statement proposes that subsidiaries prepare detailed resettlement and rehabilitation action plans (RAPs) that clearly identify, at an early stage, the entitlements of the people affected by coal projects and enables them to exercise a choice between various options. The concept of Annuity in lieu of compensation/employment is also being introduced to mitigate, if not eliminate the ever dependence of Project Affected Families (PAFs) on CIL for provision of employment.

(1) The revised Resettlement & Rehabilitation Policy, 2012 is based on the deliberations of the inter Ministerial Committee set up vide O.M. 490191/2011-PRIW-I dated 01-07-2011 of Ministry of Coal , deliberations of the CMDs meet held on 05/03/2012 at New Delhi and has been approved by the CIL Board in its 279th meeting held on 12th and 13th March, 2012.

(2) Objectives and general principles of Coal India's Resettlement and Rehabilitation Policy- 2012

A. To re-visit CIL's existing R&R policy 2008 and evolve a PAP friendly policy by incorporating such provisions of the National Policy and The Draft Land Acquisition, Rehabilitation and Resettlement Bill-2011 as considered suitable in light of the growing difficulties many subsidiaries face in land acquisition.

B. To accord the highest priority for avoiding or minimizing disturbance of the local population while taking decisions to open new mines or expand existing ones too (exploring alternative sites and project designs) and to ensure that wherever people are likely to be adversely affected by a project, the subsidiaries will prepare resettlement and rehabilitation action plans for the project.

C. To ensure a humane, participatory, informed consultative and transparent process for land acquisition for coal mining and allied activities with the least disturbance to the owners of the land and other affected families.

D. To provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make

adequate provisions for loss of livelihood of such affected persons including their rehabilitation and resettlement.

E. To ensure that the cumulative outcome of compulsory acquisition should be that the affected persons become partners in development leading to an improvement in their post acquisition social and economic status and matters connected therewith or incidental thereto.

F. Through the preparation of resettlement and rehabilitation action plans, subsidiaries will safeguard that project-affected people improve or at least regain their former standard of living and earning capacity after a reasonable transition period. The transition period is to be kept to a minimum. However, the involvement of subsidiaries in resettlement and rehabilitation activities may continue until all the actions specified in the rehabilitation plan have been completed.

G. Involuntary resettlement is conceived and executed as a development programme with project-affected people being provided sufficient resources and opportunities to share in a project's benefits. The efforts of subsidiaries are complementary to the Government's schemes in rural development and the concurrence, approvals and support from concerned Government authorities will be sought.

H. In parallel, subsidiaries will work closely with non-governmental organizations of proven repute which are legally constituted and recognized and also have the confidence of the project-affected people, in the preparation and implementation of rehabilitation plans.

I. Corporate Social Responsibility (CSR) : Activities shall be intensified in and around the villages where land is being acquired in accordance with the CSR Policy of Coal India.

J. Actual implementation of R&R package must follow a detailed survey of the project-affected villages to formulate the list of persons/families affected by the project, nature of the affect, the likely loss of income, etc. For this purpose, if necessary, the services of a reputed NGO with an impressive record of integrity and performance may be engaged.

3. SCOPE:

This Policy may be called "Rehabilitation and Resettlement Policy of Coal India Limited-2012". It extends to the Coal India Limited and its subsidiary companies in India. It shall come into force from the date of its approval by the CIL Board and is applicable to all cases in which land is taken after the date of approval by the CIL Board. While implementing the policy it is to be ensured that the provisions of the concerned Acts applicable and Rules mentioned there under shall not be violated .

4. Definitions

(a) ***"affected family"*** means:

(i) a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land (including direct negotiation) for a project or involuntary displacement for any other reason; or

(ii) any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the *abadi* or other property) in the affected area or other wise, has been involuntarily displaced from such land or other property; or

(iii) any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person, who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any other reason.

(b) "***family***" includes a person, his/her spouse, son including minor sons, dependant daughters, minor brothers, unmarried sisters, father, mother residing with him or her and dependent on him/her for their livelihood; and includes "***nuclear family***" consisting of a person, his/her spouse and minor children. Provided that where there are no male dependants, the benefit due to a land loser may devolve on dependent daughter nominated by the land loser.

(c) "land owner" includes any person—

(i) whose name is recorded as the owner of the land or part thereof, in the records of the concerned authority; or

(ii) who is entitled to be granted Patta rights on the land under any law of the State including assigned lands; or

(iii) who has been declared as such by an order of the court or District Collector;

(d) Displaced person - means and includes any person who is deprived of his homestead on account of acquisition. Provided that the person/family who does not ordinarily reside in the homestead land acquired for the project can be termed "Displaced" but he will be eligible for compensation only for homestead and not for livelihood.

(e) Ordinarily resides" shall mean residing in the homestead / acquired land for a period more than 6 months every year for at least the preceding 5 years.

5. Socio-economic Survey and preparation of RAP.

A baseline socioeconomic survey will be carried out to identify the PAPs who are enlisted to receive benefits in line with Coal India's Resettlement and Rehabilitation Policy. This survey will be conducted within two months of notification under the relevant land acquisition Acts by the subsidiaries with the help of reputed independent institutional agencies, who are well versed with the social matrix of the area.

The basic objective of the socio-economic study will be to generate baseline data on the social and economic status of the population who are likely to lose their means of livelihood or homestead due to the acquisition of the land for the project. The data base will be used to formulate a viable and practical Rehabilitation Action Plan (RAP) for the affected persons in line with their entitlements. Digital Satellite Maps would also be prepared of the project Area freezing the dwelling units and habitations existing at the time of negotiation for Land Acquisition wherever feasible .The RAP will also address the following-

(A) Implementation, Monitoring and Evaluation, Dispute Mechanism

The rehabilitation action plan will address the following:

i) The project design, including an analysis of alternative designs aimed at avoiding or minimizing resettlement;
ii) Socio-economic survey and activities to ensure restoration of incomes of PAPs in line with Coal India's Resettlement and Rehabilitation Policy;
iii) Description of the institutional and other mechanisms for provision of entitlements;
iv) Time table for the acquisition and preparation of the resettlement site(s);
v) The cost and budgets for the resettlement and rehabilitation of PAFs;
vi) Project-specific arrangements to deal with grievances of PAFs; and
vii) Time tables, benchmarks and arrangements for monitoring the resettlement and rehabilitation effort.

The RAP will be formulated in consultation with PAPs and State government.

(B). Environment Impact Assessment (EIA) will be conducted as per any law, rule and regulation of the locality in which the land has been acquired.

6. Eligibility Criteria -

(A) Eligibility Criteria for Economic Rehabilitation Benefits

This benefit shall accrue only to Entitled Project Affected Person. Entitled Project Affected Person shall be one from the following categories.

(i) Persons from whom land is acquired including tribals cultivating land under traditional rights.
(ii) Persons whose homestead is acquired.
(iii) ,Sharecroppers, land lessees , tenants & day labourers.
(iv) Tribal dependent on forest produce as certified by the District Forest Officer/Revenue Authorities.

(B) Eligibility Criteria for Resettlement Benefits

1 . Only a 'Displaced' family / person shall be eligible for resettlement benefits.

2. A family/person shall be termed 'displaced' and hence eligible for resettlement benefits if such family/person has been a permanent resident and ordinarily residing in the project area on the date of publication of notification U/S 9 of CBA(A&D) 1957 / U/S 11 of LA Act, 1894/ Or both/ on the date of the land vested with the State/ Central government as the case may be.

and

(a) on account of acquisition of his/her homestead land / structure is displaced from such areas

or

(b) He/she is a homesteadless or landless family/person who has been/is required to be displaced.

7 .**Census & Identification of displaced families**:

1. Within two months of publication of notice U/S 4(1) of the Land Acquisition Act or U/S 7(1) of CBA (A.D) Act 1957 for acquisition of land for the project a census would be undertaken in the manner to be decided by the Collector / project authority for identification of displaced families and for preparing their socio-economic profile and list of eligible persons for the purpose of receiving Rehabilitation & Resettlement Benefits.

2. A photo identity card to each Entitled Project Affected Person shall be issued under the signature of the Collector / project authority concerned indicating the following particulars:

(a) Name of the village/GP/PS :
(b) Name, Father's name and address of the head of the family :
(c)Category of entitlement :
(d)Whether S.C./S.T./O.B.C./General :
(e)Age,Sex,educational qualification of the members of the family :

8. **Types of Compensation and Rehabilitation Entitlement**

Option to the land losers regarding Rehabilitation & Resettlement Benefit - The land losers shall have the option for Rehabilitation and Resettlement benefits in accordance with the awards for each affected family in terms of the entitlements passed by the Concerned Collector of the State or as per this Policy with the consent of the concerned Collector.

8.1 Eligibility and Compensation

The table below shows the compensation and rehabilitation benefits will be offered by the subsidiaries for each Project Affected Person or family, affected by one of their projects. Evidence to the effect that a person is a legitimate PAP will need to be provided in the form of a written legal document, or reference to a record, such as a revenue officer certificate, electoral roll, ration card or school record.

Category of Persons affected by the Project	***Compensation and Rehabilitation entitlement option***
	Provisions
(i) Persons (including tribals cultivating land under traditional rights) from whom land is acquired.	All land owners with titles will receive monetary compensation for the land acquired from them. The value of the land is determined on the basis of prevailing legal norms. *In respect of tribals cultivating land under traditional rights, authentication of land held under traditional rights by state authorities will be necessary.* In addition to above the following shall apply.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
	A). Land Compensation - Land compensation shall be paid as per the provisions of the concerned Act or State Govt. notification. Where no notification of the State Govt. is available the concerned subsidiary Board may decide on the rate of compensation keeping in view the compensation provided by the neighboring states. Authentication of land held under traditional rights by state authorities will be necessary. In addition to above Solatium will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt. Escalation of land compensation – Escalation will be paid as per provisions of the concerned Act / as imposed by the Concerned State Govt. or Escalation at the rate of 12% per anum for a maximum period of three years. **(B): Employment provision:** Apart from payment of the land compensation, employment may be given in the following manner – **1)** The maximum total number of employments that may by provided to the land losers would be limited to the total no. of acres of land acquired divided by two. However employments will be released in proportion to the land possessed . **2)** For every two acres of land one employment can be considered; 3) Subsidiaries of CIL may give an option to the Land losers having less than two acres of land to club together their land to the extent of two acres and nominate one of the land losers among the groups or their dependent for employment under package deal or employment under Descending order system by preparing the list of eligible land oustees in the descending order of land lost subject to the cut off equivalent to the total number of permissible employments or any other method with the approval of the respective Board of the subsidiary. **4)** The land loser must be a domiciled resident/Mool Niwasi and the certificate to this effect shall be issued by the concerned State Authority **5)** The modalities for offering employment shall be such as may be approved by the Board of the Subsidiary companies as per the unique conditions of the subsidiary provided that - **a)** The initial employment shall be given with pay of Category-I pay scale of NCWA, with training period of 6 months. b) In the seniority list, the seniority of the appointee should be reflected in appropriate manner in order to keep the senior most as senior. **c)** The land loser trainees shall be posted as per requirement, including underground duties.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
	(C): Lumpsum Monetary Compensation – 1. All the land losers who are not eligible for employment as above shall be entitled to receive monetary compensation in lieu of employment at the rate of Rs.5,00,000/- (Five Lakhs) for each acre of land on pro-rata basis . 2. Land losers who are offered employment as per principle specified in point No (8.(i)B) above will have the option either to opt for employment or to forego employment and opt for monetary compensation at the rate of Rs.5,00,000/- (Five lakhs) for each acre of land on pro-rata basis with minimum of Rs. 50,000 (Fifty thousands) provided that the employment thus surrendered shall not be available for offer to any other person and will stand lapsed from the total sanctioned number of employments as specified in point No.(8.(i)B1). 3. The Land losers who have clubbed their land in Package Deal can claim employment for only one land loser of the clubbed two acres of land and remaining land losers of the package cannot claim either employment or lump sum monetary compensation in lieu of the land contributed by them. 4. Annuity – All land losers who are entitled to get lump sum monetary compensation may opt for payment of compensation amount in the form of annuity made payable to the land losers monthly, annually or at such intervals (not less than one year) as may be opted for by him. The annuity be paid for a maximum period extending to 60 years of age or the life of the project for which the land has been acquired, whichever is earlier. **Note:** *A person receiving a job forgoes all claims to above compensation and a person receiving above compensation forgoes all claims to employment.*
(ii) Person whose homestead is acquired	I. Compensation for homestead shall be paid as per the standard valuation method of the L.A Act. of the concerned State Govt. II. One time lump sum payment of Rs.3,00,000/- (three lakhs),shall be paid in lieu of alternate House site, Assistance in designing Shifting Allowance,compensation for construction of cattle shed , Monetary compensation for construction of work shed etc.The compensation shall be paid to displaced persons only after vacation and demolition of the homestead/ work shed etc. III. Subsistence allowance :Each affected displaced family will get subsistence allowance at the rate of 25 days (Minimum Agricultural Wage) per month for one year.

Category of Persons affected by the Project	*Compensation and Rehabilitation entitlement option*
	Provisions
(iii)Sharecroppers, land lessees, tenants and day labourers	The subsidiary will assist PAP to take-up non farm self employment through petty contracts or formation of cooperatives. If such co-operatives will not be entitled for awarding work as per Manual for lack of experience, the said co-operative will be facilitated by awarding small jobs to acquire experience after relaxation of the provisions of the Manual pertaining to experience with approval of the Subsidiary Boards. Subsequent jobs may be awarded after getting report of the timely completion / quality / of the awarded jobs from the concerned Department or contractors. Contractors will also be persuaded to give job to eligible PAPs on a preferential basis, where feasible as per terms of contract.
(iv)Landless tribals, Tribal dependent on forest produce	The subsidiary will assist PAP to establish non farm self employment through the provision of infrastructure, petty contracts or formation of cooperatives and encourage provisions of Jobs with contractors. Contractors will be persuaded to give jobs to eligible PAPs on preferential basis, where feasible. - In addition, the subsidiaries will shift the tribal community as a unit and provide facilities to meet the specific needs of the tribal community that will allow them to maintain their unique cultural identity. - Tribal affected family will be given one time financial assistance of 500 days of MAW for loss of customary right or usages of forest produce. Loss of customary rights needs to be authenticated by the district authority. - Tribal affected families resettled out of the district shall be given 25% higher rehabilitation and resettlement benefit.

9. Resettlement & Rehabilitation Committee - A Committee will be constituted at project Level under the chairmanship of the Collector to be called the Rehabilitation and Resettlement Committee with the following objectives to monitor and review the progress of implementation of the Rehabilitation and Resettlement scheme and to carry out post-implementation social audits in consultation with the village panchayat in rural areas and municipality in urban areas in the manner will be decided by the concerned State Govt.

I. To approve the list of land losers and other PAPs;
II. To approve the list of persons eligible to be offered employment as per R&R Policy;
III. To approve the detailed Rehabilitation Plan for the project in consultation with the displaced persons and Gram Sabhas;
IV. To expedite issue of domicile certificates and other necessary documentation required for State Authorities;
V. To monitor and review the progress of the Rehabilitation Scheme, grant of benefits and handing over of possession of land in a smooth manner;
VI. To facilitate the land acquisition process in any other manner as may be required including resolution of disputes;
VII. To carry out post implementation social audit in consultation with the authorities.

10. Community facilities - The subsidiary will provide at the resettlement site a school, road with street light, pucca drain, pond, dugwell and/or tubewell for drinking water supply, community center, place of worship, dispensary, grazing land for cattle and play ground. Similar infrastructural facility, if necessary, will be extended to the host locality. The community facilities and services would be available to all residents of the area, including PAPs and the host population.

The approach for operation of community facilities would be flexible and all efforts will be made to involve the State and local self Government / Panchayat for operating the facilities. To achieve this, subsidiaries will pursue with these agencies to ensure the same. The planning of the community facilities and their construction should be undertaken in consultation with the affected community.

11. Corporate Social Responsibilities - This should be as per Company's Corporate Social Responsibility (CSR) Policy.

12. Monitoring and Evaluation Mechanism.

The RAP will be monitored and evaluated periodically after the completion of the land acquisition process.

I. The resettlement and rehabilitation activities are the responsibility of a separate group, both at the projects and corporate level, which will be constituted for planning, implementation, monitoring and evaluation of the Rehabilitation Action Plan. At the corporate level the group will be headed by a senior manager, whereas at the project, an executive of the rank of manager will head the group. The project group should have at least one member with social science qualification / experience and skills.

II. The project group will closely interact with the state authorities during the implementation of the RAP. Although the subsidiaries will develop the plots and infrastructural facilities in the resettlement colony and actively implement the RAP, assistance of State authorities will be taken for administrative services such as allotment of land. Implementation will be planned, monitored and corrective measures will be incorporated in the RAP, if needed. In addition to the State Government, the PAPs, the village leaders including the Pradhans and NGOs will be consulted and associated with the implementation of the RAP.

III. The Resettlement and Rehabilitation Cell at the corporate level will evaluate the implementation of the RAP after its completion.

13. Flexibility to the Subsidiary Companies – The Subsidiary Companies Boards have been authorised to approve necessary modifications in the R&R Policy with reference to unique conditions prevailing at the concerned Subsidiaries as the policy is not exhaustive.

(The above list is only indicative and not exhaustive)

Annexure-I



Impact Assessment of CSR projects undertaken by Bharat Coking Coal Limited, Dhanbad FY(2015-16)

By

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At the outset, we would like to thank BCCL for granting this project to National CSR Hub, TISS. We express heartfelt gratitude to Director (Personnel), BCCL for giving us the opportunity to carry out the Impact Assessment study of CSR projects for the FY 2015-16. We express our gratitude to the General Manager, CSR and the entire CSR department of BCCL for their continuous support and guidance to the research team of NCSR Hub.

We also extend our gratefulness to respective area General Managers, Medical Officers (Health Department) and concerned project in-charge appointed by BCCL (CSR officials) for making all the arrangements for the study and making us comfortable with their warm hospitality.

Prof. B. Venkatesh Kumar
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EXECUTIVE SUMMARY

Bharat Coking Coal Limited is a subsidiary of Coal India Limited, a Maharatna Company. The company is currently operating in 12 administrative areas in Jharia Coalfields encompassing around 226 peripheral villages mainly in the District of Dhanbad, Jharkhand and in some part of West Bengal. The Strategic CSR of BCCL states that the company's main objective is to improve the quality of life of people living in and around its command areas. The key areas of CSR invention are rural development, livelihood generation and skill development. It has a long history of philanthropic activities which were converged to align with the Corporate Social Responsibility mandate of the Companies Act 2013. Rural development, livelihood generation and skill development are thrust areas of the BCCL's CSR interventions. As per the CSR guideline, BCCL has partnered with Tata Institute of Social Sciences to conduct evaluation studies for the completed CSR projects.

For the purpose of this report, impact assessment studies were carried out for four projects, namely, Scheme for Multi-Purpose Utilisation of Mine Water, Mobile Medical Van, Village Adoption and Construction of PCC/Bituminous Road.

The primary data collection for the impact assessment studies was completed in September 2017 by a six member team from TISS. Mixed research methodology was used while In-Depth Interviews, Household Surveys and focused group discussions were the main methods implemented to collect data. 1000 samples were collected from 13 operational areas of BCCL for the impact assessment study.

The objectives of the impact assessment were:

(i) To assess if the objectives of individual projects have been met;

(ii) To understand the continued relevance of the individual projects in their respective contexts; and

(iii) To identify issues in programmatic implementation and provide recommendation to fulfill the objectives efficiently.

Mobile Medical Van has aimed to provide quality health services to the rural poor residing in the operational areas of BCCL. The impact of the project on the community has been remarkable as it provides doorstep medical services to the poor, reduces the medical expenditures, reached the most remote villages and awareness generation. Limited health services, awareness campaigns and limited regularity are the major drawbacks of the project.

In the project Scheme for Multi-Purpose Utilisation of Mine Water, 352 samples were collected, 13 FGDs and 4 Key Informant Interviews (KII) were conducted. There is strong demand for the supply of mine water in the renovated ponds especially during water scarcity periods, which have been stopped for the last couple of months. The mine water is used for household and cattle consumption. Livelihood generation activities have not commenced as yet.

BCCL also adopted Lahbera village, situated in Jharia block of Dhanbad district and committed to the holistic development of the village. Various infrastructural and economic projects were implemented in the village. Although the project has been a huge success, a lapse in monitoring, incomplete projects and limited resources for employment generation have inhibited the successful completion of the project.

BCCL also constructed roads at 7 locations across Dhanbad districts. The roads had led to improved connectivity and enhanced hygienic living conditions, but lack of monitoring, limited connectivity and lack of participatory approach have been some of the shortcomings of the project.

TISS has also provided recommendation such as regular monitoring, creation of employment generation activities, the formation of SHGs etc. for efficient execution of future projects.

LIST OF ABBREVIATIONS

ADC	-	Adult Education Center
BCCL	-	Bharat Coking Coal Limited
CHC	-	Community Healthcare Center
CSR	-	Social Corporate Responsibility
CTP	-	Computer Training Program
FGD	-	Focused Group Discussion
GM	-	General Manager
HHI	-	Household Interviews
IDI	-	In – depth Interviews
IT	-	Information and Technology
KII	-	Key Informant Interviews
LVA	-	Lahbera – Village Adoption
MMV	-	Mobile Medical Van
MUMW	-	Scheme for multipurpose utilization of abandoned mine water
PCC	-	Plain Cement Concrete
PHC	-	Primary Health Care Center
SHG	-	Self Help Group
ST	-	Schedule Tribes
STC	-	Sewing Training Centre
STP	-	Sewing Training Program
EJ	–	Eastern Jharia
WJ	–	Western Jahria
WWD	_	Western Washery Division
CV	–	Chanch Victora

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CHAPTER 1 - INTRODUCTION

Businesses are the most powerful constituents of the society, and they do not operate in isolation; there is an increased realization that not only can companies affect society at large, but they are also in a unique position to influence society and a make positive impact.

> "The Organization for Economic Co-operation and Development[1] (OECD) established a set of guidelines for multinational enterprises in 1976 and was thus a pioneer in developing the concept of CSR. The purpose of these guidelines was to improve the 'investment' climate and encourage the positive contribution multinational enterprises can make to economic and social progress".

An evaluation is 'the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipient and donors.' (OECD Publications, 2010)

1.1. About Bharat Coking Coal Limited

Bharat Coking Coal Limited (BCCL) is a subsidiary of Coal India Limited, a Maharatna Company. The company is operating in 12 administrative areas in Jharia Coalfields encompassing around 226 peripheral villages mainly in the District of Dhanbad, Jharkhand and in some part of West Bengal. The Strategic CSR of BCCL states that the company's main objective is to improve the quality of life of people living in and around its command areas. Towards achieving this objective and understand the interest levels of the local community, BCCL has undertaken a departmental baseline survey cum Skill Gap Analysis study at some locations. The recommendations from the study would form the basis for the design and deployment of the various skill development initiatives to be planned.

[1] http://www.oecd.org/about/

1.2 About National Corporate Social Responsibility Hub, TISS

National Corporate Social Responsibility Hub, (NCSR Hub) was established in 2011 by the Department of Public Enterprises to enable the Public Sector Enterprises to design and implement holistic and rights-based CSR initiatives. Tata Institute of Social Sciences (TISS), Mumbai and Department of Public Enterprises (DPE), Government of India had come to realize that there is a need to have a centralized system where core functions of CSR including learning and knowledge dissemination take place. The core activities of the Hub are:

- Vision and strategic direction setting for Policy and Programme
- Advisory role for PSEs on Policy and Programme implementation
- Research and development and 'evidence-based' policy advocacy
- Capacity building of PSEs, partners and civil society institution
- Impact assessment, monitoring and evaluation
- Empanelment and partner management

1.3 Project Backgrounds

Bharat Coking Coal Limited (BCCL) sanctioned impact evaluation studies for four projects in different stages of completion which were carried out by National CSR Hub in August-September 2017. The following report details the evaluation of projects undertaken by Bharat Coking Coal Limited in accordance with their CSR policy laid out in 2014. A cogent CSR policy is a requirement laid out in the Companies (CSR Policy) Rules, 2014 conferred under the Companies Act, 2013.

As stated above, for this report four projects were evaluated namely: *Mobile Medical Van, Scheme for multipurpose utilisation of abandoned mine water, Village adoption program and construction of PCC/Bituminous road.*

a) **Mobile Medical Van (*Swastha Ratha*) -** The service of Mobile Medical Van for villagers under command areas of BCCL started in 2009 with the help of 2 Mobile Medical Vans. Now BCCL has fourteen Medical Mobile Vans (MMVs) equipped with doctors, paramedical staff serving different 203 villages situated in and around the mining areas on working days. The villagers are examined by the experienced clinicians

and medicines are dispensed free of cost to them. This provision has been made by BCCL exclusively under CSR activities for the benefit of villagers by providing them free medical assistance.

Objective: To provide health services in peripheral villages in and around BCCL command area to provide medical facilities with a focused service on identification, screening, diagnosis and treatment to provide free medical; assistance.

Location of implementation: 203 villages in the peripheral areas of BCCL

b) **Scheme for multipurpose utilisation of abandoned mine water -** BCCL since inception has felt the importance of water and endeavoured for effective and gainful utilisation of mine water from abandoned mines which has to be taken out compulsorily in the course of the mining process. For harnessing such water, BCCL has taken upon the task of holding the mine water into the water bodies by restricting them to flow into the natural drainage course like village reservoirs which gets dried during summers by laying out a pipeline network of approximately 45 km.

Objective of the project: Harnessing mine water for its gainful multipurpose utilisation in the peripheral villages of BCCL command area.

Location: Two reservoirs are situated in Khonathi and Behrakudar villages of Baghmara block of Dhanbad district.

c) **Lahbera Village Adoption Program** - In order to develop peripheral villages of BCCL in an integrated manner, including their economic development, infrastructure upliftment, providing opportunities for social empowerment and other aspects of overall human development. i.e. education, health, drinking water supply, providing training and tools for self-employment etc. This would include economic development, infrastructure development and other aspects of human development, i.e. education, health, drinking water supply and credit linkage.

Objective of the project: The objective of Village Adoption Programme is to develop the selected village in an integrated manner ensuring the holistic and integrated development of village through capacity building and participation of local people and institutions.

Location: Lahbera Village in Jharia block of Dhanbad district

d) Construction of PCC/Bituminous road - Understanding the importance of Road BCCL had Constructed PCC Roads in and around eight villages of the BCCL command area. Roads are of vital importance to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty. They open up areas of economic and social development.

Objective of the project: Enabling and increasing the connectivity from semi-rural to urban areas by constructing PCC Road.

Location:

SN	Name of Village/Area	Construction in Km/Meters
1	Kacharra Arah Tola , Hatudih Panchayat	400 meters
2	Lahbera Village	1.5 Km
3	Aamtal Village, Aamtal Panchayat (Kusunda)	1.5 km
4	Satitand Village, Bauakala Panchayat (Kusunda)	500 meters
5	Padugora Village, Padugora Panchayat (WJ area)	400 meters
6	Kandra Village, Kandrta Panchayat	500 meters
7	Bakaspura Village, Luti Pahari Panchayat	400 meters

CHAPTER 2 – RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it, one studies the various steps that are adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter outlines the research methodology and also examines the objectives of the study and the research question. The chapter also includes the research design, methods, and level of engagement for data collection, on and off the field. The stage of data collection has also been explained in the chapter with a subsequently the steps utilized to analyze the data that is already collected from the field.

2.1 Objective of Study

The very purpose of the research is to discover answers to the question through the application of the scientific procedures (Kothari, 2004). The aim of the study was to understand the extent of the impact of projects on the socio-economic conditions of the targeted beneficiaries.

The Impact Assessment was conducted on four major projects namely:

1. Mobile Medical Van (MMV),
2. Scheme for multipurpose utilization of abandoned mine water (MUMW),
3. Road Construction, and
4. Labhera village adoption project (LVA)

Therefore the objective of each project has some variation from the other even though having that the main objectives were as follows:

i. To Analyzed the key impact areas of the project
ii. To Analyzed the extent of impact on the beneficiaries
iii. To suggest recommendation for improvement for the project.

2.2 Research Design

The research design refers to the overall strategy that one choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring one will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data (De Vaus, 2001)

This study is an **Evaluation** research study as it is designed to assess the outcomes of an intervention so that the findings will provide insights useful for the organizations that have funded and implemented the project. The study is an end line evaluation study, which implies that the findings would be useful if the Company intent to reintroduce the project.

The project undertaken for impact assessment studies were those which are implemented by the BCCL CSR and which covers a mixed chunk of populate spread across the BCCL Command area. As there were four projects that required studying, the research team had developed two research designs based on the project objectives and population covered. This study employs a mixture of Quantitative and Qualitative research methods to evaluate the key aspects of the two projects namely; MMV and MUMV. If one has to define mixed method research it can be 'In general, mixed methods research represents research that involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon.' (Leech N, Onwuegbuzie A, 2008). The study has attempted not just to generate summary statistics that reveal the overall performance of the projects but has also attempted to delve into the individual stories, histories, life experiences and psyche of the beneficiaries through intensive beneficiary-specific case studies (of selected beneficiaries. While conducting the study of MMV and MUMW the research team used two major tools for data collection mainly: Focused Group Discussion (FGD) and Household Survey (HH). These methods were felt appropriate by the research team as it helped in fulfilling the appropriate size and appropriate response.

Simultaneously a different research design was formed for studying the impact of LVA and Road Construction. The qualitative research design enabled the research team to understand the impact of project in their daily life. Along with it, the project had limited beneficiaries that provided the research team with the opportunity to study and to understand the lived narratives of the beneficiaries and also the impact of LVA and road in their day to day life.

2.3 Tools for Data Collection

The tool is one of the essential components of a research study. It is an instrument that helps the researcher to meet the objectives of the research. There are various kinds of tools that are utilized based on the needs and objectives of the research. In the current study the research team undertook certain sets of tool they are listed below;

Major tools involved in the study were:

i. **i. House Hold Interview (Survey) (HHI)**: As a few projects had greater coverage in terms of area and population the household survey was used to get details from the identified villages and areas/panchayats

ii. **ii. Focused Group Discussion (FGD):** FGDs where conducted in all the four project, and the interviewers for the FGD was the village members, Ward/Gram Panchayat Representative, ASHA, Women Representative, SHGs Group Women's, Youth group member etc.

iii. **iii. In-depth Interviews (IDI):** Similarly IDI was conducted with village members who were directly affected by the project

iv. **iv. Case studies:** Case studies were used to get life narratives of the beneficiaries and to understand the impact of the project on their socio-economic and cultural lives

v.

2.4 Data collection methods

The sampling type used for data collection was stratified random sampling method. **The primary data** was collected using the following methods, selected as per the above-explained research design:

a. Survey of beneficiaries through questionnaire
b. Semi-structured interview (using interview schedule) and In-depth interviews. The in-depth interviews were open-ended with complete scope for probing and getting detailed information from the participants.
c. Participatory research methods such as transect walk
d. Document analysis (review of project reports)
e. Direct observation (home visit, village/town visit and institution visit)

2.5 Participants of Data Collection

This study emphasizes the obtaining of perspectives from multiple stakeholders. Accordingly, the following participants and stakeholders were covered through the data collection done in this study:

i. Beneficiaries, i.e. people impacted by the project

i. ii. Higher authorities of BCCL, Area GM, Medical Officers

ii. iii. Village level stakeholders (Community Leaders):, Sarpanch, ward members and former Sarpanch

iii. iv. Project In-charge appointed by BCCL (CSR officials) – the monitoring authority involved in the project

2.6 Sampling with Location for Data Collection

Table 1 – Showing sampling of Multipurpose Utilization of Mine Water (MUMW) through Household Survey

Sr No	Village Name	Block	District	Sample Achieved
1	Darda	Baghmara	Dhanbad	82
2	Sidhwatand	Baghmara	Dhanbad	65
3	Behrakhurd	Baghmara	Dhanbad	34
4	Nisithpur	Baghmara	Dhanbad	82
5	Konati	Baghmara	Dhanbad	93
			Total	**356**

Table 2 – Showing sampling of Mobile Medical Van (MMV) through Household Survey

Sr No	Village Name	Block	District	Sample Achieved
1	Karma Tand	Chandrapura	Bokaro	13
2	Patra Kuli	Chandrapura	Bokaro	8
3	Uper Devghara	Baghmara	Dhanbad	15
4	Chhatawad Kailudih	Baghmara	Dhanbad	10

5	Power House	Dhanbad	Dhanbad	26
6	Madhuban	Baghmara	Dhanbad	13
7	Rathtand	Baghmara	Dhanbad	10
8	Chanchpotri	Agra Khurd	Dhanbad	12
9	Barora	Kulti	Bangal	25
10	Mohlidih	Katras	Dhanbad	20
11	Khanodih	Baghmara	Dhanbad	6
12	Bhim Kanali	Baghmara	Dhanbad	3
13	Bakaspura	Baghmara	Dhanbad	10
14	Bhagabandh	Dhanbad	Dhanbad	19
15	Manjhla Dih	Dhanbad	Dhanbad	19
16	Bhatdih	Jhariya	Dhanbad	19
17	Manpur	Chandan Kyari	Bokaro	19
18	Amlabad	Chandan Kyari	Bokaro	19
19	Sona Nagar	Baghmara	Dhanbad	14
20	Mandal Kedwari	Baghmara	Dhanbad	9
21	Gudri Bera	Baghmara	Dhanbad	18
22	Southari	Dhanbad	Dhanbad	19
23	Betenga bandh	Dhanbad	Dhanbad	12
24	Kari Tand	Dhanbad	Dhanbad	7
25	Basjoda	Dhanbad	Dhanbad	24
26	Lavera Manjhi Tola	Jhariya	Dhanbad	20
27	Ranguni	Baghmara	Dhanbad	18
28	Bangali Kothi	Baliyapur	Dhanbad	20
29	Aamtalbauritola	Baliyapur	Dhanbad	18
30	Nunudih	Jhariya	Dhanbad	20

31	Idgah Pathar tola	Jhariya	Dhanbad	20
32	Pathaldih(Pandiya Tola)	Jhariya	Dhanbad	18
			Total	**503**

The Data collection for Lebhara and Road construction were through FGD where the research team intend to capture the live narrative of the beneficiaries impacted by the project, therefore in FDG the interviews mostly consisted of Sarpanch, Village members, Women Representative, Senior citizen, Children, youths and BCCL higher authorities

2.7 Data Analysis

As previously mentioned, this study employs a mixture of qualitative and quantitative methods. Accordingly, SPSS was used for the quantitative data analysis of the study (such as the analysis of the responses of closed-ended questions in the questionnaires). The responses from the in-depth interviews and the other qualitative data were subjected to coding for detecting patterns. The data from interviews and discussions were analyzed **thematically,** and the data from all the sources was integrated as per the responses to understand, assess and evaluate the entire process of implementation. Being a qualitative study, there was an emphasis on understanding and analyzing the perceptions, views and experiences of the beneficiaries and other key stakeholders with respect to the scholarship project.

2.8 Challenges of the study

1. Language Barrier: The major hurdle in data collection was the language barriers, few of the villagers were speaking Bengali, and few were oddia.

2. Limited documentation: The Limited documentation of CSR project was another hurdle faced by the research team as it had to completely rely on primary data. Most of the employees working on the projects were mostly retrained and even in a few projects, documentation was not available.

CHAPTER 3 –MOBILE MEDICAL VAN (SWASTHA RATH)



3.1 Introduction

Health is an important aspect of human life; it plays a very vital role in our social, economic and other spheres of our life. The better the health, the better the other factors. Mobile Medical Van or Swastha Rath was one of the popular projects that aimed at treating the general illness in the command area population of BCCL. The project was initiated with only 2 Mobile Medical Van in 2009, had now covered more than 203 villages with 14 Mobile Medical Vans. The staffs in the van consist of the doctor, paramedical staff and a driver to provide free consultancy and medicine for general illness.

3.2 Objectives of the Project

The objective of the project was to provide medical health facilities with a focus on identification, screening, diagnosis and treatment of general illness by providing free consultancy and medicine.

3.3 Locations of project

The project location covers the command area of BCCL. This includes rural, semi-rural and urban areas. Following is the list of villages and town where the Swastha rath facility is being provided.

Table 3 – Showing list of villages covered under Mobile Medical Van services (Swastha Rath)

SN	Name of Area	Name of Village
1	BARORA	1. PatraKulh 2. Karmatand 3. Manpur 4. Amlabad
2	BLOCK-II	1. Rath Tand Basti 2 Bakaspur Basti 3. Mahato Tola Bhim Canali Basti 4. Khanudih Basti
3	GOVINDPUR	1. Chhatawad Kailudih, 2. Uper Devghara
4	EJ	1. Lavera Manjhi Tola 2. Idgah Pathar tola
5	WJ	1. Moonidih Basti 2. Bhawardaha Basti
6	WWD	1. Southari 2. Betenga bandh 3. Kari Tand
7	KATRAS	1. Alakdiha 2. Mohlidih
8	SIJUA	1. Pandeydih Basti
9	KUSUNDA	1. Lahbera Basti 2. Rawani Basti
10	BASTACOLLA	1. Sonar Basti. 2. Amtal Basti 3. Bangali Kothi
11	PB	1. Surguja Basti 2. Kaligarh Basti
12	LODNA	1. Nunudih Basti 2. Bhatdih
13	CV	1. Bhatnidih 2. Dispur Basti

3.4 Impact of the project on community

i. Door to door accessibility of health service

Due to the lack and poor health services most of the people in the command face difficulties in accessing the health services as services in government CHC, PHC are not up to the mark. The people used to do self-diagnosis and just randomly take medicine from the pharmacist without any proper consent from the doctor and which

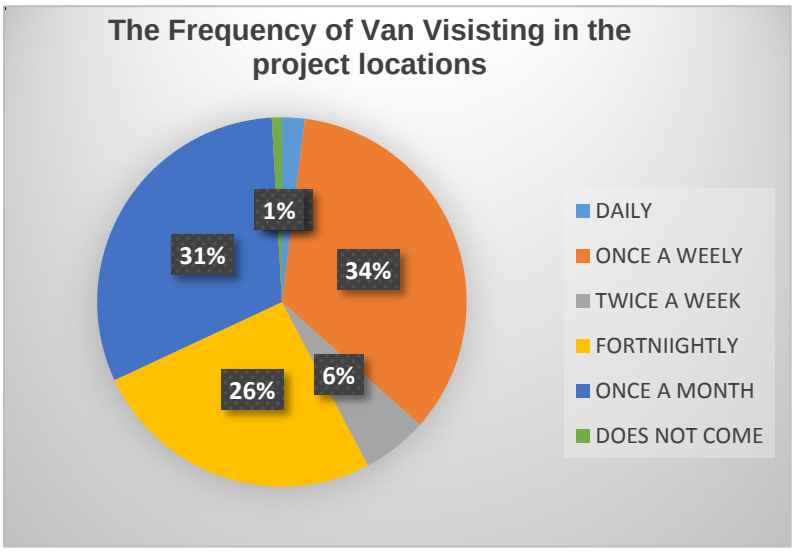


Figure 1 – Frequency of Van Visiting in the project locations

eventually seems to be one of the major cause for the adverse impact on their health. To avoid this and provide basic health care service to the people in the command area of BCCL, Swastha Rath was introduced. The Swastha Rath used to visit at least twice in each village. The respond gathered from the respondent through FGD and HH shows positive impacts of the project on the people in terms of the door to door accessibility of the project.

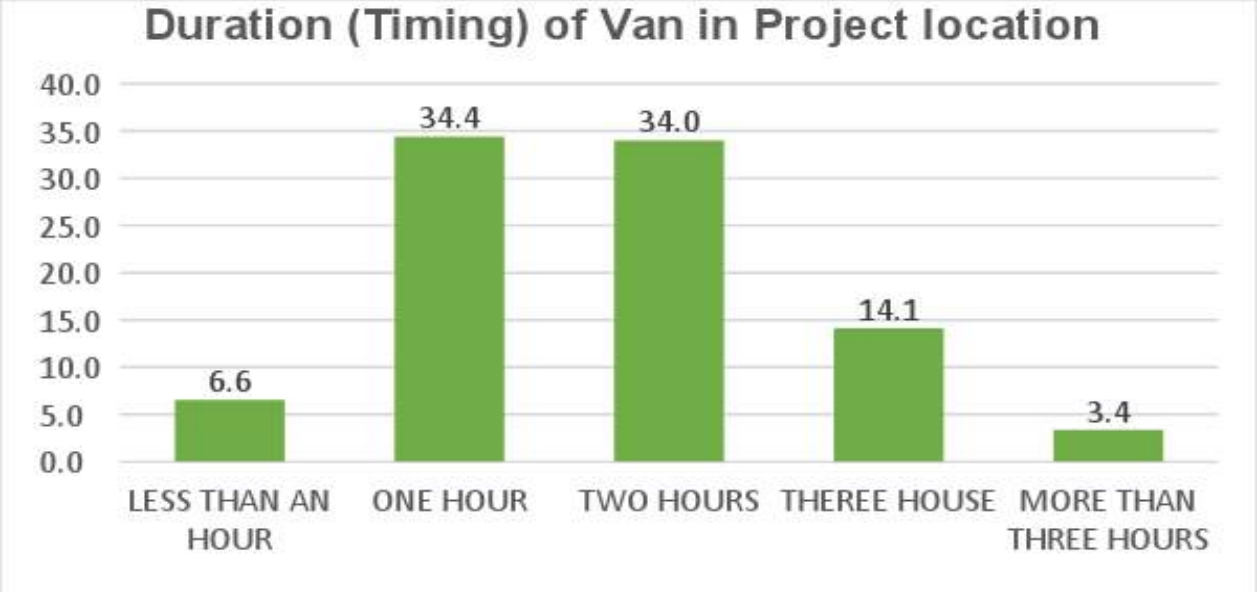


Figure 2 – Duration (Timing) of Van in project location

When interviewed, out of 503 respondents, 93.4 per cent responded that the medical van used to halt on fixed locations. Around 54.9 per cent people reported that the Medical Van had fixed timing and date of visits, which was informed by the Mobile Medical Team prior to its arrival. The locations were selected by keeping in mind the centre point of the villages or near the vital resource area of the villages such as Samaj Mandir, panchayat office etc. 70 % of respondent reported that the Swastha Rath used to wait at least 1 to 2 hours in each village making sure that all the people approaching them are checked and medicines were provided.

When interviewed people regarding the satisfaction of the duration of stay of van in their villages, 47.9 per cent people reported that they are satisfied by the duration (Time) of the van in their villages. Whereas, around 44.1 per cent people responded that they are not satisfied by the timing of the van. Similarly, around 92.8 per cent respondent reported that the location of Swastha rath was easily accessible by them as well as by their family members.

ii. **Filling the gap in health service**

Health is a primary and essential need of human being. It plays an important role in human life. The government hospital lacks in quality health care, infrastructure and accessibility because of which people mostly avoid going to the government-run hospital. To avoid this and provide basic health services, BCCL started Swastha Rath which aims in providing basic health service at the doorstep. Also, the service has enabled people to get access to basic health services at free of cost. Thus the service was a boon to the villagers.

Availability of health services

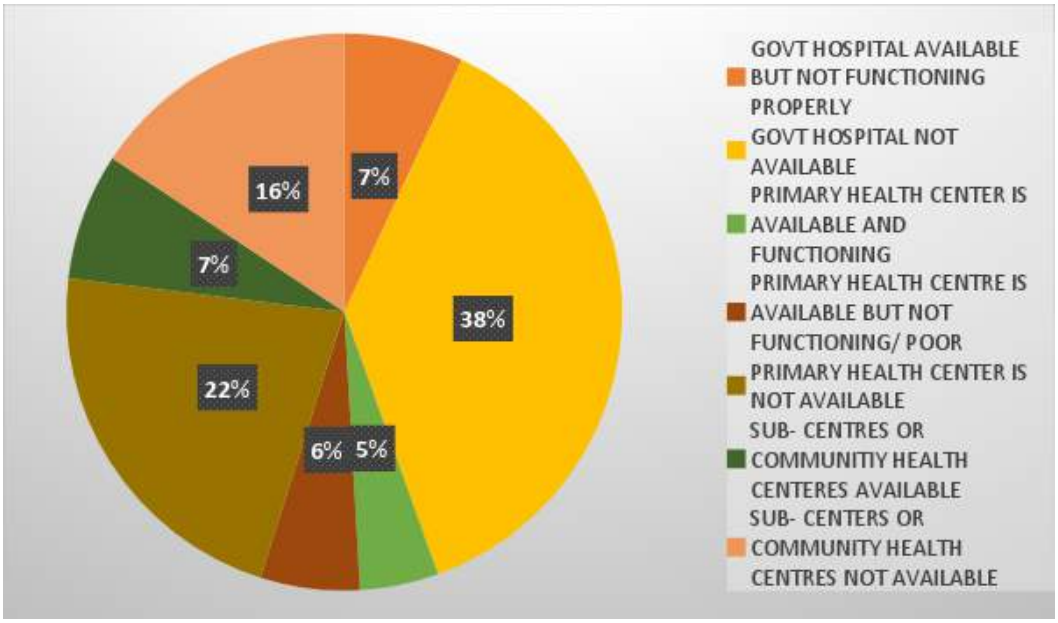


Figure 3 – Availability of health services

The above figure was derived by interviewing 505 households, out of which 38 per cent beneficiaries reported that government hospitals are not available, 22 per cent reported non-availability of primary health center and 16 per cent reported government hospital available but not functioning. Around 90 per cent respondent responded saying the nearest government heath care center is around 6 to 8 km away from their villages. Besides that, one of the major hurdles in reaching the health centre is the non-availability of adequate road infrastructure.

Around 95 per cent of people reported that the roads leading to the PHCs, CHC and Government hospital are mainly kaccha and thus is inaccessible. Therefore by understanding and analyzing the needs of the people regarding health services, BCCL felt the need of starting the Mobile

Medical Van called *Swastha Rathi* that would aim at providing primary health care service to these needy and disadvantaged group on their door step at free of cost.

iii. Awareness about health and hygiene :

Awareness generation was one of the core aspects of Swastha Rath. The MMV team used to provide information regarding healthy surrounding, general cleanness, tuberculosis, maternal and child health care, hygienic water consumption and hygienic sanitation. Many respondent also reported that the team used to practice healthy habits so that people can easily understand. Besides that around 95 per cent people knew that the swastha rath was run by BCCL. And in that around 29 per cent people reported that they came to know about this by seeing the BCCL name on the van.

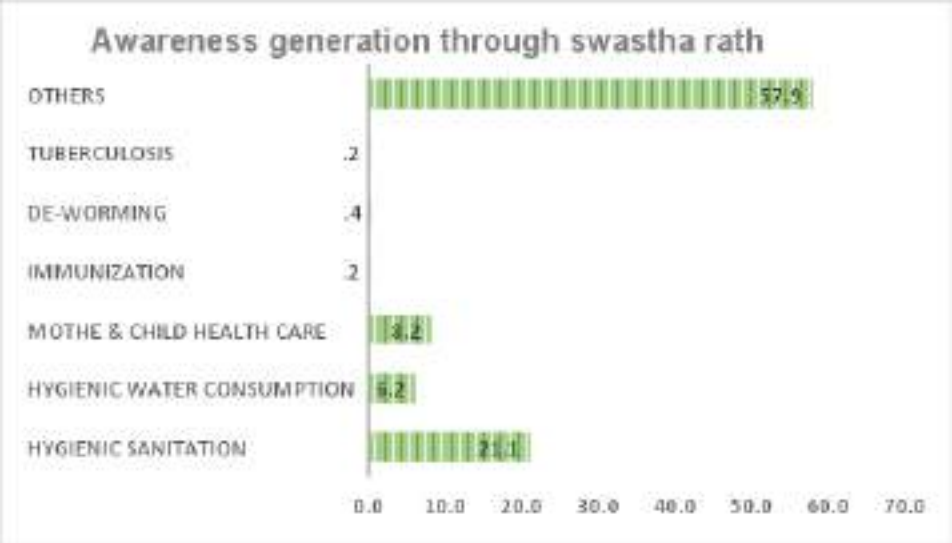


Figure 4 – Awareness generation through swastha Rath

iv. Reduce Economic Burden

Most common disease reported in the region is fever, cough, cold, anaemia, diarrhoea, and skin infection. Since there is no availability of medical services in the entire region, the villagers have to suffer a lot. The average income of the household were not good as the villagers are mainly engaged in agricultural work or work as a labourer. So, their

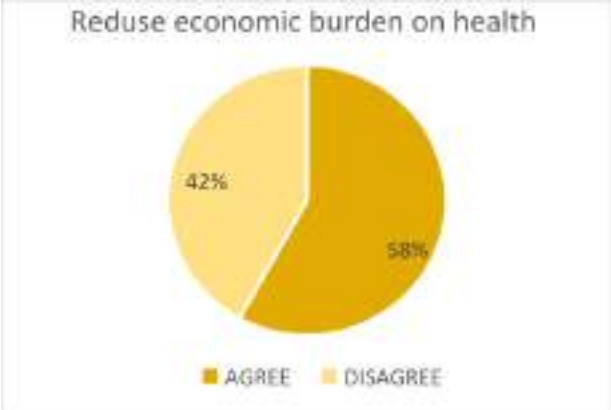


Figure 5 – Reduction in economic burden on health

earning is not sufficient and somehow people manage to survive and fulfil their basic needs. And if someone from family falls ill, then it's a significant economic burden on them to buy medicines because they have to go private hospitals or privately run clinics to purchase medicines even for normal fever or a cough and cold. Therefore, they are thankful to Swastha Rath for providing them medicines and eventually reducing their economic burden.

v. Addressing the health needs of people

Health care services in the entire region are dismal in terms of accessibility, infrastructure and quality. There are only a few Sub Health Centres in the entire area which is functional, but due to lack of such basic medical facilities, people were forced to travel at least 5 to 10 km to avail such medical facilities. Besides that, the transportation system is also very expensive and so accessing the existing health care facilities, which is at a quite long distance, becomes a crucial issue for the villagers. So, Swastha Rath was great hope for them as they are getting services at their doorstep without paying a single penny; in fact, it's saving their money and time as they are getting free services and medicines and also saving their travelling time and transportation cost.

Major ailments in the families

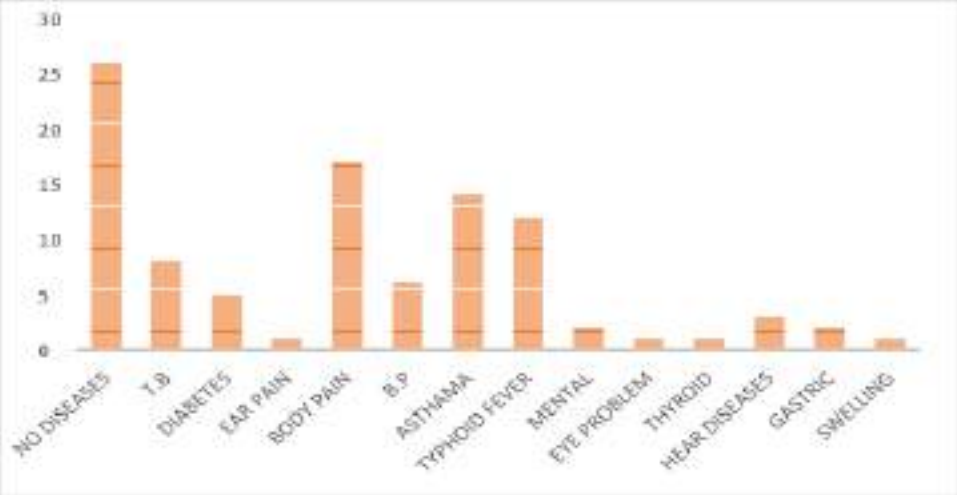


Figure 6 – Major ailments in the families

The major ailments that were reported by the respondent were Body pain, Asthma and Typhoid. When asked further, the respondents replied saying that the working environment and the pollution caused by the open cast mining illness such as respiratory tract infections have had an adverse impact on their health.

vi. Reduction in sickness

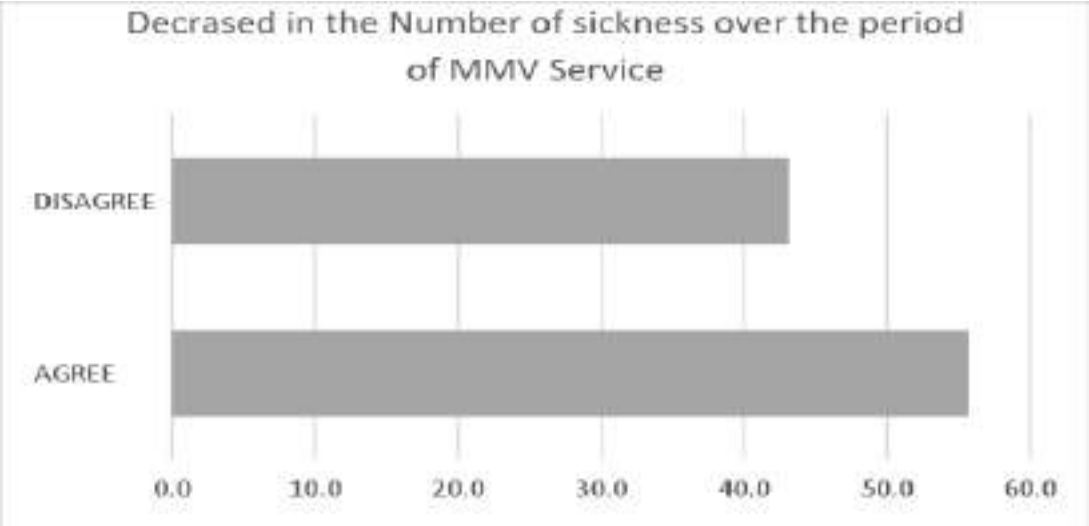


Figure 7 – Decrease in number of sicknesses over the period of MMV service

The above graph shows that 56% of the beneficiaries agreed about the fact that there was decrease in occurrence of sickness over the period of MMV services. While 44% beneficiaries disagreed about this fact.

3.5 Gap identified in the project

a. Limited Regularity of Swastha Rath

Even though the intention of the project was noble, but the regularity was the big hurdle in proper implementation of the project. The Swastha Rath had the target to visit the villages at least twice a month, but during the study it was identified that a few of the places were kept untouched by the project and these areas were mostly near to the colliery areas. As mentioned above around 34 per cent people reported that the Swastha Rath visits once in a week and 31 per cent people reported that it used to report once in a month. The reason for the same reported by medical team of BCCL was availability of limited number of vans. Each BCCL area had only 1 to 2 Swastha Rath. It becomes difficult for the doctors and also to the staffs to reach all the

villages, as each area only gets a van for only 15 days and thus this also limits their accessibility in terms of reaching all the villages.

b. Limited Awareness campaign

In spite of having awareness campaign as the core idea of swastha rath around 93 per cent of people reported that no such awareness campaign has been done by the Swastha Rath. Whereas only 7 per cent of people reported that awareness campaign has been conducted by the Swastha Rath

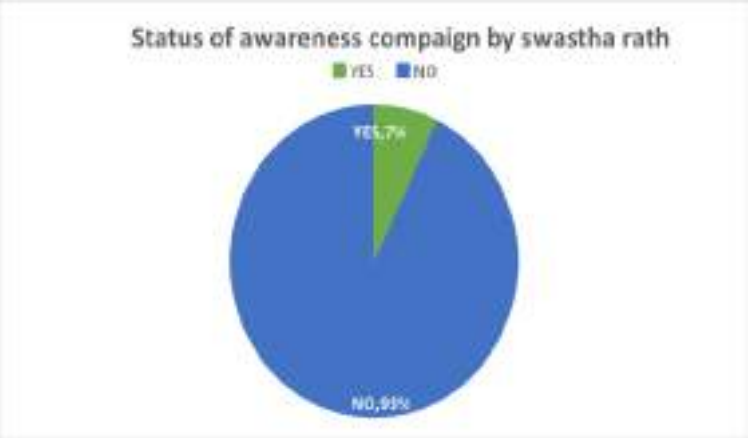


Figure 8 – Status of awareness campaign by Swastha Rath

c. Limited Health Services

The Basic/Primary health services is very limited that is only free health checkup and medicine supply. In some villages, it was also found that the doctor used to visit sometimes and only the pharmacist and the driver use to go and distribute the medicine without any proper diagnosis process being followed. In addition to that blood pressure check and weight checkup were not conducted. At the village level, there was no appointed person who could look after the health services in absences of Swastha Rath. Around 99 per cent people raised the concerns stating that there is scope for improvement and enhancement of the Swastha Rath. 3.6

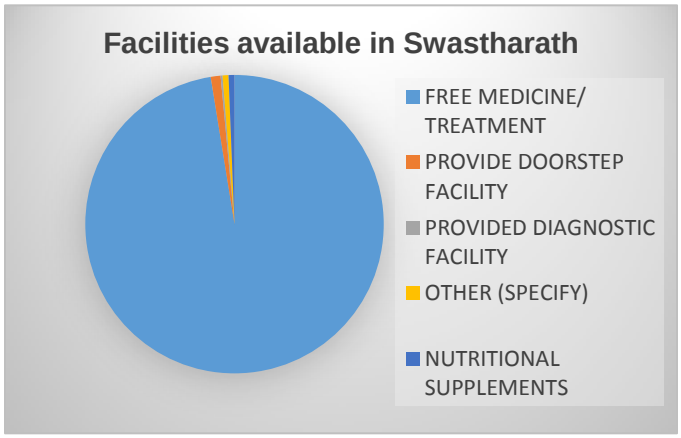


Figure 9 – Facilities available in Swastha Rath

Multi-stakeholder Perspective on Swastha Rath

a. **BCCL Officials:** BCCL being a responsible corporate in Dhanbad region had always been active in providing basic health services to the people of the company's command area since a long time. Therefore BCCL started Swastha Rath with the intention of providing basic health care service in the remote areas for those who are unable to access them or afford them. Besides that, the company aims at creating general awareness about health and hygiene. The Project was run in 206 villages and has targeted more than 2 lakhs people.

b. **Village People:** The Swastha Rath was very useful. It has helped the villagers in many ways. The accessibility of health care has increased as medicines and treatments are being provided free of cost at their doorstep. The economic burden has been reduced. Now people neither travel nor go to the private hospitals and clinics. At the same time, the cost of the travelling is also being saved. Along with this various awareness campaign are conducted wherein the people are being provided with the informations regarding health and hygiene.

3.6 Beneficiaries' point of view on Swastha Rath

3.6.1 Vinay Bhal, 49 year old: a resident of fulwar basti is a laborer in coal mine says "Since the time Swastha Rath had started coming we are very happy because we are staying here for a very long time and health is the major problem that we are facing. The nearest Sub-centre is around 8 km away and that too is not in good condition. It was difficult for us to travel so long, with no other option left, we used to go to local pharmacy and tell them our sickness, and accordingly they use to give us the medicine, and we use to have it. Swastha Rath comes in the village twice a month and provides us medicines free of cost. They treat us all. The doctor behaviour is good. He checks us and also make us aware of the health and hygienic conditions in we should dwell. Since Swastha Rath started coming to our village, our money is being saved and also the medicines are effective".

3.6.2 Meena Rahman 25 year old, resident of Amlabad village says: "Coming from a poor background we are unable to afford to go to private clinics or hospitals. The nearest government Sub-centre is around 7 km away. From where do we bring the money? We work as a wage earner. There is no guarantee of the job. We would get tomorrow or not, we don't know. Thanks to BCCL Swastha Rath! Since the time it has started coming to the village, the economic burden of health has been reduced. We get free treatment and medicines. The van comes twice a month and check all of us. Now we don't get worried so much as the van comes and check us and treat us for free."

3.7 Recommendation of the project

1. **Frequency of the Swasth Rath Should be Increased**

One of the most important demands that came from the public was that the frequency of the Rath should be increased. As it was supposed to visit the targeted villages twice a month, but as mentioned previously that the Rath was unable to visit a few villages. Similarly in many villages, the Rath only visited once in two to three months. Therefore the frequency of the Rath should be increased and should be available in the areas/ villages where it is needed the most and also the availability should be increased.

Frequency of Swastha Rath in Village

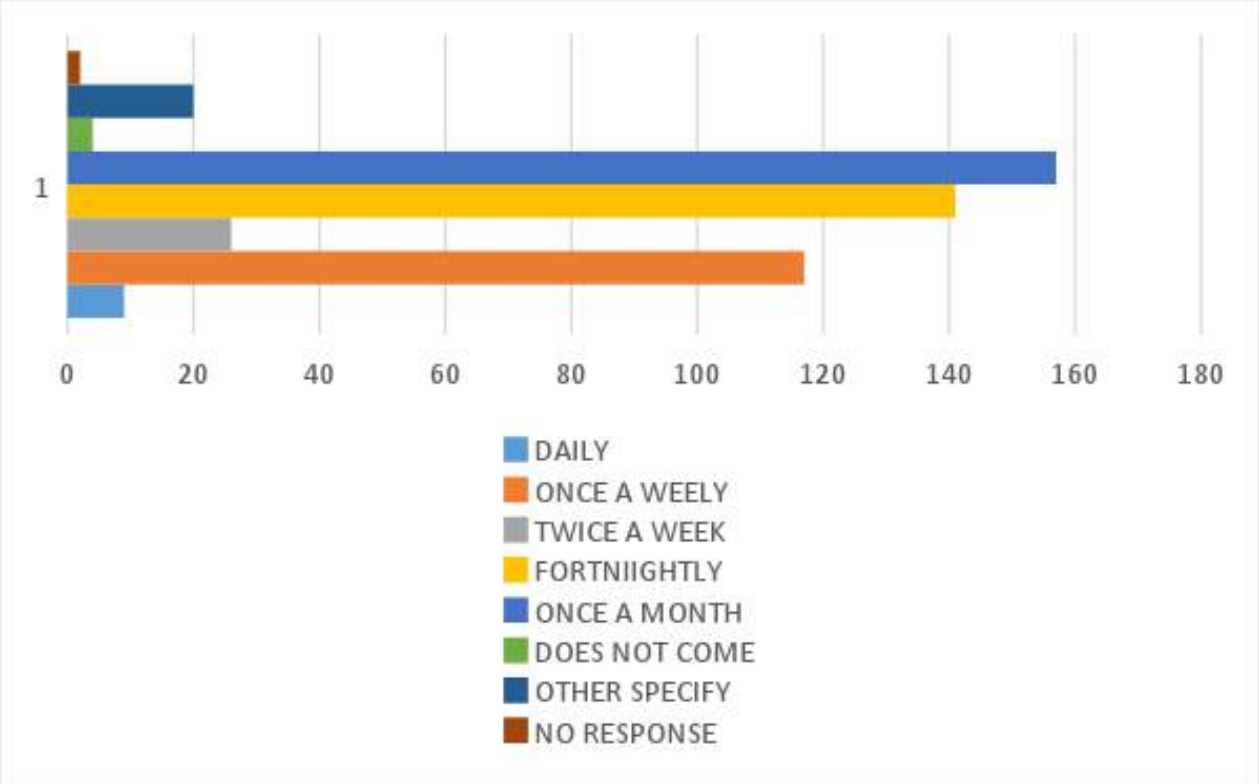


Figure 10 – Frequency of Swastha Rath

The above graph highlights that the frequency of Swastha Rath in the targeted village. Around 157 people responded that the Swastha Rath came once in a month, whereas 141 respondents reported that the Swastha Rath used to come once in fortnight. Again, around 117 people reported that every once a week the Swastha Rath used to come.

2. Need for female doctor and nurse

It was highlighted by the statistical data that out of 500 samples 99.8 per cent reported that there is a need for female doctors and nurses in the Swastha Rath as the women feel uncomfortable to open up their sicknesses in front of male doctors.

3. Need of a health worker at the village level

It is recommended that there should be a health worker appointed at the village level that would look after the health services and status of the village and subsequently could report to the nearest BCCL regional or area hospital. At the same time, medical stock should be provided to this appointed health worker, who in times of emergency could provide necessary medicines as per the need of the villagers.

ii. 4. Necessary Provision for Emergency

Around 98.5 per cent of people responded the need of emergency services in Swastha Rath, and this could be done by printing the emergency helpline number on the van so that during the emergency the people can avail the services.

iii. 5. Need of Additional Services

Additional services such as blood pressure check, BMI, Weight test and malnutrition test should be conducted and if significant issues found in the test results, then further treatment should also be provided to the beneficiaries by referring them to the nearby BCCL area hospitals.

CHAPTER 4 – MULTIPURPOSE UTILIZATION OF MINE WATER



4.1 Background of the project

Since its inception, BCCL has felt the importance of water and endeavoured for effective and gainful utilisation of mine water from abandoned mines which has to be taken out of course of mining process necessarily. For harnessing such water, BCCL has taken upon the task of holding the mine water into the water bodies by restricting them to flow into the natural drainage course like village reservoirs which gets dried during summers, by laying out a pipeline network of approximately 45 km.

With the help of this scheme, approximately 47 million gallon surplus mine water is presently being discharged into natural water courses from the mines of Barora, Block-II & Govindpur areas of BCCL. This water is being stored in two reservoirs situated in Khonathi and Behrakudar villages with storage capacities 16 million gallon & 31 million gallon and with area of about 4.0 ha & 4.5 ha respectively.

Under this scheme of BCCL, the farmers residing nearby and having their cultivation fields in reasonable proximity will benefit in carrying out their agricultural works, in all seasons, which at present is totally dependent on rainwater in monsoon.

This provision will certainly enhance the Socio-Economic status of the area and will also result in more opportunities in secondary & tertiary fields of employment. This water could also be used for drinking purposes after required treatment. In these reservoirs, Pisciculture could also be adopted with the help of self-help groups for their livelihood.



4.2 Objective of the project

To harness mine water for its gainful multipurpose utilisation in the peripheral villages of BCCL command area.

4.3 Location of Implementation

Two reservoirs situated in Khonathi and Behrakudar villages of Baghmara block of Dhanbad district.

4.4 Study sample details

Out of the 352 samples collected by the research team in the villages near the two ponds in Baghmara block, 72 per cent respondents belong to the OBC category while SC makes up 10.5 per cent of the sample studied. Again, 8.2 per cent are Scheduled Tribe and 7.4 per cent belong to the General category. Apart from these categories, a few samples from Nomadic Tribe and Denotified Tribe (around 0.9% each) were also taken into consideration for the study.

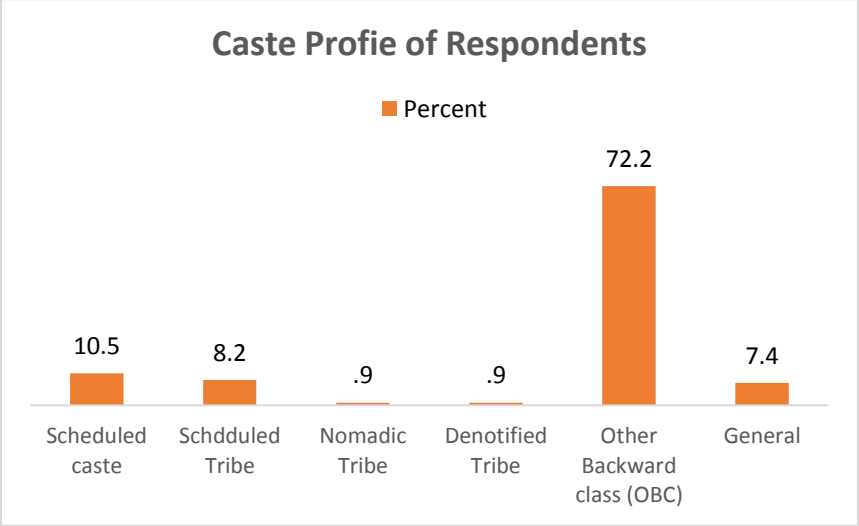


Figure 11 – Caste profile of respondents

42.3 per cent respondents reside in 'pucca' houses while 34.1 per cent resides in semi-pucca houses. 15.3 per cent respondents owned kutcha houses, and 8.2 per cent of the respondents reside in huts. Focused Group Discussions revealed that houses in the villages were not accurate depictions of income and wealth of respondents as the most of the houses were inherited which housed two to three families dwelling together, i.e. 10-15 people in a two bedroom house. Therefore, the respondents staying in houses made of brick and mortar do not necessarily have high-income sources. Electrification of the villages has been a success as 92.9 per cent of the respondents' houses were electrified although the electricity is supplied for 3-4 hours daily. Open defecation is an overarching phenomenon in the villages with 51.7 per cent of respondents opt for this option while 41.5 per cent use their pit toilets.

Private sources of water are scarce as 45.2 per cent of respondents rely on community hand-pump for their potable water needs. While the quality of water could not be ascertained, 38.6 per cent respondents boil the water as a method of water purification, 16.5 per cent respondents sieve the water, and 6.3 per cent do not do anything for water purification.

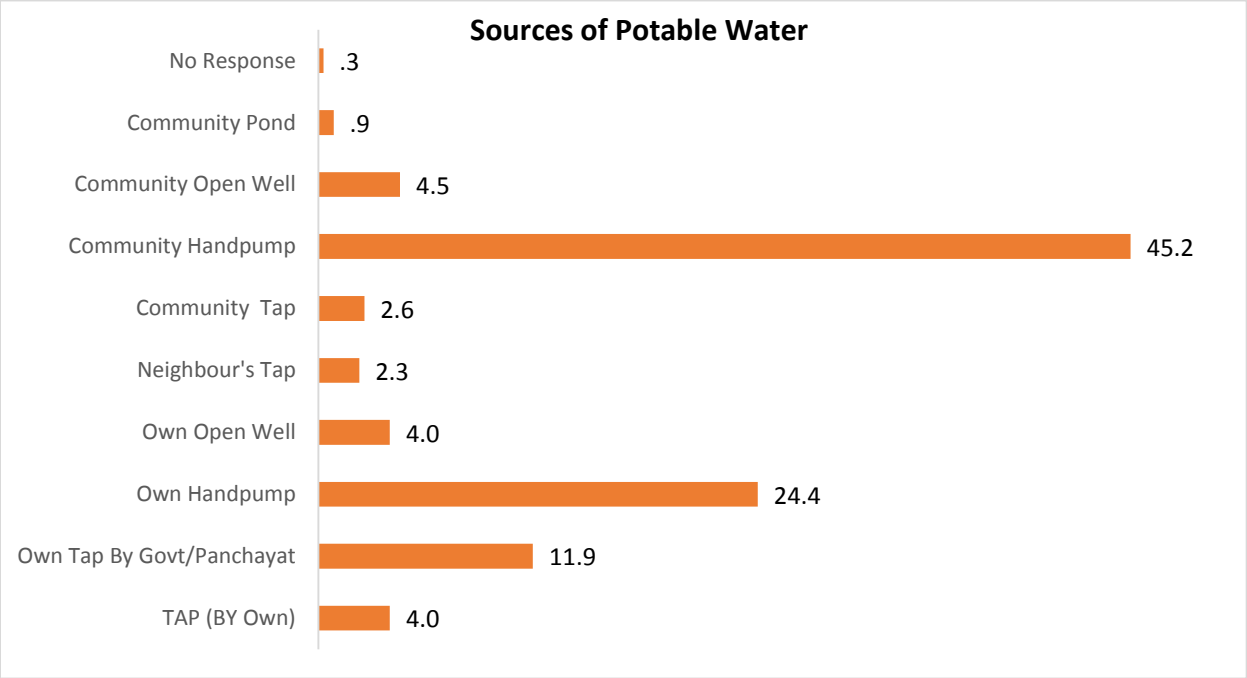


Figure 12 – Sources of potable water

4.5 Impact on the community

i. Use of Mine water supply for filling ponds

The respondents are compelled to use whatever water is available to them for their daily needs. To wash clothes, 49.4 per cent respondents use the mine water ponds while only 0.3 per cent respondents use the ponds for agricultural activities.



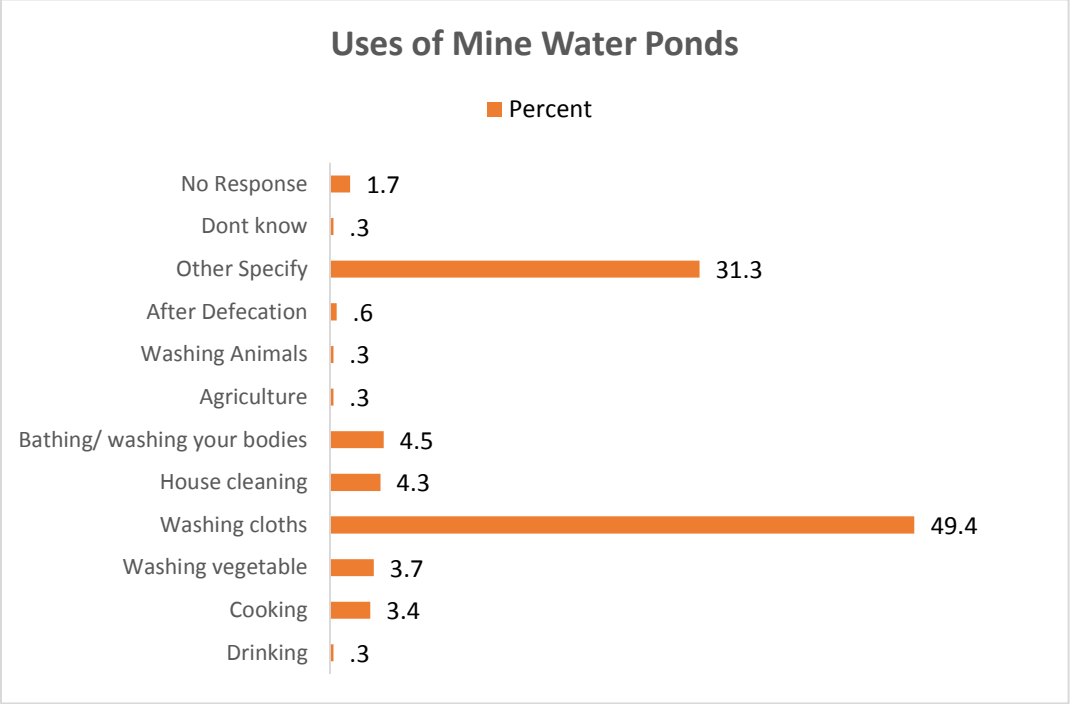


Figure 13 – Uses of mine water ponds

ii. Land holdings and irrigation sources



64.5 per cent respondents claimed they owned agricultural land while 35.5 per cent were found landless. According to the landed respondents, 35.5 per cent of them use the mine water pond for irrigation while 4 per cent have no sources of irrigation. Borewells near the farmland are another source of irrigation which is depicted in the 'other' category in figure no 14. The major crops grown by the respondents are paddy (65.3 per cent), vegetables (21 per cent) and maize (11.3 per cent).

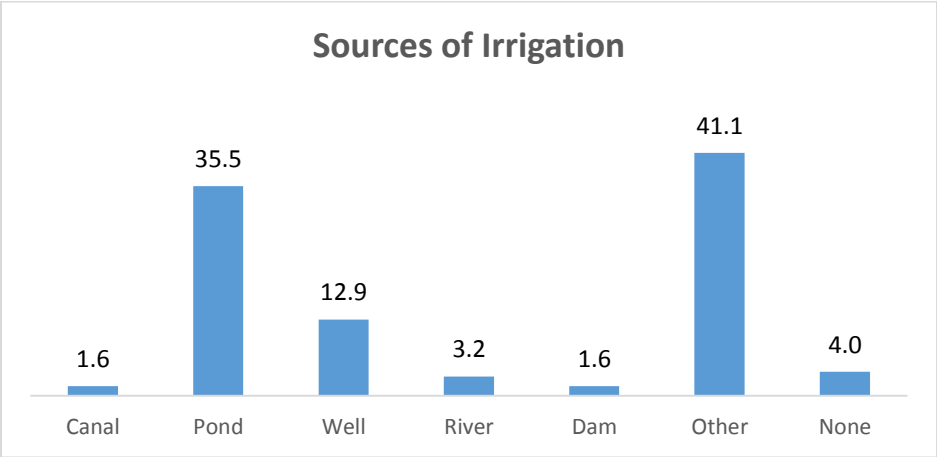


Figure 14 – Sources of irrigation

iii. Renovation activities of the ponds:

For the impact assessment study, it is primarily important to gauge the opinions and perceptions of the beneficiaries about the mine water ponds. BCCL has been operational in the Baghmara block for several years and has created a rapport with the residents of the villages. Therefore 59.1 per cent respondents knew that the mine water was drained into ponds. The respondents were enquired about the activities done by BCCL for the pond. 54.3 per cent of them knew that embankment or stone pitching was done around the bank, while 17 per cent knew that the *ghats*/stairs were constructed. 16.8 per cent respondents did not knew any of these activities, mainly due to the farther distance from the pond or not being present at the time, etc.

Table 4 – Beneficiaries awareness about activities done by BCCL for the pond

Activity	Percentage of respondent responses
Embankment or stone pitching around the bank	54.3
Inlet and Outlets	2.6
Ghats/Stairs	17.0
Repair	8.5
Don't know any of the above	16.2
Don't know	.6
No Response	.9
Total	100.0

Approximately 70 per cent of beneficiaries came to know about the renovation of the pond by physically observing the activities while 9.1 per cent came to know through the display boards put up by BCCL. Only 2.3 per cent were informed in the *gram sabha*.

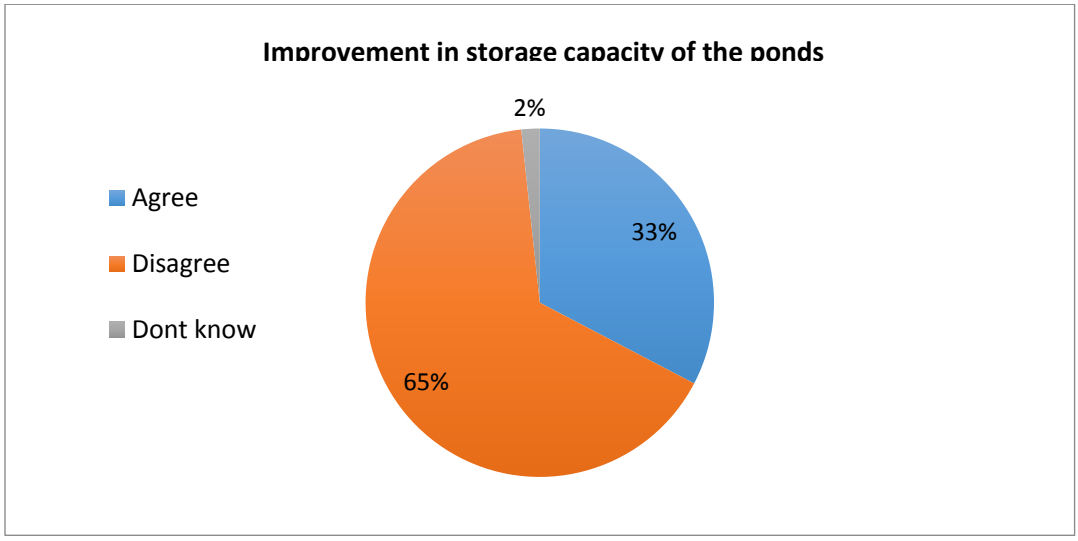


Figure 15 – Improvement in storage capacity of the ponds

It is of great importance that the beneficiaries are being involved in the planning process of a project so that their needs and problems are accounted during the intervention.



During FGDs it was found that heavy machinery such as excavators, loaders and trucks were used to finish the work in less than ten days as manual labour would have extended the time of completion of work to 30-35 days. It was also mentioned that the work in one of the ponds was proposed to be carried out in monsoon. But due to monsoon, the pond was full of water and therefore many areas in the pond was left unexcavated.

4.6 Gaps Identified

i. Minimal improvement in storage capacity

During the discussions, it was discovered that the ponds lie in the natural catchment area of rainwater, therefore, the water in the ponds did not dried up during the summer season before the renovation.

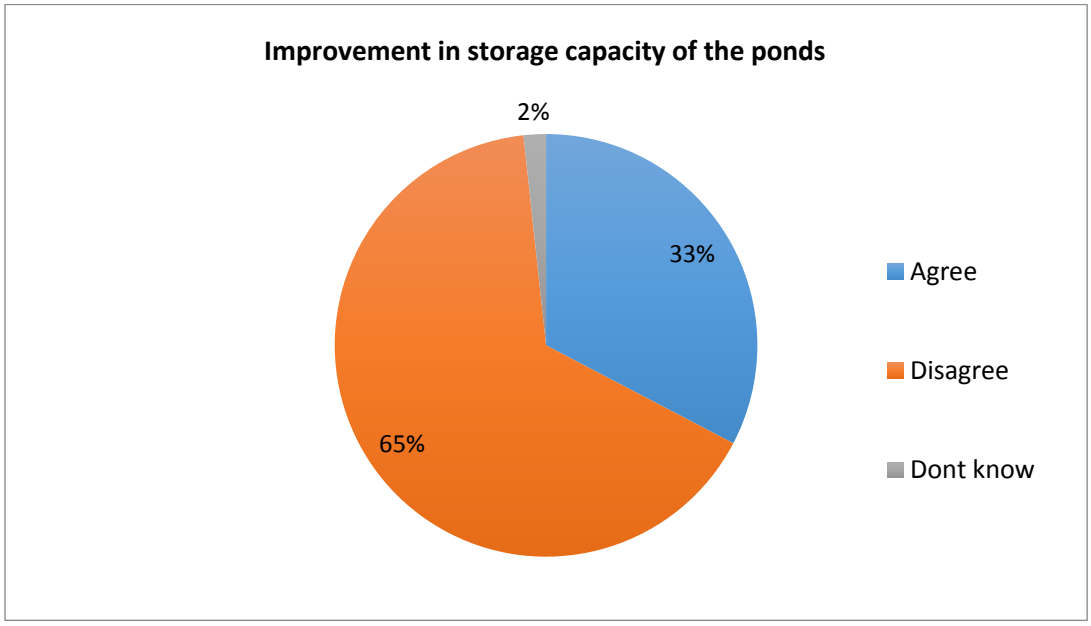


Figure 16 - Improvement in storage capacity of the ponds

Even though the ponds do not dry up, the water is scarce and the population depending on it for routine activities is increasing every year. Respondents also shared that they have to skip bathing for many days so as to preserve water for cooking and drinking. Therefore, 65.6 per cent of the respondents disagreed when asked about the improvement in storage capacity after the renovation of ponds. Also, as evident in Figure 17, 69.3 per cent respondents states that the scarcity of water has not reduced.

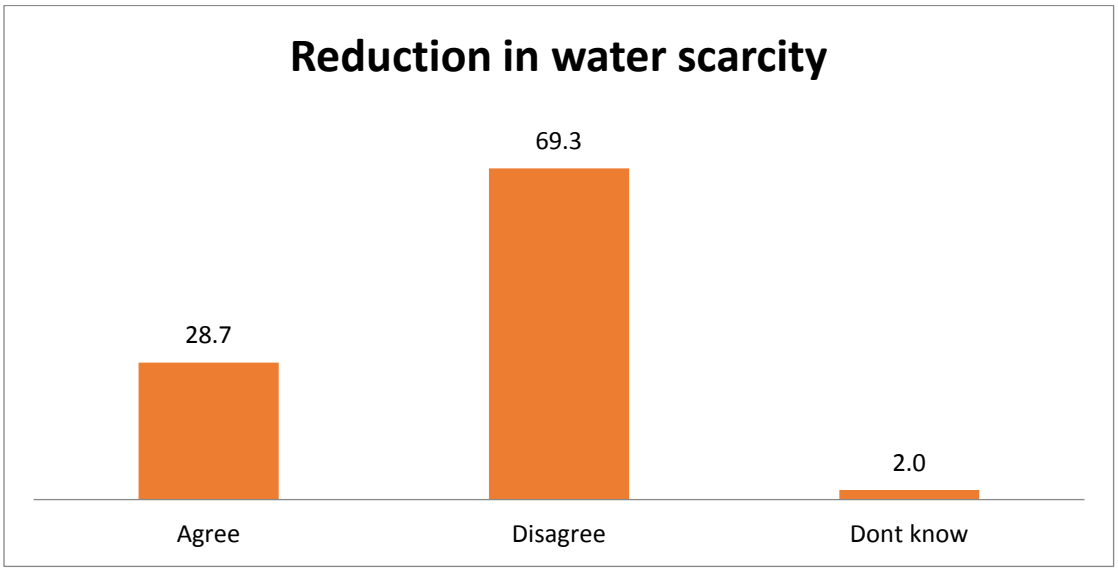


Figure 17 – Reduction in water scarcity

ii. Lack of employment generation activities

Employment generation would have been an important gainful use from the ponds as duckery and fishery activities were proposed in the project. But 92.3 per cent respondents feel that no new job opportunities have been created with the renovation of the ponds.

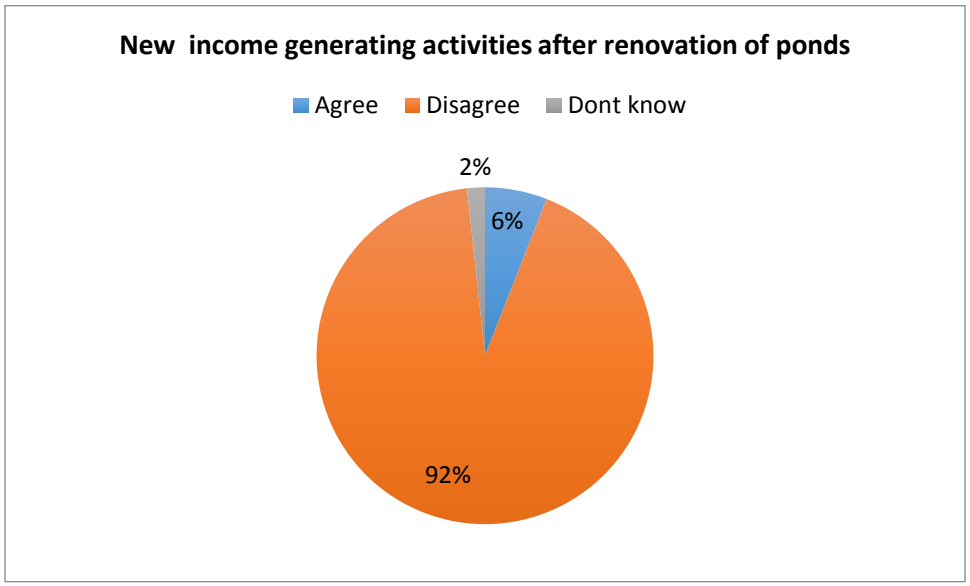


Figure 18 - New income generating activities after renovation of ponds

The respondents also stated their concern to the research team that these gainful activities are being carried out by contractors for their profits, and therefore, the villagers are unofficially banned from carrying out these activities.

iii. Minimal increase in agricultural production



Further, 86.6 per cent respondents believe that the pond has not aided in critical irrigation requirements as there are farmlands of hardly four to five farmers near the pond. Most of th e farmlands are significantly at greater distances. In such cases, the cost of machinery to lift the water to these far away farms is high that residents avoid taking water for irrigation from these ponds. Therefore, the number of crops grown per year by most of the respondents has also remained unchanged after the renovation of ponds.

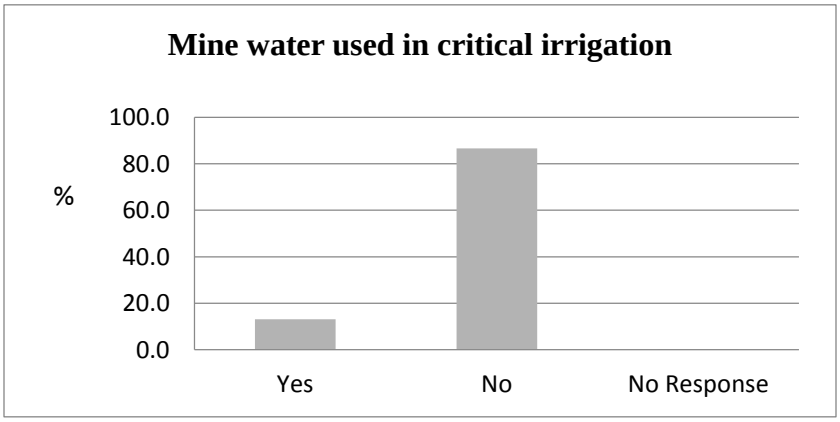


Figure 19 – Mine water used in critical irrigation

As per 90.3 respondents, agricultural production does not happen beyond personal consumption. As a result, the small and marginal farmers go to cities in search of work at least 15 days a month in order to feed their families.

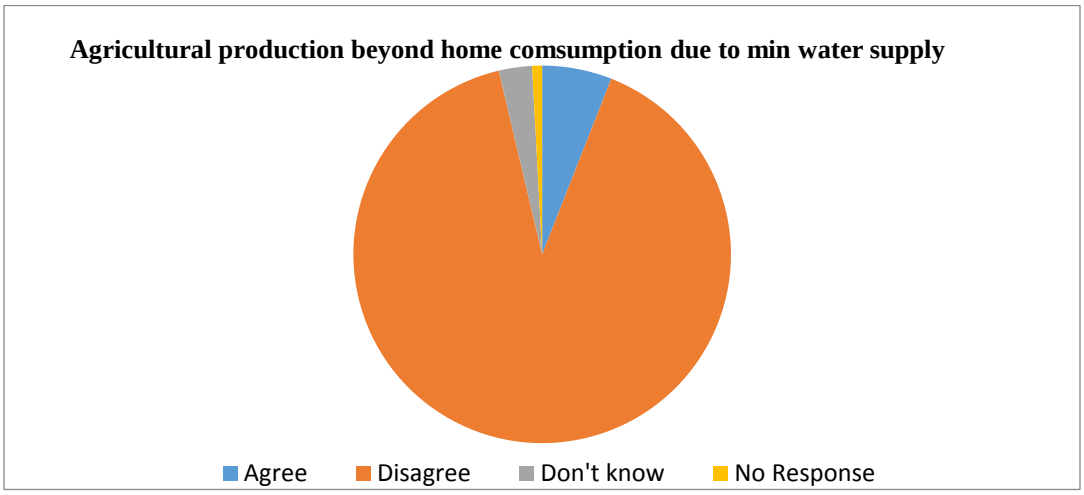


Figure 20 - Agricultural production beyond home consumption due to min water supply

Therefore, when asked if there has been a cumulative increase in the income of the household post- renovation of ponds, 94.9 per cent of the respondents replied negatively.

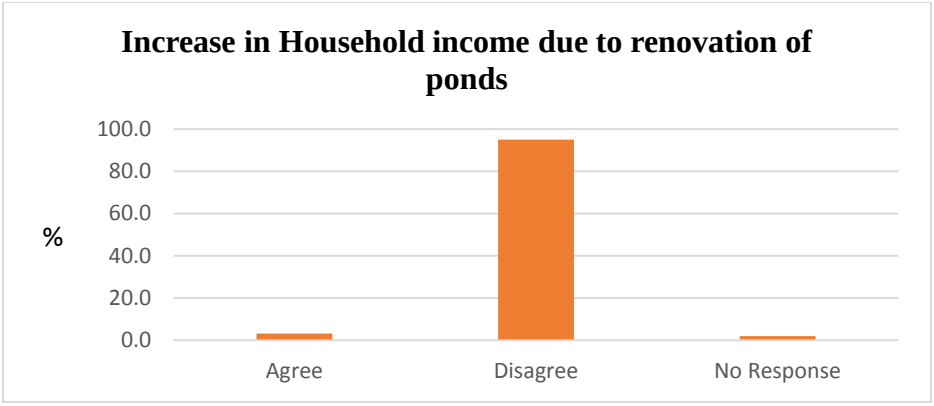


Figure 21 - Increase in Household income due to renovation of ponds

iv. Irregular supply of mine water

Another motive of conducting the impact assessment of this project was to find out from the beneficiaries whether there is any need of improvement in the projects and in which areas. In FGDs, respondents overwhelming suggested that there is an urgent need for improvement in the project in terms of mine water supply. Officially, 70 per cent respondents did not know how often the mine water is being supplied, but 83.2 per cent respondents agreed that there should be a timely supply of mine water.

v. Lack of participatory planning

94.3 per cent respondents claim that no village meeting was conducted before the supply of mine water in the ponds. This highlights the lack of participatory nature of the activity. It can further be showcased when the respondents were asked regarding their participation through *shramdaan* (voluntary labour) and 84.9 per cent responded negatively. Apart from these concerns, 51.1 per cent of the respondents did not know who carries out repair and maintenance of ponds, while 8.8 per cent claimed that BCCL is responsible for the same.



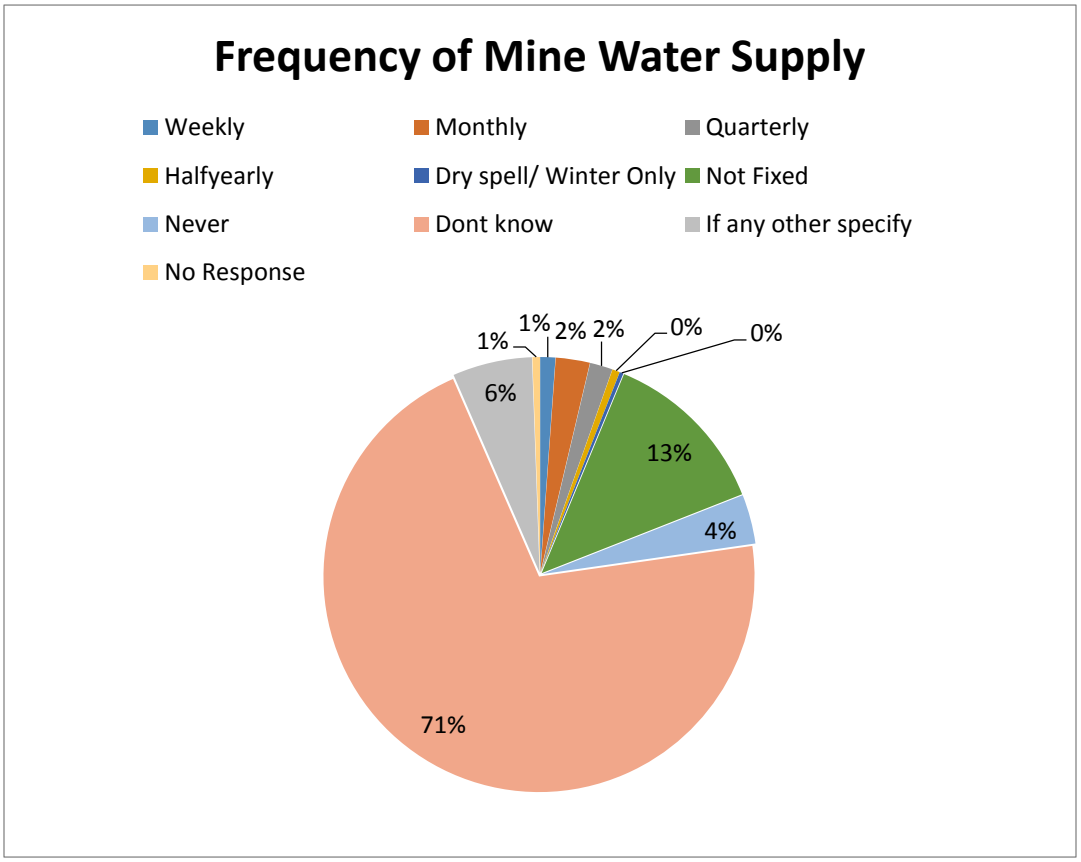


Figure 22 – Frequency of mine water supply

The respondents stated that since the renovation of the pond had taken place, only two or three times the mine water had been supplied. And eventually it was not sufficient for consumption by all the beneficiaries of the ponds.

Table 5 – Beneficiaries response on last supply of mine water.

Last supply of mine water	Percentage
Last three months	.6
Last six months	1.7
Last one year	9.1
More than a Year	47.2
Don't know	40.1
No Response	1.4
Total	100.0

It is of utmost importance to note that 94.3 per cent of the respondents want BCCL to resume supplying mine water to the ponds as they believe that even though there may be no short-term benefits of the project, long-term benefits will help the future generations in leading a better quality of life.

4.7 Recommendations

Due to various reasons, mine water supply to both the ponds has been halted for the past one year. According to the beneficiaries, they have not been able to reap any benefits from the projects. In the project proposal, 25000+ beneficiaries were identified who would be able to avail the benefits of the mine water supply project. However, it was found that only around 1000 families were able to use the ponds. Also, the project proposal had stated further highlighting that the beneficiaries would see a marked improvement in the household income after the pond renovation as they will be able to carry out multiple income generating activities. But as of now, the beneficiaries uses the ponds for only household consumption which was the case prior to the pond renovation as well. Overall, they insist that the mine water project was a fruitful venture but the supply of mine water is insufficient to bring about a change in their income or general quality of life.



Following are the main recommendations for the improvement of the Mine Water supply project:

- Participatory approach: Participatory project development is necessary to gauge the perception and needs of the beneficiarie,s and hence the project needs to be modelled around that.
- Pond upkeep: Repairs and maintenance of the ponds need to be carried out regularly with an immediate attention to Khonati pond as one of the pipes laid near this pond has been damaged.
- Sharing of information: For proper dissemination of the information regarding project cost, project details and maps, boards need to be put up at various locations so that damage to the pipelines could be avoided.
- Focus on employment generation: A plan needs to be developed to ensure effective utilisation of the mine water supplied to the ponds which would subsequently lead to augmentation of household incomes of the beneficiaries.
- BCCL should conduct a cost-benefit analysis as well as Social Return on Investments (SROI) analysis in such large-scale projects.

CHAPTER 5 - VILLAGE ADOPTION PROJECT (LAHBERA)

5.1 Introduction

Lahbera, a village situated in Jharia block of Dhanbad district, Jharkhand is one of the centers attraction of BCCL CSR activities. The village mainly consists of the tribal population of 392 people with 63 households. The charm of this project lies in many facts, one of which is the integrated module of development experimented by the BCCL. The BCCL adopted the village in the year 2009 with an intention of integrated development of tribal for their economic and social development through various schemes and program run by them. As the part of the CSR activities, various infrastructural and economic projects were set up that could help the villagers in their economic development.

5.2 Objectives of the Study

The main objectives of the project is to develop the selected village in an integrated manner ensuring its holistic and integrated development through capacity building and participation of local people and institutions, and this is done through establishing and creating various infrastructures such as:

a. *Construction of Primary School*
b. *Masala Chakki,*
c. *Health Centre*
d. *Sewing Training Centre*
e. *Multipurpose Hall*
f. *Adult Education Centre*
g. *Pipeline for water supplies*
h. *PCC Road and Drainage lines*
i. *Solar lights*
j. *Playground*

5.3 **Projects and their Impacts**

I. Multipurpose Hall



The hall as its name suggest was used for multiple reasons. It was constructed in the year 2009. It is located in the premises of playground and having the area of approx 800 – 1000 sq ft. The amount invested in this infrastructure was Rs.650851/-. The hall is used for various programs such as conducting health camps, adult education centre, village meetings, social gatherings, marriages, family functions and various other programs. The hall was equipped with tube lights, fans and toilet facilities that have impressed the people, utilizing it for various purposes.

Beneficiaries' viewpoint

Meera Marandi, a residence of labhera village says: 'this hall has helped us a lot, especially during our adult education centre; we use to come here daily at 4 pm and study till 6 pm. Not only this, we also used hall for various occasions such as marriages, meetings and other family functions. She also added further admitting that her brother marriage was also fixed here. When we were small, our family used to have functions in our aangana. But after the hall was constructed we are utilizing it for many purposes, and it does not cost us anything as it is free for us. When asked for maintenance, Meera said that usually BCCL looks into it. But she feels it's also her's responsibility to take care of the hall as it is very beneficial for them.

II. Adult Education Centre



The Center started in the year 2009 and was run by the two mentors which were appointed to teach by the BCCL. The aim of the Centre was to provide basic and primary education skill sets to those who were unable to get benefit from the regular education system but were dedicated to learn. The classes were held in the hall where 150 students including young girls and married women were taught in one batch, from 4 pm to 6 pm, for five days a week. The course design was from simple to complex or from known to unknown. The classes include subjects that were related to the daily life of people such as basic mathematics and hindi. Besides that, subject such as English was also encouraged. The session on gender sensitization and human biology were also being taught. Teaching and writing skills to the women was one of the important aspects of the AEC. Girls and women used to like the classes and the mentor's way of teaching.

Beneficiaries' viewpoint

Rani, a construal laborer in a mine and also the residences of lahbera village says: 'from the time the classes had started, I used to come here for studying. Coming from a poor family, I was unable to get school education as I had to assist my parents in coal mines. I wanted to study, but my family condition didn't allow me. Then through BCCL, we got this education centre, where the master used to teach us - how to speak, read and write. In the beginning, I was very shy but then the master always used to motivate me and call me in front and asked me to talk about myself. I used to be very shy and reluctant. But gradually I started speaking and slowly writing and reading too. Now, I also understand basic maths that helps me to calculate the numbers of days my friends and I work and the salary we deserve for it.Earlier we used to be paid less. Because of these classes, I feel empowered and confident now. I can directly speak to my malik

(Boss) and other people.' Rani now feels she is empowered and also has the courage. She also motivates other girls like her to come and join the classes. But it is unfortunate that the classes are not running now as the salary of a few of the mentors has not been paid yet by the BCCL. Hence, the mentors have stopped coming to teach.

III. Health Centre



The Health Centre was also established in the year 2009 and was operation till 2015. The aim of this project was to provide primary health care services to the people of lahbera village. The total cost of construction of health centre was Rs.373096/-. The Health Centre was used to run with the help of the Kusuda Area Medical team. The team consisting of doctors and nurses used to visit the hospital on a regular basis. The health team used to provide services such as consultations and medicine free of cost to all the villagers. Besides that, services such as blood pressure checking and weight measurement were also been provided. In addition to these services, awareness generation on health and hygiene was also provided periodically. The timing of the hospital was mostly 11 am to 2 pm. In case of emergency, the case was transferred to

Kusuma area hospital for further treatment. Health camps were also organized in the village whereby services such as eye checkup and other primary health care treatment were provided. When the research team asked the people about the medical services, a common replay come from all of them was that, 'the health centre must start again'. The impact of this health services was not only limited to the lahbera village, but it was also beneficial for the people from the nearby villages. From the response that the team got from the people states that medicines were mostly provided on general and seasonal illness. And for terminal sickness, the patients were recommended to visit the regional hospitals or the central hospital in Dhanbad.

Beneficiaries' viewpoint

Ravi Mhatto, a residence of lahbera says: 'the health centre was very helpful for us. In the older days we have walk a few kilometres to get access to the health services. Most of the people use to just go to the medical shop and ask for the medicines, and the shopkeeper just used to give them medicines without any knowledge about the sickness. But, when the health centre started, people started coming here. They used to get free treatment and medicines. The doctor's behaviour was also good and kind. But from past few years, the health centre is closed. Since then, it's the same condition as before.' He added: 'we are adopted village and health is the most basic things that we need. We request BCCL that they should start the health centre once again'.

IV. Masala Chakki

Masala Chakki was one of the economic empowerment projects of BCCL. BCCL had provided the Masala Chakki to the villages. The total cost spend on the masala chakki project was Rs.394918/-, and it was run by the group formed by the villagers itself, consisting both male and female members of villages. The aim of Masala Chakki project was to provide self-employment and develop entrepreneurship at the village level. The Masala Chakki was operational only for a few weeks after which the group stopped it. The reasons highlighted for the same was that there was no market linkages, no proper monitoring and no guidance to run the Chakki and even no proper financial management. Hence, it was nonfunctional project as said by the people.

V. Sewing Training Centre

The Sewing Training Centre was another economic empowerment activity of BCCL which intended to provide sewing skills sets to young girls and women through practical teaching. The course was started in the year 2009. The investment made by the BCCL CSR was Rs.378459/-.



The centre was run in collaboration with BCCL CSR and Nari Shakti Samiti, a branch of women development of BCCL. The training was provided to girls and women from the lahbera village which was free of cost but for other participants from nearby villagers was Rs.50/- for admission and Rs.25/- as monthly fees. The training was taught by the two mentors appointed by the BCCL and Nari Shakti Samiti. The training consisted of sewing training of various types such as dress, fall biding, bed sheets and a few others. The total batches run till now were two with the targeted beneficiaries of 156. After the completion of course, a certificate was also issued to the participants. The duration of the first batch was for nine months and for the second batch was six months. The training program also had the practical exam whereby the participants were told to demonstrate the skills that they had learned during the sewing classes.

Beneficiaries' viewpoint

'I did not know what is called sewing', says Nelam Marandi, a girl of 18 years coming from a poor family. She only got a chance to educate herself till STD 4 after which she was told to assist her family by working with them in coal mines. Nelam was very much fond of clothes, especially designing and sewing. But due to no proper skill sets she used to get disappointed. Since the sewing course had started, she joined in. She was the student of the first batch. Over a period of months she started enjoying the training program as it was something that she liked. She learned about different type of fabric cloth, stitching, dress designs and much more. Over the period, she was empowered. Her skills in sewing was improved considerably, along with that her confidence too! After completing the course, she got a job of the assistant tailor in a tailor shop where she experimented her skills and also gathered enough money to buy a new sewing machine for her'. She says, 'I was working hard, saved the money which I got from my job and bought a machine for me. Now, I work from home and I earn around Rs.2000/- a month from this'. She was very thankful to the training centre and also motivated many others like her.

VI. Solar Lights

As on paper, 20 stands of solar lights were to be installed in and around village. But on field, it was observed that only 6 solar lights were present and that too around the corner of the park. Also, the batteries of these 6 solar lights stands were stolen and thus it was not functioning.



VII. Primary School Building

One of the major infrastructural developments in Lahbera was the primary school building. As per the information obtained from the residents, the school was constructed in 2014 but not yet inaugurated. The school intended in providing primary education to the children of lahbera village and other nearby villages. Since the construction had been completed, the school building is not being inaugurated and thus left abandoned.



VIII. Computer Training Center



The centre was started in collaboration with Nari Shakti Samiti and BCCL CSR. Around eight computers were provided to Lehbera CTP. The purpose of the project was to develope IT skills among the youths of Lahbera. The project was functional only for a few months, without any expected outcome.

IX. Drainage line and PCC Road

The Construction of Drainage line and PCC Road in Lahbera covered only a particular region of the whole village. The drainage line physically observed was less than 400 metres, and half the work of the drainage system had been left incomplete. Same was the case with the PCC road construction. A few areas of the village had incomplete road construction as well as unrepaired kaccha roads. The amount of money spent on drainage line and PCC road was Rs.7, 27,949/-.





X. Water supply



Before the village had been adopted, it was facing water scarcity issues. The villagers had to walk a few kilometres to fetch water. The situation didn't change even after the adoption. BCCL installed only three water pipelines that were observed on the field against the population of 392 peoples. As observed on the field, the water flow was very slow and also the water supply was only for 3 hours a day. In place of taps, BCCL had just provided a pipe with no proper measures to control the flow of water and to avoid the wastage of water. The total cost spent on the project seems to be more considering the negligible impact caused by it.

5.4 Multi-stakeholder Perspectives on village Adoption project

Table 6 – Multi – stakeholder perspectives on village adoption project

Projects	Villagers	BCCL
Multipurpose Hall	The Hall was very useful for them as it is easily accessible and can be used for both, personal and community functions purposes.	The BCCL was aware of the need of community hall as it was used for important purpose, both at personal and community level.
Health Center	The Health centre was useful as it was providing medical treatment free of cost. But now disappointed as the centre is closed from past two years and even the MMV project has been stopped. So people now depend upon the privately run clinics.	As a part of adoption project, health was seen as an important aspect. Thus the Health Centre was constructed.
School Building	The school building is constructed. However, it has not yet started and thus need to start.	BCCL was aware of the educational problem of villagers and so they constructed the school. But the school has not started yet as the procurement is under process.
Masala Chakki	The people were upset as it had provided employment only for a few weeks.	Intention was to generate employment opportunity by providing the required infrastructure.
AEC	The centre was very useful as it had helped many girls and women to learn basic reading and writing skills and hence villagers demanded to start it once again.	Intention was to provide basic skills of writing and learning.
STC	The Training was useful, but at times there was discrimination among the girls as the girls from Lahbera were	The intention was to provide entrepreneur skills to the girls and women by providing them sewing

	given preferences, and girls from other villages were not allowed to use the machine in spite of paying the fees.	training skillsets.
Drainage line and PCC Road	The project was good as it had reduced the mosquito breeding spots and has made the communication with main road easy. But the construction is left incomplete and only a few lanes have PCC road and drainage system.	The intention was to increase the communication and reduce the unhygienic condition in Lahbera
Water Connection	The scarcity of water prevailed before, and even now the villagers bring water from outskirts. Only three pipelines are being installed for the whole village which is not sufficient.	Intended to provide water for the entire village by providing pipeline supply system.
CTP	It was useful but was shut down after some time. reason was not to know	Intended to develop IT skills among the student of Lahbera village.
Solar Lights	It was not useful for people, as it is only limited to a few spots. The villagers get electricity connection through state supply electricity connection.	The intention was to provide electrification to the village.

5.5 Gaps and Scope for Improvement

i. **Lack Monitoring:** The proposed project intented towards the integrated development of Lahbera village. But since past few years, no monitoring has been done by the BCCL and that had led to the ineffectiveness of the projects. Some of the projects have been unsuccessful, namely Health Center, STP, CTP, and AEC, due to lack of monitoring.

ii. **Unfinished projects: A** Few of the projects/infrastructures such as school building, road and drainage lines, solar light stands and water connection is partially done and that had created a negative image of the company in the eyes of villagers.

iii. **Lack of Execution:** Among nine projects that were aimed at developing the village four projects have been unsuccessful, namely Water pipeline connection, Solar Stand Lights, School and Masala chakki**.**

iv. **Limited Resources in training centre:** The resource supply in training centre especially STP was very limited. The number of students in a batch was more than 50 but the sewing machines available were only 4. A few batchmates even complaint for not allowing them to use the machines.

v. **No Scope for employment generation:** One of the common gaps found among the STP and the Computer centre was that there was no scope for the students, neither for future training nor employment generation, as this centre only provided basic training. In case of masala chakki, no market linkages were made for the production and sale of masala.

vi. **Limited growth through training program:** The training programs such as STP, AEC, and CTP had very limited growth outcome as teachers/mentors teaching the courses were not upgraded, and also the salaries of the mentors were not paid. Thus, it was reflected in their teaching. In case of STP and CTP, no linkages were created.

5.6 Recommendations

i. **Creating a local sustainable mechanism to look over the monitoring of the projects:** It is essential that a village development committee consisting of BCCL officials, village members and the panchayat representative should be formed. This committee must be autonomous and should monitor and recommend projects that are essential for the developing Lehbera as an ideal village. At the same time, periodic training should be provided to the villagers for increasing their skills sets and capability.

ii. **Formation of SHGs:** Self Help Groups have played an important role in development of individual and as well as the community. Therefore, SHGs especially of women and youth should be formed, and they should be provided training on capacity building and entrepreneur skills rather than just providing infrastructure.

iii. **Need Base Assessment should be done:** The demand for a particular project or infrastructure should come from the voices of people rather than from the BCCL. Therefore, proper need base assessment should be done.

iv. **Creating Jobs and Market linkages:** Linkages should be created for jobs so that after the training the students can get jobs. At the same time, market linkages such as textile and spice market should be created, might be within BCCL, where the product produced by the villagers could be sold.

v. **Rejuvenating the existing project:** The projects such as CTP, ADC, STP, and Health Centre should be rejuvenated, as these projects had created good impacts on the villagers. At the same time, it is essential that required resources and periodic upgradation should be done. Emergency medical vans should be made available. A female doctor should be available in the health centre.

vi. **Linking the villages with existing government schemes:** It was evident during the field visit that most of the villagers belong to the ST community. Hence, they could be linked with various government schemes and services that are available for them by creating awareness generation for the same.

CHAPTER 6 - CONSTRUCTION OF PCC ROAD

6.1 Introduction

Roads are primary mean of transportation. These provide human access to different places. Roads make a crucial contribution to economic development and growth and bring important social benefits. They are of vital importance in order to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty. Roads open up more areas and stimulate economic and social development. Hence understanding the importance of Road BCCL had Constructed PCC Roads in and around eight villages of the BCCL command area.

6.2 Objective of the project

Enabling and increasing the connectivity from semi-rural to urban areas by constructing PCC Road.

6.3 Location of implementation

Table 7 – Location of implementation of road projects in various areas

SN	Name of Village/Area	Construction in Km/Meters
1	Kacharra Arah Tola , Hatudih Panchayat	400 meters
2	Lahbera Village	1.5 Km
3	Aamtal Village, Aamtal Panchayat (Kusunda)	1.5 km
4	Satitand Village, Bauakala Panchayat (Kusunda)	500 meters
5	Padugora Village, Padugora Panchayat (WJ area)	400 meters
6	Kandra Village, Kandrta Panchayat	500 meters
7	Bakaspura Village, Luti Pahari Panchayat	400 meters

6.4 Impact of Road on Community

1. Improved Connectivity



The most important aspect of this project is improved connectivity of people from both rural and urban area to the main town or urban world. The road has helped these communities by increasing their accessibility and communication to various vital resources centres such as health, market, schools and employment places. Hence people have now been easily accessing this place without any difficulty.

Beneficiaries' viewpoint

Sunil Mahato Resident of Kahcharra arah Tola, Hadudih Panchayat says: 'the road has helped us. The connectivity has increased. Health centre, schools and marketplaces are now easily accessible. Besides that, there is increase in the rate of vehicles after completion of the road.'

2. Enhanced Hygienic Living Condition



The Construction of Road has enhanced hygienic living condition. PCC road had reduced the risk of getting malaria and other vector-borne diseases. Besides that, there is also improvement in communication from one part to another part of village and also to the other vital resources centres

Beneficiaries' viewpoint

'The road has improved our living condition. We had Kaccha road in rainy season. There was always water logging and slushy pathways that made all of us difficult to walk, Children use to fall on the road. Besides that, due to the slushy pathways we also faced health issues such as malaria. Mosquitos were all around, especially in rainy season. But, since the PCC road has been constructed, it has prevented water logging and slushy pathways and even had reduced the mosquito breeding spots. Thus our health issues are also being reduced'; says Krishna Singh, Resident of Amtal Village.

6.5 Gaps identified in the project

i. Inferior Quality of Road Construction



Almost all the road constructed under the CSR project was of inferior quality. The quality of the road had started diminishing after a few months from its construction. In many places, potholes and cracks were found by the research team. It was reported by the community that the construction of the road involved several unscrupulous means.

ii. Limited Connectivity

Most of the road constructed had limited connectivity. The road which was constructed was the internal road, which at some places was not even connecting to the main road. For example, the road constructed in lahbera was mostly internal and no connection was made with the main road. Thus, the people highlighted regarding its limited social value. A few of the road constructions were left incomplete. Besides that, lack of maintenance was also reported by the people.

iii. Participatory Approach

It was reported by the people that the participatory approach was neither utilized before nor during the construction of the road. Opinion and views of the people should be taken into consideration. The people reported that consent during infrastructure development such as in road was mostly avoided.

iv. Lack of monitoring from the BCCL

All the villages and areas where the road had been constructed, people reported that no monitoring or follow-up was done after the construction of the road. It was also told to the research team that after the construction of the road that is after two to three years, it is only now that the BCCL officials have come to inspect the road, along with the research team. People reported that they were highly unsatisfied for the negligence of BCCL officials in terms of monitoring and inspection.

6.6 Multi-stakeholder Perspective

i. BCCL officials - The aim of the project was to provide connectivity, connecting the small villages to the main town or main road that would subsequently enhance the productivity of the people and also the standard of living.

ii. **Villagers -** The road is useful to villagers in many ways. For example, it has increased the accessibility of vital resource centres such as schools, market, hospitals, etc. It has also increased the communication from one village to another and also from the village to the main town.

6.7 Recommendations

i. **Periodic monitoring** should be conducted by the BCCL. This would enable the company to identify the gaps in implementation of project, and at the same time while doing this; the creditability of the organization will also increase among the people/community.

ii. **Considering People's opinion and view** will enable the BCCL to implement the project in more effectively. Besides that good rapport will develope between both the parties.

iii. **Regular Maintenances** should be done by the BCCL. Similarly expansion should be done based on the needs and demands of the people/community.

iv. **Improvisation of road quality** by tendering the project to a contractor with better credibility and good quality work record in the past.

v. Participation of community should be encouraged before as well as during the construction of road as it would provide an opportunity to the villagers to monitor and supervise the construction process in terms of higher transparency, accountability and sustainability.

ANNEXURE

Confidential (for research purpose only- property of TISS)

HOUSEHOLD QUESTIONNAIRE

Project - Mobile Medical Van (*Swasth Rath*)

(As this questionnaire requires input from male and female members of household, it should be administered to head of household in the presence of other responsible adult male and female members.)

IDENTIFICATION PARTICULARS

Before Starting Interview

Name of District _____Code:_____
Name of Taluka _____Code:_____
Name of Block _____Code:_____
Gram Panchayat _____Code:_____
Name of the village_____Code:_____

Name of the Mining Area _____

Date of Interview (DD/MM/YY): _____/_____/_____
Time of starting Interview (HH.MM): _____. _____ AM/PM

After Ending Interview

Time of ending interview (HH.MM): _____. _____ AM/PM
Names of Respondents 1: _____ MID: _____
2: _____ MID: _____
3: _____ MID: _____
Name of Interviewer: _____ Code: _____

After Checking/Editing Questionnaire

Name of Supervisor: _____Code: _____
Name of Editor: _____Code:
_____

A: HOUSEHOLD PROFILE AND HEALTH SEEKING BEHAVIOR

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
A01	What is your religion?	HINDU….....1 MUSLIM….....2 CHRISTIAN….....3 SIKH….....4 BUDHHIST….....5 JAIN….....6 OTHER _____7 NO RELIGION….....8	
A02	Do you come under scheduled caste, scheduled tribe, nomadic tribe, or other backward class? Which one?	SCHEDULED CASTE….....1 SCHEDULED TRIBE….....2 NOMADIC TRIBE….....3 DENOTIFIED TRIBE….....4 OTHER BACKWARD CLASS (OBC)……..5 GENERAL….....6 DON'T KNOW….....7	
A03	From where do you fetch water for your household? (ask for all sources)	TAP (BY OWN).....1 OWN TAP BY GOVT/PANCHAYAT .....2 OWN HANDPUMP.....3 OWN OPEN WELL.....4 NEIGHBOUR'S TAP.....5 COMMUNITY TAP.....6 COMMUNITY HANDPUMP.....7 COMMUNITY OPEN WELL.....8 OTHER(SPECIFY)_____9	
A04	If household members fall sick, where do you go or whom do you consult first?	TRADITIONAL HEALER/DAI.....1 LOCAL DOCTOR/RMP.....2 CHEMIST SHOP.....3 MOBILE CLINIC OF JHARKHAND GOVERNMENT.....4 SHC/ASHA/ANGANWADI.....5 PHC/CHC.....6 GOVT HOSPITAL.....7 PRIVATE CLINIC.....8 PRIVATE HOSPITAL.....9 COMPANY/AIDED HOSPITAL.....10 SEEK NO TREATMENT.....11 DEPENDS ON AILMENT.....12 MOBILE MEDICAL VAN OF BCCL....13	

		OTHER_____14	
A05	During the last 12 months, which are the agencies did you/your household members visit for consultation and/or treatment? (ASK FOR ALL SOURCES)	TRADITIONAL HEALER/DAI.....1 LOCAL DOCTOR/RMP.....2 CHEMIST SHOP.....3 MOBILE CLINIC.....4 SHC/ASHA/ANGANWADI.....5 PHC/CHC.....6 GOVT HOSPITAL.....7 PRIVATE CLINIC.....8 PRIVATE HOSPITAL.....9 COMPANY/AIDED HOSPITAL.....10 MOBILE MEDICAL VAN OF BCCL.....11 MOBILE CLINIC OF JHARKHAND GOVERNMENT.....12 OTHER_____13 NO TREATMENT.....14 NOBODY FELL SICK.....15	
A06	How the purification techniques followed at household level?	BOIL THE WATER.....1 ADD BLEACH/CHLORINE.....2 SIEVE IT THROUGH CLOTH.....3 WATER FILTER (CERAMIC, SAND, COMPOSITE, ETC.).....4 LET IT STAND AND SETTLE.....5 OTHER _____6 DON'T KNOW.....7	
A07	What type of toilet facility do you have?	FLUSH TOILET (OWN).....1 PIT TOILET(OWN).....2 FLUSH TOILET(COMMUNITY).....3 PIT TOILET(COMMUNITY).....4 OTHER _____5 GO FOR OPEN DEFECATION.....6	
A08	Do you wash hand properly after defecation?	YES.....1 NO.....2	
A09	What is the status of health infrastructures availability in the villages or nearest location in terms of government services?	GOVT HOSPITAL AVAILABLE BUT NOT FUNCTIONING PROPERLY.....1 GOVT HOSPITAL NOT AVAILABLE…..2 PRIMARY HEALTH CENTER IS AVAILABLE AND FUNCTIONING.....3 PRIMARY HEALTH CENTER IS AVAILABLE BUT NOT	

		FUNCTIONING/POOR.....4 PRIMARY HEALTH CENTER IS NOT AVAILABLE.....5 SUB-CENTRES OR COMMUNITY HEALTH CENTRES AVAILABLE .....6 SUB-CENTRES OR COMMUNITY HEALTH CENTRES NOT AVAILABLE.....7	
A10	How is the access to health facilities in terms of connectivity to/from villages, type of approach road?	KUCCHA ROAD.....1 PACCA ROAD IN GOOD CONDITION....2 PACCA ROAD IN BAD CONDITION.....3 ROAD INSIE THE VILLAGE IS GOOD..4 ROAD INSIDE THE VILLAGE IS NOT GOOD.....5	
A11	What are the major Ailments in your family?	COUGH & COLD.....1 SKIN DISEASES (ITCHING ETC.)....2 WATER BORNE DISEASE .....3 MALARIA/ DENGUE.....4 OTHER (SPECIFY)_____5	
A12	What is the mode of transport used for referral cases?	AMBULANCE.....1 HIRED VAN/TRAKER/TAXI/AUTO RICKSHAW.....2 JUTE COT (KHATIA).....3 MAN DRIVEN RIKSHAW.....4 OTHER(SPECIFY) _____5	

B. SERVICES OF MOBILE MEDICAL VAN (*Swastha Rath*)

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
B01	Are you aware that Mobile Medical Van (Swastha Rath) is sponsored by BCCL?	YES.....1 NO.....2	
B02	How long back the van been coming?	MORE THAN FIVE YEARS.....1 FIVE YEARS.....2 FOUR YEARS.....3 THREE YEARS.....4 TWO YEARS.....5 ONE YEARS.....6 DON'T KNOW/REMEMBER.....7	
B03	How does the BCCL plan to publicize and make the communities in the village aware of their visits as they have a set a time for their visits	ANNOUNCEMENT BY MUKHIYA IN GRAM SABHA.....1 ANNOUNCEMENT THOUGH LOUDSPEAKER BY BCCL.....2 BY ASHA WORKER/VILLAGE VOLUNTEERS.....3 BCCL REPRESENTATIVES CALL FOR VILLAGE MEETING.....4	

		OTHER MEANS(SPECIFY)_____5	
B04	Do you think the van comes frequently enough?	DAILY.....1 ONCE A WEEKLY.....2 TWICE A WEEK.....3 FORTNIIGHTLY.....4 ONCE A MONTH.....5 DOES NOT COME.....6 OTHER SPECIFY.....7	
B05	Is there a fixed point where the van comes and waits?	YES.....1 NO.....2 DON'T KNOW.....3	
B06	If yes, specify:		
B07	Does fixed date and time of visit is maintained by the Mobile Medical Van?	YES.....1 NO.....2 DON'T KNOW.....3	
B08	How long does the van wait in the village?	LESS THAN AN HOUR.....1 ONE HOUR.....2 TWO HOURS.....3 THREE HOURS.....4 MORE THAN THREE HOURS.....5 DON'T KNOW.....6	
B09	Do you think this time is enough?	YES.....1 NO.....2 CAN'T SAY.....3	
B10	If no, how much longer should it wait? (Write as it is)		
B11	How is the priority in beneficiary selection governed?	FIRST COME FIRST SERVE.....1 AGED PERSONS.....2 INFANTS/CHILDREN.....3 DIFFERENTLY ABLED.....4 PREGNANT WOMEN.....5 RANDOM, NO PRIORITY AS SUCH....6 VISIBLY VERY UNWELL PERSON.....7	

B12	Facilities available in the van	FREE MEDICINE/ TREATMENT.....1 PROVIDE DOORSTEP FACILITIES....2 PROVIDE DIAGNOSTIC FACILITY....3 PROVIDE ALL THE FACILITIES THAT ARE PROVIDED IN A HOSPITAL.....4 OTHER(SPECIFY)_____5	
B13	Does the medical team give awareness about the followings?	HYGIENIC SANITATION.....1 HYGIENIC WATER CONSUMPTION.....2 MOTHER & CHILD HEALTH CARE.....3 IMMUNIZATION.....4 ANAEMIA.....5 DE-WORMING.....6 VECTOR BORNE DISEASES.....7 HEPATITIS.....8 TYPHOID.....9 COMMON CARDIAC PROBLEMS.....10 HIV.....11 DIABETES.....12 SNAKE BITE.....13 TUBERCULOSIS.....14 OTHERS_____15	
B14	Does the medical team diagnose the following?	BLOOD PRESSURE.....1 HEMOGLOBIN LEVELS.....2 OXYGEN SATURATION.....3 MALARIA.....4 HEPATITIS.....5 DENGUE.....6 TYPHOID.....7 DIABETES.....8 OTHERS_____9	
B15	What kind of services do you get from the van as far as cure is concern?	MEDICINES.....1 NUTRITIONAL SUPPLEMENTS.....2 DE-WORMING.....3 TONICS.....4 OTHERS_____5	
B16	Is it convenient for your family to reach the MMV point? (Ask specific to women, children, senior citizen, and differently abled if any in the family).	WOMEN.....YES(1) NO(2) CHILDREN.....YES(1) NO(2) SENIOR CITIZEN.....YES(1) NO(2)	

		PWD.....YES(1) NO(2)	
B17	If no, then what is the difficulty?	LONG DISTANCE.....1 NO INTERNAL ROAD.....2 NO APPROACH ROAD.....3 NO CONNECTING BRIDGE.....4 KUTTCHA ROAD.....5 NO MODE OF TRANSPORTATION.....6 INCONVINIENT TIMING OF THE MMV.7 OTHERS SPECIFY_____8	
B18	Who are present in the Mobile Medical Van of BCCL?	DOCTOR.....1 COMPOUNDER/PHARMACIST.....2 NURSE/ANM.....3 DRIVER.....4 ALL THE ABOVE.....5 OTHER(SPECIFY)_____6	
B19	What is the availability of doctor in the Van?	ALWAYS PRESENT .....1 SOMETIMES PRESENT.....2 NEVER PRESENT.....3	
B20	If no, then who facilitate the service? (Write as it is)		
B21	Do you able to convey your problems to the Doctor/pharmacist? (probe behavior of the medical team)	YES.....1 NO.....2	
B22	What if a person falls ill in the period when Van is not visiting? (Write as it is)	VISIT PRIVATE PRACTIONER.....1 VISIT RMP.....2 NEAREST HEALTH GOVERNMENT HEALTH CENTER.....3 NEAREST PRIVATE CLINIC/HOSPITAL..4 WAIT FOR MMV FOR NEXT VISIT.....5 OTHERS(SPECIFY)_____6	
B23	Does the medical team provide awareness campaign?	YES.....1 NO.....2 CAN'T SAY.....3	
B24	If yes, what are they?	HIV/AIDS/SMOKING/ALCHOLISM.....1 PUBLICITY AND SENSITIZATION CAMPAIGN.....2 CLEANINESS AND HYGIEN.....3	

		MATERNITY CARE.....4 OTHER(SPECIFY)_____5	

C. BENEFICIARIES' FEEDBACK ON MMV SERVICE

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
C01	Do you think the frequency of doctor's visit to private clinic/hospital or government health center has been reduced due to service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C02	Do you think monthly expenditure on health checkups /medicine has been reduced due to the service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C03	Do you think that your time has been saved due to the service of MMV provided by BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C04	Do you think travelling cost has been saved due to service provided by MMV of BCCL?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C05	Do you think you get free advice by a qualified trained/ qualified doctors at your door step?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C06	Do you think major ailments in your family have been reduced due to awareness given by the medical team of BCCL through MMV? OR your family is healthier than before?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	
C07	Is there any scope of improvement in MMV? If yes, answer the question from **C08 to C12**	YES.....1 NO.....2 CAN'T SAY.....3	
C08	MMV should reach on time/ time should be fixed	YES.....1 NO.....2 CAN'T SAY.....3	
C09	There should be fixed/ convenient time of reaching the MMV (any)	YES.....1 NO.....2 CAN'T SAY.....3	
C10	Quantity/ variety of medicines should be increased (any)	YES.....1 NO.....2 CAN'T SAY.....3	

C11	Frequency/coverage of MMV should be increased (any)	YES.....1 NO.....2 CAN'T SAY.....3	
C12	Requirement of a lady doctor/nurse	YES.....1 NO.....2 CAN'T SAY.....3	
C13	How would you rate (out of 5) the service of Mobile Medical Van provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C14	Do you think this service by BCCL should be continued?	AGREE.....1 DISAGREE.....2 CAN'T SAY.....3	

HOUSEHOLD QUESTIONNAIRE

Project - Scheme for multipurpose utilization of abandoned mine water

(As this questionnaire requires input from male and female members of household, it should be administered to head of household in the presence of other responsible adult male and female members.)

IDENTIFICATION PARTICULARS

Before Starting Interview

Name of District

_____Code:_____

Name of Taluka

_____Code:_____

Name of Block

_____Code:_____

Gram Panchayat

_____Code:_____

Name of the

village_____Code:_____

Pond Name_____

Date of Interview (DD/MM/YY): _____/_____/_____

Time of starting Interview (HH.MM): _____. _____

AM/PM

After Ending Interview

Time of ending interview (HH.MM): _____. _____

AM/PM

A: HOUSEHOLD PROFILE AND AGRICULTURE AND WATER AVAILABILITY

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
A01	What is your religion?	HINDU….....1 MUSLIM….....2 CHRISTIAN….....3 SIKH….....4 BUDHHIST….....5 JAIN….....6 OTHER _____7 NO RELIGION….....8	
A02	Do you come under scheduled caste, scheduled tribe, nomadic tribe, or other backward class? Which one?	SCHEDULED CASTE….....1 SCHEDULED TRIBE….....2 NOMADIC TRIBE….....3 DENOTIFIED TRIBE….....4 OTHER BACKWARD CLASS (OBC)……..5 GENERAL….....6 DON'T KNOW….....7	
A03	Type of house (record as per guidelines based on type of wall, roof and floor)	RCC .....1 PUCCA .....2 SEMI-PUCCA .....3 KUCHCHA .....4 HUT .....5 TENT (MAKESHIFT).....6	
A04	House electrified?	YES.....1 NO.....2	
A05	From where do you fetch potable water for your household? (ask for all sources)	TAP (BY OWN).....1 OWN TAP BY GOVT/PANCHAYAT .....2 OWN HANDPUMP.....3 OWN OPEN WELL.....4 NEIGHBOUR'S TAP.....5 COMMUNITY TAP.....6 COMMUNITY HANDPUMP.....7 COMMUNITY OPEN WELL.....8 COMMUNITY POND.....9 OTHER(SPECIFY)_____10	
A06	How far is the water source from your household?	JUST OUTSIDE.....1 WITHIN 1/2 KM.....2 WITHIN 1 KM.....3 MORE THAN 1 KM.....4	

A07	If it is used for drinking, what is purification techniques followed at household level?	BOIL THE WATER.....1 ADD BLEACH/CHLORINE.....2 SIEVE IT THROUGH CLOTH.....3 WATER FILTER (CERAMIC, SAND, COMPOSITE, ETC).....4 LET IT STAND AND SETTLE .....5 OTHER (SPECIFY).....6 DON'T KNOW.....7	
A08	What is the purpose of mine water utilization through pond?	DRINKING.....1 COOKING.....2 WASHING VEGETABLES .....3 WASHING CLOTHES.....4 HOUSE CLEANING.....5 BATHING/WASHING YOUR BODIES....6 AGRICULTURE.....7 WASHING ANIAMLS.....8 AFTER DEFECATION.....9 OTHER(SPECIFY) 10	
A09	What type of toilet facility do you have?	FLUSH TOILET (OWN).....1 PIT TOILET(OWN).....2 FLUSH TOILET(COMMUNITY).....3 PIT TOILET(COMMUNITY).....4 OTHER _____5 GO FOR OPEN DEFECATION.....6	
A10	Do you use pond water after open defecation?	YES.....1 NO.....2	
A11	Does your household own any agricultural land including any plantation land?	YES.....1 NO.....2	
A12	How much agriculture land do you own?	_____ACRS _____(LOCALE MEASUREMENT SCALE)	
A13	How much of the land cultivated by you is irrigated?	NIL..... 0 _____ACRS _____(LOCALE MEASUREMENT SCALE)	
A14	What are the sources of irrigation? Do not record rain as a method of irrigation (ASK FOR ALL SOURCES)	CANAL.....1 POND.....2 WELL.....3 RIVER.....4 MOTOR PUMP.....5 TUBE WELL.....6	

		BORE WELL.....7 DAM.....8 OTHER_____9 NONE.....10	
C15	What is the lift irrigation equipment used by you to draw water from pond to agriculture field?	DIESEL ENGINE/PUMP.....1 ELECRIC MOTOR..... .....2 SUBMERGIBLE PUMP.....3 OTHER (SPECILFY)_____4	
A16	Major crops grown	1) _____ 2) _____ 3) _____ 4) _____ 5) _____	

B. AWARENESS ABOUT MINE WATER SUPPY, REPAIRS, RENOVATION & RESTORATION OF THE PONDS AT KHONATHI AND BEHRAKUDAR BY BCCL

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
B01	Do you know that BCCL is supplying mine water to the pond?	YES.....1 NO.....2	
B02	Do you know about the activities done by BCCL for the pond?	EMBANKMENT OR STONE PITCHNG AROUND THE BANK .....1 INLET AND OUTLETS.....2 GHATS/STAIRS .....3 REPAIRE.....4 INCREASED THE CATCHMENT/RESTORATION.....5 DON'T KNOW ANY OF THE ABOVE.....6	
B03	How you come to know that BCCL has renovated the pond?	DISPLAY BOARD BY BCCL.....1 GRAM SABHA.....2 OBSERVED RENOVATION WAS GOING.....3 OTHER SOURCE (PLEASE MENTION)..4 _____	
B04	Whether BCCL conducted any village meeting along with Mukhiya before supplying mine water to the pond?	YES.....1 NO.....2 DON'T KNOW.....3	

B05	When and how many meetings were held? (Specify the number with month and year)		
B06	Does the pond dry up initially during summer?	YES.....1 NO.....2 DON'T KNOW.....3	
B07	How often the mine water is supplied to the village pond by BCCL?	WEEKLY.....1 MONTHLY.....2 QUARTERLY.....3 HALFYEARLY.....4 DRY SPELL/WINTER ONLY.....5 NOT FIXED.....6 NEVER..... .....7 DON'T KNOW.....8 IF ANY OTHER, SPECIFY.....9	
B08	How many hours/day is water supplied?	30 MINUTES.....1 45 MINUTES.....2 ONE HOUR.....3 TWO HOURS.....4 MORE THAN TWO HOURS.....5	
B09	Is the quantity of water supplied sufficient for your village?	YES.....1 NO.....2 DON'T KNOW.....3	
B10	Has there been any case of illness die to poor water quality? If yes, please specify	NO YES (SPECIFY) _____ _____	
B11	What is alternative source of water in case the existing facility is damaged? (Specify)		
B12	When was the last mine water supplied by BCCL?	LAST MONTH….....1 LAST THREE MONTHS….....2 LAST SIX MONTHS….....3 LAST ONE YEAR.....4 MORE THAN A YEAR(HOW LONG,SPECIFY) _____5	

B13	When was the last monitoring done by BCCL regarding utilization of mine water?	LAST MONTH….....1 LAST THREE MONTHS….....2 LAST SIX MONTHS….....3 LAST ONE YEAR….....4 MORE THAN A YEAR(HOW LONG,SPECIFY) _____5 NEVER.....6 DON'T KNOW.....7	

C. IMPACT AFTER THE INTERVENTION ON UTILIZATION OF MINE WATER FOR DOMENSTIC AND AGRICULTURAL USE

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
C01	Is water available throughout the year?	YES.....1 NO.....2	
C02	What you think, the availability of water in the pond throughout the year is due to?	MINE WATER SUPPLIED BY BCCL...1 NATURALLY DUE TO RAIN WATER...2 GROUND WATER REGENERATION.....3 DON'T KNOW.....4 OTHER REASONS(SPECIFY)_____ _____5	
C03	Is there any improvement in water storage capacity or catchment areas of tank seen after the renovation of pond by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C04	Do you think that water scarcity has reduced during dry spell/winter due to mine water supply provided by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C05	Do you find adequate quantity of water during summer/winter due to mine water supply provided by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C06	Do you think the impact of flood has been reduced during monsoon due to renovation of pond by BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C07	Do you think the distance of water availability has been reduced for animals especially for those who can't go long distance to drink water due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	

C08	Do you think you get water for household easily and timely due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C09	Do you think that villages has developed new job opportunity like duckery and fishery in dry season and use their time better than before?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C10	Do you utilize pond water for critical irrigation?	YES.....1 NO.....2	
C11	Do you think you are able to produce two crops (Winter crops) in a year due to mine water supply of BCCL	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C12	Do you think you produce beyond your home consumption and get money to be used for different purposes due to mine water supply of BCCL?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C13	Are any new crops grown due to this intervention, which were not sown before due to unavailability of water during winter/dry spell?	YES.....1 NO.....2	
C14	The new crops grown are	1)_____ 2)_____ 3)_____ 4)_____ 5)_____	
C15	Was any increase in land under irrigation seen?	YES.....1 NO.....2	
C16	How much land under irrigation increased?	_____ACRS _____(LOCALE MEASUREMENT SCALE)	
C17	Do you think your income has been increased due to pond renovation and mine water supply?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C18	Do you think your agricultural production has been increased due to pond renovation and mine water supply?	AGREE.....1 DISAGREE.....2 DON'T KNOW.....4	
C19	Have you used pond for fishery or duckery	YES.....1 NO.....2	
C20	How much income have you gained?	RS._____/MONTH	

C21	Do you think there is scope for improvement with regards to mine water supply? If yes, answer **C22 to C24**	YES.....1 NO.....2	
C22	Mine water should be reached on time/ time should be fixed	YES.....1 NO.....2 CAN'T SAY.....3	
C23	Frequency of mine water supply should be increased	YES.....1 NO.....2 CAN'T SAY.....3	
C24	Quantity and quantity of water should be improved	YES.....1 NO.....2 CAN'T SAY.....3	
C25	How would you rate (out of 5) the quantity of water service provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C26	How would you rate (out of 5) the quality of water service provide by BCCL.	POOR(1/5).....1 BELOW AVERAGE(2/5).....2 AVERAGE(3/5).....3 GOOD(4/5).....4 EXCELLENT(5/5).....5	
C27	Do you think BCCL should continue supplying Mine water?	YES.....1 NO.....2	

D. MANAGEMENT OF POND

Qn.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
D01	Have community participated during pond renovation through*"shramdaan"*?	YES.....1 NO.....2 DON'T KNOW.....3	
D02	Is there any evidence that the pond has been recently undergone maintenance/ de-silting?	YES.....1 NO.....2 DON'T KNOW.....3	
D03	Does community also participate in maintenance/ de-silting?	YES.....1 NO.....2 DON'T KNOW.....3	

D04	If the BCCL water supply facility gets damaged, who repair it? (write as it is)		
D05	Maintenance is carried out?	FUND RAISED BY COMMUNITY(*CHANDA*) .....1 MUKHIYA DEVELOPMENT FUND.....2 BCCL CSR FUND.....3 MP/MLA FUND.....4 OTHER(SPECIFY)_____5	
D06	Constraint in O & M	**INEFFECTIVE COORDINATION AMONG USERS**.....1 **LACK OF FUND REHABILITAION**....2 NEGELGENCE OF LOCAL AUTHORITY.3 OTHER(SPECIFY)_____4	

QUESTIONNAIRE
VILLAGE ADOPTION PROGRAMME (Lahbera, Dhanbad)

1. Date Time

2. Village:
   Panchayat:
   Block:
   District:
   State:

3. Mukhiya/Sarpanch/Ward member/Participant:
   Name:
   Contact No.:

4. Population:

Multipurpose hall

Questions

1.	When was the hall built? How much time did the construction take?
2.	Who built it? (Mention implementing agency). Who provided the land for the same.
3.	Why was the need felt to build this hall?
4.	Were the villagers consulted before constructing the hall?
5.	What is the cost of the building? (How many respondents know?)
6.	Was there any board displayed during/after the construction of the hall providing information related to it?
7.	Is the hall useful?
8.	What is the hall used for? • SHG Meetings • Wage Payments • Bank related details • Gram Sabha • Awareness Campaigns • Meetings with BCCL • Trainings • Functions (community) • Functions (individuals) • Livelihood activities • Fairs • Lodging • Others (Please specify)
9.	Is the access to multi-purpose hall affected by any factor? • Caste • Religion • PRI Members • Gender • Gram Sachiv • Other govt. employee • Others (Please specify)
10.	Who has the control over or authority related to the multi-purpose hall? • Gram Sabha • Sarpanch • Specific committee/group • Individual (Please specify) • BCCL • Others
11.	What is the procedure to use the hall for any purpose? Is there a system devised? If yes, please specify.
12.	How can this hall be better utilized?

Masala Chakki:

Questions for Beneficiaries

1.	When was the Masala Chakki made operational? How much time did the process of operationalization take?
2.	Who installed it? (Mention implementing agency). Who provided the land/building for the same?
3.	Why was the need felt to start this initiative?

4. Were the villagers consulted before starting this initiative?
5. What is the cost of the initiative? (How many respondents know?)
6. Was there any board displayed during/after the installation and operationalization of the Masala Chakki providing information related to it?
7. Is the Masala Chakki useful?
   - Enhancing livelihood
   - Making grinding easier
   - Others (Mention)
8. What is the impact of this initiative for participants?
- Tangible (income)
   - Earnings of individual workers
   - Collective income of the community
   - Profit by owners
   - Others

- Intangible
   - Services/sales/production increase or decrease
   - Empowerment
   - Drudgery Reduction
   - Negative impacts if any (pollution/disputes/others)
   - Are they now able to make Investment in areas like:
      - Health
      - Education
      - Malnutrition
      - Transportation
      - Other (Specify)
   - Others (Mention)
9. What is the mechanism of selling the products? Where are the masalas sold? How is the demand in market?
10. What is the technical support provided for production as well as marketing? What more is expected?
11. How can we make this initiative better?
- To enhance positive impacts
- To reduce negative impact
12. Are impacts overall positive or negative? For whom?
13. What are the most important impacts? According to whom?
14. How significant are they? In what way?
15. Do changes alter livelihood strategies and security, or do they just add one element (a coping strategy) within existing approaches? Can impacts be summarised in terms of changes in livelihood security or robustness?

***Health Centre*:**

Questions

1. What was the scenario before the Health Centre was started?
   - Doctors
   - Health workers
   - Nearest Health Centre
   - Access to medicines
   - Access to screening tests
   - Others (Mention)
2. Why was the health centre set up in the village?
3. Were people of the village involved in the decision making?
- Need Assessment
- Location of Health Centre
- Others (Specify)
4. What is the basic infrastructure available?
   - Electricity
   - Water
   - Drinking water
   - Ambulance
   - Others (Mention)
5. What is the human resource deployed at the health Centre?
   - Doctor (qualification)
   - Nurse/ANM
   - Pharmacist
   - Lab-technician
   - Others (Specify)
6. How is the behaviour of the staff?

7. Population Coverage by the Health Centre
8. How is the utilization of the medical services at the Health centre?
9. Institutional Deliveries • Vaccination • First Aid • General Check ups • Ante natal services • Others
10. What diseases do people generally suffer from?
11. Name the diseases/symptoms. Also mention if they receive treatment for the mentioned diseases at the health centre
12. Are referral services provided?
13. What are the timings of the Health Centre?
14. How are emergencies handled?
15. Are people satisfied with the health Centre? If yes provide reasons.
16. What are people dissatisfied about? • Staff unavailable • Non-examination by staff • Improper attention • Centre not clean • Medicines not available • Others (Mention)
17. Are the services provided for free? If not, how much do they pay for treatment/medicines?
18. Is education/awareness provided at the health centre?
19. Complaints/Improvement suggestion for health centre.

Sewing Training Centre

Question

1. Why was the Sewing Machine initiative started?
2. Who use the Sewing Machine Initiative? Name the stakeholders. • Direct Participants o Owners o Workers o Customers • Non-participants (local residents) • Others o Government o NGO o CBO o PRI o Co-operatives
3. What is the criterion to be a part of this initiative?
4. Who is not a part of it or stays out of it?
5. Specify who and the reason. Following maybe the reasons: • Gender • Power Dynamics • Education • Poverty • Disability • Other
6. How can participation be encouraged?
7. How is it beneficial?
8. What is the impact of livelihoods for participants? • Tangible (income) o Earnings of individual workers o Collective income of the community o Profit by owners • Intangible (empowerment) • Direct (services/sales/production) • Positive • Negative • Intended • Unintended

9. What impact does it have on the quality of life?
10. How has the investment pattern changed? • Health • Education • Malnutrition • Transportation • Other (Specify)
11. What is sown or stitched? Where are the clothes sold? How is the demand in market?
12. What is the technical support provided for production as well as marketing? What more is expected?
13. How can we make this initiative better? • To enhance positive impacts • To reduce negative impact
14. What are the most important impacts? According to whom?
15. How significant are they? In what way?
16. Why did only 6 women start earning? How can that be improved?

Adult Education Centre:

Questions:

1. What is the literacy percentage of the village? Male and female both.
2. Why did the need to have arisen to have the adult education centre?
3. How long has it been functional?
4. What subjects are taught?
5. How many students are enrolled? How many attend
6. How is the attendance of the students? Do they enjoy coming?
7. Anyone who has dropped out from the Adult Education centre? If yes, Why?
8. Why are only women studying? What is the selection criterion?
9. What is the impact of the initiative on the following? • Employment • Basic Reading Skills • Health • Personal Goals • Further Education • Skill Development • Other outcomes
10. How can we encourage participation of enrolling illiterate people irrespective of barriers? What are the barriers? How can we overcome them?
11. Who is the teacher? How does he/she evaluate the progress?
12. Any complaints
13. Any success story

Primary School building:

Questions

1. When was the school constructed? Since when is it functional?
2. How many students study in school? Male/Female
3. What is the human resource and the respective strength in the school?
4. What is the average number of students in a class?
5. What is the infrastructure at the primary school? • Classrooms • Benches • Electricity • Lights • Fans • Toilets and water supply • Drinking Water • Other (mention)
6. Are teachers good? What is the learning level of children? • Good 4-5 • Average 2-3 • Bad-0-1
7. Do children enjoy going to school?
8. Are children benefitting from the school? In what ways (Mention)?
9. Any complaints?

Water supply

Questions

1. What difficulties were faced by the villagers before the intervention?
2. How far are the other water sources from the village?
3. Why did the need of laying down pipelines arise?
4. Who all were involved in the decision making process?
5. Where is the water supplied (individual households/common storage)? If it is a common storage how do people take it home for use?
6. How many people benefit from this?
7. What do the people use the water for?
8. How does it affect their life? • Education • Livelihood • Sanitation • Commercial • Domestic affairs • Others
9. What are the areas with water deficit? How does this initiative benefit those areas?
10. Any complaints?
11. How can this be improved?

Drainage:

Questions
1. How was the drainage managed before the initiative?
2. What is the drainage for?
3. What are benefits that are reaped by the people after the initiative?
4. Where is the waste water directed to?
5. Does it have an impact on health? • Positives • Negatives
6. Were people of the village provided information before implementing the project?

Solar Lights:

Questions

1. How is the supply of electricity in the village?
2. What were the issues faced by the villagers before the solar light intervention?
3. What is the use of the installed solar lights?
4. Why are the provided for public usage and not for individual usage?
5. Success stories
6. Complaints

QUESTIONNAIRE

CONSTRUCTION OF PCC/ BITUMINOUS ROAD FOR THE COMMUNITY

5. Date Time

6. Village:
   Panchayat:
   Block:
   District:
   State:

7. Mukhiya/Sarpanch/Ward member/Participant:
   Name:
   Contact No.:

8. Population:

1.	When was this road constructed?
2.	Do you know the agency who created this road? a. BCCL b. State Government c. Local MLA d. MP e. Others -
3.	If BCCL, How you know about this fact? a. Display board by BCCL b. Gram Sabha/Village Meeting c. Witnessed/passing while construction was going d. Villages e. Others
4.	What is the length of the road? (In kms.)
5.	What was the condition before the construction of the road? a. Pucca b. PCC but damaged
6.	What is the condition after the construction of the road?
7.	How far is the road from your place? (in kms)
8.	How many villages or towns does this road connect? (The geographical scale, names of the villages)
9.	Has this road been benefitted or affected your situation? Please elaborate.
10.	Please state <u>your</u> uses of this road.
11.	Did the community contribute in any way during the construction? If yes, how?
12.	Do you know anyone who was directly involved in the construction of road? a. Yes, who? b. No
13.	How has this road improved the quality of the life in this particular area? the following questions mark YES or NO. If yes, kindly elaborate.
	a. Has there been an increase in amount (volume/proportion) of the commercial profit agricultural production in the area?

	b. Has it become easier to reach the markets with the produce of the area?
	c. Have you noticed an increase employment of people in this area?
	d. Are more people engaging in the non-agricultural employment like businesses,eg. groceries, artisans, labourers,etc.?
14.	Has this road improved the connectivity of this area to other places, causing decrease in transportation cost and time to reach places? If yes, how?
	For the following questions mark YES or NO. If yes, kindly elaborate.
	Education:
	a. Has it helped to access the educational institutes more easily? Does it take less time to reach them? b. Has there been an increase in attendance in primary and high schools of the area after the construction?
	c. How far are the high schools from here?
	d. Has it become more convenient to reach them now?
	e. Are more children from this area going to school now?
	f. Can you use transports like cycles or rickshaws to reach these places now?
	Health:
	a. Is there any health care facility in your area? i. Primary Health Centre ii. Community Health Centre iii. Referral Hospital iv. Private Nursing home/Dispensary v. Others
	b. How far is the closest healthcarefacility or hospital? i. Less than half Km ii. Less than 1 Km iii. More than 1 Km iv. More than 5 Kms. v. Others
	c. Has road made it more convenient to access these centres now?
	d. Are you provided with MMV services here?
	e. How often? i. Weekly: ii. Monthly:
	f. Have you seen an overall improvement of health because of this?
	g. Has there been an increase in the utilization of hospitals or healthcare centres after the construction of road?
	h. Has the maternal health improved since the construction of the road?
	i. Do you see any improvement in rates institutional delivery of infants in this area?
15.	Has there been any repairs or upkeep after the construction of the road? If yes, who is responsible for the upkeep? a. Fund raising in the villages b. Mukhiya Fund c. Others:
16.	How does this road serve you during rains?

17.	Have you faced any problems after the construction? If yes, what? Please elaborate.
18.	How the village does contributes to the upkeeping of the road?
19.	How would rate the quality and viability of this road on a scale a. Very poor b. Poor c. Average d. Good e. Excellent
20.	Kindly provide any additional comments, concerns and/or observations/suggestions to improve this project?



Mid- term Evaluation of Project *Swablamban* - Reeling and Spinning Training Projecr under CSR (Sustainable Development Department), Bharat Coking Coal Limited, Dhanbad FY(2015-16)

By

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Prof. B. Venkatesh Kumar
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EXECUTIVE SUMMARY

The purpose of this report, mid-term evaluation study was conducted for Reeling and Spinning training as a skill development project. The locations of the study were Alakdiha and Mukunda training centres, in Dhanbad. The primary data collection for the mid-term evaluation was completed in September 2017 by a 6 member team from TISS. Qualitative research methodology was used while in-depth interviews and focused group discussions were the main methods employed.

The Reeling and Spinning training project was conducted in association with Jharkhand Silk Textile and Handicraft Development Corporation (JHARCRAFT), a Government of Jharkhand undertaking under Industry Department, registered under section 26 Companies Act. 1956.

While BCCL provided monetary support and infrastructure, JHARCRAFT provided skilled trainers, handlooms and raw material for the training. The Primary beneficiaries of the project were 150 underprivileged women across locations. Five training centres were proposed in the project proposal out of which two centres were selected as pilot initiatives of the project.

After successful completion of two month long training course at both the centres, beneficiaries were given access to handloom machinery to hone their skills and earn an income in the process. Currently, only one centre is functional with 20-25 beneficiaries regularly coming to the training centre. The project in the mid-implementation phase faces certain challenges such as minimal increase in household income and lack of orders from JHARCRAFT, these if overcome, can result in effective and efficient implementation of the reeling and spinning training project.

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CHAPTER 1- INTRODUCTION

Businesses are the most powerful constituents of the society and they do not operate in isolation; there is an increased realization that not only can companies affect society at large, but they are also in a unique position to influence society and make positive impact.

> "The Organization for Economic Co-operation and Development[1] (OECD) established a set of guidelines for multinational enterprises in 1976, and was thus a pioneer in developing the concept of CSR. The purpose of these guidelines was to improve the 'investment' climate and encourage the positive contribution multinational enterprises can make to economic and social progress".

An evaluation is 'the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfillment of objectives, development efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipient and donors.' (OECD Publications, 2010)

1.1. About Bharat Coking Coal Limited

Bharat Coking Coal Limited (BCCL) is a subsidiary of Coal India Limited, a Maharatna Company. The company is operating in 12 administrative areas in Jharia Coalfields encompassing around 226 peripheral villages mainly in the District of Dhanbad, Jharkhand and in some part of West Bengal. The CSR strategy of BCCL states that the company's main objective is to improve the quality of life of people living in and around its command areas. Towards achieving this objective and to understand the interest levels of the local community, BCCL undertook a departmental baseline survey cum Skill Gap Analysis study at some locations. The recommendations from the study formed the basis for the design and deployment of the skill development initiatives.

[1] http://www.oecd.org/about/

1.2. About National Corporate Social Responsibility Hub, TISS

National Corporate Social Responsibility Hub, (NCSR Hub) was established in 2011 by the Department of Public Enterprises to enable the Public Sector Enterprises to design and implement holistic and rights-based CSR initiatives. Tata Institute of Social Sciences (TISS), Mumbai and Department of Public Enterprises (DPE), Government of India had come to realize that there is a need to have centralized system where core functions of CSR including learning and knowledge dissemination take place. The core activities of the Hub are:

- Vision and strategic direction setting for Policy and Programme
- Advisory role for PSEs on Policy and Programme implementation
- Research and development and 'evidence-based' policy advocacy
- Capacity building of PSEs, partners and civil society institution
- Impact assessment, monitoring and evaluation
- Empanelment and partner management

1.3. Project Background

REELING AND SPINNING TRAINING PROJECT: This is a skill Development cum employment generation project under "*Swaavlambee* Project" of BCCL targeting groups of unemployed and willing to work women from *Mukunda, Alakdiha, Gareia , Panchmohali* and *Nootangram* villages belonging to Dhanbad District. These villages were chosen because they are located in the command area of BCCL, a project was estimated to generate employment for a group of thirty women from a village. For this purpose, BCCL and JHARCRAFT entered into an agreement for implementation of the project.

1.4. Objectives of the project

1. Skill enhancement through Training and shortening the learning curve of skilled and semi-skilled women.
2. Self-Employment generation and enhancing employability of women groups in the villages.

3. To help improve overall quality of life by providing employment to women especially the weaker section of the society.

1.5. Mid Term Evaluation study for Reeling And Spinning project of BCCL

Bharat Coking Coal Limited (BCCL) sanctioned mid-term evaluation of the reeling and spinning skill development project to National CSR Hub in August-September 2017. The following report details the evaluation of projects undertaken by Bharat Coking Coal Limited in accordance to their CSR policy laid out in 2014.

As per the agreement with CIL, TISS was entrusted the responsibility to undertake the work of generating data through a baseline survey in the peripheral villages of BCCL. Accordingly TISS conducted a sample survey in 42 villages in and around BCCL in the year 2013 to assess community needs that could be addressed through CSR initiatives. .

Based on the results of the baseline survey, a skilled development and employment generation project was envisioned for unemployed women of these villages. In order to facilitate the identified groups of women of these villages with employment opportunities, initiatives have been taken to take the help of JHARCRAFT, a Government of Jharkhand undertaking. Five groups of women each group comprising of thirty (30) women were identified at Mukunda, Alakdiha, Gareria, Panchmohali and Nootangram village.

CHAPTER 2– RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. In it, one studies the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). This chapter outlines the research methodology and also examines the objectives of the study and the research question. The chapter also includes the research design, methods, and level of engagement for data collection, on and off the field as well as the ethics of research and the limitations that the researcher has kept in consideration.

2.1 Objective of Study

The very purpose of the research is to discover answers to the question through the application of the scientific procedures (Kothari, 2004). These objectives help in exploring answers and understanding the behaviour, condition or phenomenon prevalent in the population under study. The aim of the study was to understand the extent of the impact of the project on the socio-economic conditions of the targeted beneficiaries. Further, following are the main objectives of the study:

i. To assess if the objectives of individual projects are being met/have been met;
ii. To understand the continued relevance of the individual projects in their respective contexts;
iii. To identify issues in programmatic implementation and provide recommendation to fulfil the objectives efficiently.

2.2 Key issues addressed

- Implementation mechanisms used by the Implementation Agencies;
- Monitoring mechanisms undertaken by the IAs;
- Scope of improvement as articulated by various stakeholders;
- Efforts towards ensuring sustainability of the project
- Documentation of the project design, outcomes and achievements.

2.3 Research Design

The research design refers to the overall strategy that one chooses to integrate the different components of the study in a coherent and logical way, thereby, ensuring one will effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data (De Vaus, 2001)

This study is an **Evaluation** research study as it is designed to assess the outcomes of an intervention, so that the findings will provide insights useful for the organizations that have funded and implemented the project. For the purpose of the mid-term evaluation of reeling and spinning training project, qualitative research design was developed.

2.4 Research Methods

Tools for Data Collection

The tool is one of the essential components of a research study. It is an instrument that helps the researcher to meet the objectives of the research. There are various kinds of tools that are utilized based on the needs and objectives of the research. In the current study the research team made use of certain sets of tools which are as follows:

- **Focused Group Discussion (FGD):** FGDs where conducted in all the 4 project, and those interviewed for the FGD were the village members, Ward/Gram Panchayat Representative, ASHA workers, Women Representatives, SHGs Youth group members etc.
- **In-depth Interviews (IDI):** Similarly IDI was conducted with village members who were directly affected by the project
- **Case studies:** Case studies were used to get life narratives of the beneficiaries and to understand the impact of the project on their socio-economic and cultural lives

2.5 Data collection methods

The sampling type used for Data collection was Random Stratified sampling. **Primary data** was collected using the following methods, selected as per the above-explained research design:

a. Survey of beneficiaries through questionnaire

b. Semi-structured interview (using interview schedule) and In-depth interviews. The in-depth interviews were open-ended with complete scope for probing and getting detailed information from the participants.
c. Participatory research methods such as transect walk
d. Document analysis (review of project reports)
e. Direct observation (home visit, village/town visit and institution visit)

Secondary data: Secondary data, wherever made available by the implementing agencies, consisted of Annual reports, Project Proposals, Baseline studies and project blue prints

2.6 Participants of Data Collection

This study aims to capture perspectives from multiple stakeholders. Accordingly the following participants and stakeholders were covered through the data collection done in this study:

- Beneficiaries i.e. people (here SHG/Women's group) impacted by the project
- Officials of BCCL (Sustainable Development Department)
- Village level stakeholders (Community Leaders):, Sarpanch, ward members and former Sarpanch

2.7 Data Analysis

As previously mentioned, this study employs qualitative methods. The responses from the in-depth interviews and the other qualitative data were subjected to coding for detecting patterns. The data from interviews and discussions was analyzed **thematically** and the data from all the sources was integrated as per the responses to understand, assess and evaluate the entire process of implementation. This being a qualitative study, there is an emphasis on understanding and analyzing the perceptions, views and experiences of the beneficiaries and other key stakeholders with respect to the skilled development project.

2.8 Challenges of the study

1. **Language Barrier:** The major hurdle in data collection was the language barriers, few of the villagers were speaking Bengali and few were Oriya/Odia.

2. **Limited documentation:** The Limited documentation of the CSR project was another hurdle faced by the research team. It rendered primary data as the only source of information

CHAPTER 3–FINDINGS FROM THE FIELD

3.1 Introduction

"Swaavlambi Project" is a Skill Development initiative of BCCL and JHARCRAFT, an undertaking of Government of Jharkhand. They have mutually agreed to develop skills in weaving and reeling to assure sustainable livelihoods to underprivileged and unemployed women of Dhanbad District of Jharkhand. Mukunda, Alakdiha, Gareia, Panchmohali and Nootangram are the chosen villages to implement this employment generation program. The purpose of the intervention is to develop an infrastructure to train women, employ them in the centres and assure a market linkage for sustainability. The aim is to ensure maximum possible monetary benefits to these women.

3.2 Background

"Swaavlambi Project" is a Skill Development initiative of BCCL and JHARCRAFT, an undertaking of Government of Jharkhand. They have mutually agreed to develop skills in weaving and reeling to assure sustainable livelihoods to underprivileged and unemployed women of Dhanbad District of Jharkhand. Mukunda, Alakdiha, Gareia, Panchmohali and Nootangram are the chosen villages to implement this employment generation program. The purpose of the intervention is to develop an infrastructure to train women, employ them in the centres and assure a market linkage for sustainability. The aim is to ensure minimum monetary benefits to these women, BCCL and JHARCRAFT have entered into an agreement to share the responsibilities of the Weaving and Reeling Training Program. JHARCRAFT imparted skill development training to a group of thirty women on Reeling and Spinning of cotton and silk thread in two locations for a period of one month. After having received training, the women were found to be skilled enough, to produce the cotton and silk handlooms. The training centre was the production centre and guidance was provided by the trainers and officials of JHARCRAFT. Apart from training, JHARCRAFT was responsible for generating a market for the produce. The Emporiums across the country were the platforms to exhibit and sale the finished products. The money earned from the sale was to be transferred to the bank accounts of women.

Reeling and spinning training project is a CSR initiative which is a skill development and employment generation project under "*Swaavlambee* Project" of BCCL. Itis focussed on willing unemployed groups of women of the villages *Mukunda, Alakdiha, Gareia, Panchmohali* and *Nootangram* belonging to Dhanbad District. To generate employment opportunities for the women, BCCL and Jharkhand Silk Textile and Handicraft Development Corporation Ltd. (JHARCRAFT) have entered into an agreement for implementation of the project. JHARCRAFT is a Government of Jharkhand undertaking under Industry Department and is registered under section 26 under Companies Act. 1956. It is operating such projects successfully at Khraswan in Jameshdpur, Nagri in Ranchi and Bhagahiya in Sahebganj. Besides this, their projects are also being implemented as CSR activities of Gua Ore Mines, Megahatburu, Kirkburn, Durgapur plant of SAIL and NTPC Hazaribagh, THIESS Minaces, JINDAL Power Patratuas organisations.

In the first phase, for one month, JHARCRAFT imparted skill development training to a group of thirty women on Reeling and Spinning of cotton and silk thread in two locations, Mukunda and Alakdiha. Once trained, these women started production of cotton and silk fabrics under the guidance of JHARCRAFT trainers and officials for the remaining project period. According to the agreement, JHARCRAFT also managed production of the silk products produced by the trained women and promoted marketing of the products through their emporiums spread over various locations of the country. Money earned from the sale of the silk products is being transferred to bank accounts of the women.

This project, therefore, intended to provide a sustainable employment generation for the women of the target communities

3.3 Objectives of the reeling and spinning training project

a) Skill enhancement through Training and shortening the learning curve of skilled and semi-skilled women.
b) Self-Employment generation and enhancing employability of women groups in the villages.
c) To help improve overall quality of life by providing employment to women especially the weaker section of the society.

3.4 Implementation of the Project

BCCL is the donor partner and JHARCRAFT the Implementing Agency for the Reeling and Spinning Training Program. JHARCRAFT is responsible to train the women and guide the production of cotton and silk handloom for the period of two years. The Agency is also liable for promoting and marketing the produce with sales. Both parties are accountable to each other for the period of mutual agreement as per the MoU. In the documents presented and official's accounts collected, it was found that there was no clear exit strategy after the completion of the project. The officials reported that bimonthly monitoring visits were made to ensure the efficient implementation of the project.

The primary beneficiaries of the project were thirty women pre centre. The beneficiaries were selected on the basis of their vulnerable background and willingness to acquire skills and participate in production post training. These women belonged to socio-economically vulnerability groups. The indirect beneficiaries were, thus, the families of these women.

Out of five proposed locations, centres have been started at Mukunda and Alakdiha. The other centres will be gradually started after analyzing the results of the pilot
Proposed Location of Implementation:

Table No. 1 – Proposed Location of implementation

Sl.No.	Name of Village	Name of *panchayat*	Name of police Station	District	State
1	Mukunda	Mukunda	Tisra	Dhanbad	Jharkhand
2	Alakdiha	Alakdiha	Tisra	Dhanbad	Jharkhand
3	Gareria	Gareria	Kenduadih	Dhanbad	Jharkhand
4	Panchmohali	Panchmohali	Chirkunda	Dhanbad	Jharkhand
5	Nootangram	Nootangram	Chirkunda	Dhanbad	Jharkhand

3.5 Observations of the Mid Term Evaluation

Focused Group Discussions with the beneficiaries and Key Informant Interviews with the officials of BCCL were conducted to gain insights on the ongoing projects. BCCL provided financial support to JHARCRAFT so as to develop an infrastructural facility to conduct trainings and manufacture the handlooms. Whereas, JHARCRAFT provided training and guidance for the duration of two years. They also arranged for required resources like raw materials, reeling and spinning equipment, technical support and a network for promotion of sale of the produce from these centres.

During the study, it was observed that out of two, only one centre at Mukunda is functional with only twenty to twenty-five women working for five days a week. The other centre at Alakdiha is non-operational. However, thirty women were provided training at the location. A negotiation is on-going between BCCL, JHARCRAFT and group of women to re-initiate the centre and start the production.

3.6 Mukunda Training Centre

The centre was inaugurated in the month of January, 2016 and training started from the month of March, 2016. The facility was provided in the adjoining centre of Mukunda Hospital operated by BCCL. The centre is spacious to facilitate trainings and store needful logistics like raw material, equipment & finished products.

Twenty-five women have been trained and are participating in the process of manufacturing at the Mukunda Centre. They reside in the radius of five kilometers from the centre and are between twenty-five to thirty-five years old. Most are either illiterate or barely educated, only one was reported to be a graduate. The women largely belong to Other Backward Classes, Scheduled Caste and Scheduled Tribe and monthly average income ranges from Rs. 15000 to Rs. 30000 per month. According to the beneficiaries, they are currently not employed anywhere else other than the training centre. None of them have started a self-employment venture as a result of the reeling and spinning training because according to the beneficiaries, the handlooms are unaffordable for them.



Beneficiaries with a finished handloom product and reeling *charkha*

The beneficiaries explained that they were uninitiated to the workings of the handloom craft and thus were hesitant to join the training and commit two years for the same. Since the beneficiaries had not contributed to the household income prior to this initiative, their family members were uncertain about the viability of the project as well. It was only after the detailed information dissemination by the '*mukhiya*' and the BCCL personnel that the women decided to join the training. The beneficiaries were also assured an increase in income as a consequence of the training program. The beneficiaries noted that their main motivation for engaging with this program was to gain a unique skill which could be used for income generation at any time in the future.

The training was conducted in a facility adjoining the Mukunda hospital operated by BCCL. The centre was found to be spacious enough to facilitate trainings and store resources. The facility houses 20 large handlooms along with a storage room for raw materials such as thread, needles, parts of the handlooms and also the finished materials. The women spent approximately five to six hours a day at the facility weaving fabrics. Even though the agreement between BCCL and

Government of Jharkhand states that JHARCRAFT will be solely responsible for the purchase of the finished products and will also bring business for the beneficiaries evidence from secondary research conducted and perspectives from KIIs on the field, indicate that JHARCRAFT has been unable to uphold this aspect of the agreement in its totality. Nevertheless, JHARCRAFT has been instrumental in providing training to the beneficiaries and the trainer is still involved with the production of fabric so that he can provide assistance to the beneficiaries when required.



According to secondary research, JHARCRAFT is, however, not able to provide the optimum market for the produce of the centre. Handloom is learnt over many years whereas these women had spent only two years practicing the craft. Consequently the quality of the product was not at par with market standards On the other hand, the women expected get gainful employment after the completion of the project. Resulting in uncertainty due to the lack of it. This is also breach of contract as they agreed to sale the output of the centre.

The beneficiaries unanimously noted that the trainer was a highly skilled professional trainer who had been integral in the growth of their artisan skills. They were well aware of the procedures of the agreement and the roles of JHARCRAFT and BCCL officials. In addition, they were found to have successfully grasped intricate concepts from their syllabus. They also mentioned that post the initial training period, they practiced the nuances of handloom reeling and spinning and are still in the process of honing their craft. They express their gratitude to the involved parties to help them work on the handloom machines post the training.

Apart from facilitation in acquiring a new skill, the reeling and spinning training project has also helped in self-esteem boost, development of entrepreneurship and enhancement in quality of life. The beneficiaries shared that they had never gone out of their house without a male companion but now are able to access the banking services without any assistance post the training program. They also shared instances of realizing the importance of quality education after exposure to myriad of delegates and officials from the well renowned organisations such as BCCL and their partners. The beneficiaries have now tried to chart out a plan to provide quality education to their children and hope this training program will aid them in contributing to the increase in their household income.



As regards to achievement of stated milestones, disappointment was expressed by beneficiaries, as there have been no financial gains to the women in spite of working for more than five hours a day for twenty days in the month. They earn a bare minimum income of INR 350- INR 600 per month which is less than minimum wages and far less than the benefit promised to them. Conclusively, there is a marginal increase in the household incomes as reported by the beneficiaries. Corrective measures for the same are yet to be taken from the all the stakeholders.

3.7 Alakdiha Training Centre

The Research Investigators were unable to interact with any of the respondents from this centre as it was not functional at the time of the study.

The training centre at Alakdiha is non-operational due to many unfortunate constraints accumulated over a period of time. Thirty women were successfully trained and were about to initiate the process of production but everything halted at the demand of mechanized reeling machines. These machines reduce the human labour and time required to weave the handlooms.

At present, all stakeholders are discussing and negotiating in order to reach a mutual consent to re-initiate the centre and avoid further delays loses losses to any of the shareholders.



The BCCL officials explained that the beneficiaries belong to the highly marginalised communities and their villages are located amidst the mining activities of BCCL. Public and private transport rarely plies to these villages making them cut-off from the nearest towns and cities. In these situations, the beneficiaries expected an avenue of income generation located in their vicinity but they feel that this training program has been unsuccessful in providing the same.

Further, there is a strong demand of a mechanised machine for reeling the threads which will reduce their manual labour on reeling on a manual charkha and focus the remaining time on weaving the thread. This matter has been escalated at the level of BCCL and JHARCRAFT and both the organisations are amidst negotiations with the beneficiaries and among themselves to come to a fruitful conclusion.

Table no. 2 – Summary of concerns in Alakdiha Centre

Sr.No	Stakeholder	Concerns in regard to mechanised reeling machine	Recommendation
1	Beneficiaries	Decreases the reeling time by at least 60%.	Demand for mechanised reeling machine.
2	BCCL	No budgetary allowances for the same in the MoU	Negotiation meeting to be scheduled with JHARCRAFT
3	JHARCRAFT	No budgetary allowances for the same in the MoU	

Secondly, the travelling is another major area of concern of these women. There are no public or private transport services bridging the distances between the centre and habitat of the women. These women hail from highly marginalized communities and reside at the sites amidst of the mining activities of BCCL. They remain disconnected with the main cities as there is no consistent and assured mode of transport which is 15-20 kms away. The beneficiaries have also demanded for the production near their vicinity. They expressed that their expectations were not fulfilled and the project was not considerate enough to support these women from the far places.
In spite of extreme difficulties, the recipients of training acknowledged the quality of training, the skills of the trainer, infrastructural facilities, tools & techniques and other necessary resources of the training program.

BCCL and JHARCRAFT are interacting with the women to find best possible solution to terminate the conflicts and re-start the process of manufacturing at the centre.

3.8 Concerns regarding the project

When asked about the challenges being faced by the beneficiaries from both training facilities in the past two years of the reeling and spinning training program, following are the main responses:

- Minimal increase in household income: even though the beneficiaries received Rs. 3000 per month for the period of the training, the beneficiaries' state that the income posts that has dwindled. In Mukunda, the women have persevered in the hope of learning new skill as they hail from economically stable families while in Alakdiha, lack of income is of primary concern as they are situated in geographically and economically remote areas. Therefore, lack of income coupled with spending a full working day at the loom is not feasible for the beneficiaries of Alakdiha centre.

- Lack of mechanised tools: the beneficiaries expressed concern about the time manual reeling machines take as compared to ones that have a motor attached. According to the beneficiaries, the mechanised reeling machine can save up to 60% of their time spent in the reeling activities in preparation of fabric production. They note that the time spent on the production of fabric can be increased if the time on reeling the thread is reduced. Currently, they spend at least 10 days on reeling the threads on a manual *charkha* which is then used in the handlooms. They claim that on a mechanised *charkha*, the same reeling process will take 4 days instead of 10 days.

- Lack of orders from JHARCRAFT: the beneficiaries have expressed that there has been a decrease in orders from the aforementioned organisation and they are not provided a variety of threads to work with. They were hoping to be working on bigger orders by now but according to their trainer some of the beneficiaries are still learning and once their skills are further developed they will be able to work with other thread varieties to produce fabric on the handloom.

CHAPTER 4 - RECOMMENDATIONS

Table no. 3 – Summary of recommendations

Sr.No	Recommendation	Purpose
1	The internal conflicts can be mutually resolved by discussions and provisions of viable demands.	To revive the existing centres (operational & non-operational) with increased productivity and enhanced quality.
2	Market Linkages can be multiplied by creating avenues like online sale, participation in exhibitions, display in retail chains and B2B contracts	To assure consistent sale for sustainability.
3	Branding, product innovation, design development, technical training and technological support can be imparted for better quality product and higher goodwill.	To compete with the changing trends of fashion and offer products at affordable prices.
4	Training in Entrepreneurship can be conducted as part of the training program.	To motivate the trainees to own the responsibility of sustaining the centres of production.
5	Trainees can be educated on forming SHGs and availing micro-finance from the financial intuitions.	To make the collective self-reliable and self-sufficient.
6	Introduce and link with State and Government schemes in Handloom Sector, Women Entrepreneurship, Micro-Finance, Market Linkages, Procurement of raw material & other technical support,	To assure support and sustainability of the enterprise.
7	A website can be launched with Brand Name	To reach to the new

	and portal for online payments to promote the produce and increase the sale. Social Media can be used as a platform for publicity and awareness.	community of online purchasers and increase the sale multi-fold.
8	Training on data management, financial management, logistics management, etc can be imparted to the beneficiaries.	To educate beneficiaries on aspects of managerial skills for analysing the state of the enterprise to plan the line of action.
9	Backward and forward linkages can be identified and specialised services can be exchanged.	To withstand the uncertainties of the market and minimise the risks by sharing it with multiple stakeholders.
10	Exposure to interact with established cluster collectives.	To learn the process of formation of an enterprise from a small no.of beneficiaries,and extending the participation for more benefits.

ANNEXURE

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QUESTIONNAIRE FOR BENEFICIARIES

SKILL DEVELOPMENT ON REELING AND SPINNING TRAINING UNDER CSR OF BCCL

Date:

Time:

Village:

1.	Details of the beneficiary:
a)	Name:
b)	Age:
c)	Educational Qualification:
d)	Income:
2.	Are you currently employed? If yes, with whom?
3.	Are you working as a skill artisan?
4.	Or are there initiatives taken to make you self-sufficient entrepreneurs?
5.	What do you know of this training? (Objectives)
6.	When did this training start?
7.	How did you know about this training?
8.	What made you join this training?
9.	What were you trained for?
10.	How were you trained?
11.	What was the duration of the training?
12.	Were you satisfied with the trainer?
13.	How has this training benefitted you?

14.	Has there been an increase in the household income?
15.	What personal skills did you develop?
16.	Has it brought about any perceptional change in your family?
17.	What did you like about the training?
18.	What did you not like about the training?
19.	What were the immediate effects after training? Social: Familial: Economic:
20.	Did you earn from the products made during the training? How much did you earn?
21.	Was it more or less according to your expectations?
22.	Were you given any stipend during the training?
23.	Can you teach others what you have learnt?
24.	Who do you sell your products to?
25.	Do they give you a target to achieve in a month?
26.	What are the transactions terms by the buyer?
27.	Were the beneficiaries given the final assessment at the end of the training? If yes, what was it?
28.	Are the beneficiaries' parts of a Self Help Group?
29.	What other skills were imparted to them?
30.	Was the community involved? If yes, in what ways?
31.	How has this project shown improvement in the quality of the life in the beneficiaries? Please elaborate (medical insurances, bank accounts, etc.)
32.	What has been the response/feedback from the beneficiaries to Jharcraft on this project?
33.	Did Jharcraft face any challenges while engaging with the community?
34.	To your knowledge, are there any other organizations working with a similar programme in this geographical area? If yes, could you provide the names of those organizations?
35.	Budget of running the particular project:

36.	What was the cost decided upon?
37.	Was there any deviance?
38.	Please provide details about the team who were assigned the project: *What was their role? What was the input and the output?*
39.	What are the strengths and weaknesses of this project?
40.	Has Jharcraft faced any challenges in engaging with BCCL? What were the key challenges faced during this project?
41.	What are the key achievements of this project?
42.	According to you should there be additional measures taken to improve this project?
43.	Kindly provide any additional comments, concerns and/or observations/suggestions to improve this project?

INTERVIEW SCHEDULE FOR BHARAT COKING COAL LIMITED

DATE:

TIME:

44.	Details of the Company:	
e)	Name:	
f)	Designation:	
g)	Contact No.:	
h)	Address:	
45.	Name of project:	
46.	Date of Implementation:	
47.	Objectives of the project:	
48.	List which of these objectives were achieved and which were not achieved?	
49.	Please explain the process of collaboration with Jharcraft. The rationale is stated in the proposal, was that idea accomplished?	
50.	Why and how did BCCL choose Jharcraft to implement this project?	
51.	As per the MoU, did Jharcraft do any baseline study before commencing the program?	
52.	State the geographical areas the project is being implemented in.	
53.	No. of villages:	Names of villages:
54.	What is the total number of beneficiaries? (please attach scanned copy of total number of beneficiaries mentioning their phone numbers)	

55.	Is there a deviance from the numbers decided upon initially? If yes, why?
56.	How did you decide upon the beneficiaries?
57.	Since when has BCCL been funding this project?
58.	What resources did BCCL contribute? E.g.: Infrastructure, monetary contribution, etc.
59.	Was the community involved? If yes, in what ways?
60.	Are the beneficiaries aware of the role of BCCL in this project? Has a display board used to make them aware?
61.	How has this project shown improvement in the quality of the life in the beneficiaries? What has been the response/feedback from the beneficiaries to BCCL on this project?
62.	Did BCCL face any challenges while engaging with the community?
63.	Did the community know that BCCL is the funder agency of this project?
64.	To your knowledge, are there any other organizations working with a similar programme in this geographical area? If yes, could you provide the names of those organizations?
65.	Budget of running the particular project:
	What was the cost decided upon? Was there any deviance?
66.	Please provide details about the team who were assigned the project: What was their role? What was the input and the output?
67.	What are the strengths and weakness of this project?
	Strengths:
	Weakness:
68.	Has BCCL undertaken monitoring of the said project? How many times? Kindly provide documents if any.
69.	Has Jharcraft conducted any evaluation of the project?
70.	Has BCCL received any monthly reports from Jharcraft? If yes, how many? Please provide with the documents.
71.	Has BCCL faced any challenges in engaging with Jharcraft? What were the key challenges faced during this project?
72.	What are the key achievements of this project?
73.	According to you should there be additional measures taken to improve this project?
74.	Would you replicate this model in future as your CSR project in more villages? Has this model been already replicated?
75.	What changes would you include in the replication of the project?
76.	Kindly provide any additional comments, concerns and/or observations/ suggestions to improve this project?

Annexure-V

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The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL /GOVERNMENT.

ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER – I

(FOR THE MONTH SEPTEMBER 2025)

E. C. no. J-11015/93/2009-IA.II (M) dated 06.02.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

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EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_2). Respirable Dust Samplers (RDS) and Fine

Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{10,}$ SO_2, & NO_X and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analysed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analysed for four parameters on fortnightly basis. Thereafter the samples were preserved and analysed at the Environmental Laboratory of CMPDI, RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_X are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

The following preventive and suppressive mitigative measures can be undertaken to contain the pollution level within prescribed level:-

- Wet drilling and controlled blasting should be practice.
- Explosive used should be optimised to restrict the dust generation.
- Transportation roads should be permanently asphalted free of ruts, potholes etc.
- Water should be sprayed on coal transportation road, service road more frequently and at regular interval.
- Dust from roads should be removed physically or mechanically.
- Greenbelts around industrial sites, service building area besides Avenue plantation along roads should be created.
- Coal dust should be suppressed by using fixed sprinklers.
- Regular maintenance of plant and machinery should be undertaken.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster I is in the westernmost part of the Jharia coalfield. It includes Damoda OCP, Damoda UG. The Cluster – I is situated at a distance of about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Jamunia River.

1.2 The Cluster I is designed to produce 0.9 MTPA (normative) and 1.17 MTPA peak capacity of coal. The average grade of coal W-II to W-IV.

The Project is being worked by deploying shovel dumper combination.

The Project has been granted Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 0.9 MTPA (normative) and 1.17 MTPA peak capacity of coal production vide letter no **E. C. no. J-11015/93/2009-IA.II (M) dated 06.02.2013.**

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets, other conditions regarding water / effluent and noise level monitoring in consultation with the State Pollution Control Board."

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & JSPCB and other statutory authorities.

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

(As per G.S.R. 742 (E) dt. 25th December, 2000)

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Damoda (A2): Industrial Area

The location of the sampling station is 23°46'9.00"N & 86°10'38.00"E. The sampler was placed at a height of approx. 1.5m above ground level.

II. BUFFER ZONE Monitoring Location

i) Karmatand village (A1) : Residential area

The location of the sampling station is at 23°45'58.20"N & 86° 9'30.59"E in Karmatand village. The sampler was placed at a height of approx. 1.5m above ground level.

ii) Madhuband washery (A3) : Industrial area

The location of the sampling station is at 23°47'24.01"N & 86°11'32.00"E in the Washery premises. The sampler was placed at a height of approx. 1.5m above ground level.

iii) Block II OCP (A4): **Industrial Area**

The location of the sampling station is 23°47'2.00"N & 86°11'15.00"E . The sampler was placed at an elevated platform of approx. height 1.5m above ground level near water treatment plant of Block II OCP.

iv) Regional Hospital Baghmara (A42): Residential Area

The location of the sampling station is 23°47'57"N & 86°12'39"E The sampler was placed at an elevated platform of approx. height 1.5m above ground level at Regional Hospital Baghmara.

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Ambient Air Quality Test Report

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Test Report for Ambient Air Samples

Month & Year	**09/2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002132F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.25**
Project	**Damoda (A2)**	**Sample Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**	**CMPDI/RI-II/LPM 11 , (IS 5182)**
Date of Sampling	02.09.25 – 17.09.25	**Period of Analysis**	**02.09.2025 to 25.10.2025**	**Zone of Station:** **Core Zone**	**AREA** **Industrial Area**

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) A4483	Observed Values (in µg/m³) A4561	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	73	73	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	38	34	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	30	31	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*

***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

***Note**: The results above relate to the samples tested as received. This report cannot be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.*

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Test Report for Ambient Air Samples

Month & Year	**09/2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002132F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.25**
Project	**Karmatand village(A1)**	**Sample Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**	**CMPDI/RI-II/LPM 11 , (IS 5182)**
Date of Sampling	01.09.25 TO 19.09.25	**Period of Analysis**	01.09.25 TO 25.10.25	**Zone of Station:** **Buffer zone**	**AREA** **Residential area**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values (in µg/m³)**		**Range Of Testing**	**LDL**	**MoEF Standards Notification dated 25th September,2000 (GSR 742 E)**	**NAAQS, 2009**
			A4477	**A4555**				
1	PM_{10}	IS -5182(Part 23):2006, R-2017	72	76	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	36	37	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	29	22	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*

***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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Test Report for Ambient Air Samples

Month & Year	**09/2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002132F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.25**
Project	**Madhuband washery (A3)**	**Sample Ref. No.**	**REM/BCCL/2025/ 09**	**Sampling Method**	**CMPDI/RI-II/LPM 11 , (IS 5182)**
Date of Sampling 03.09.25 TO 18.09.25	**Period of Analysis**	03.09.25 TO 25.10.25		**Zone of Station:** **Buffer Zone**	**AREA** **Industrial area**

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) A4490	Observed Values (in µg/m³) A4569	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	77	80	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	37	44	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	30	30	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*

***All units are in µg/m3, 24 hourly Average,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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TC-14321

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Ambient Air Quality Test Report

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Test Report for Ambient Air Samples

Month & Year	**09/ 2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002132F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.25**
Project	**Block II OCP (A4)**	**Sample Ref. No.**	**REM/BCCL/2025 /09**	**Sampling Method**	**CMPDI/RI-II/LPM 11 , (IS 5182)**
Date of Sampling: 02.09.25 TO 17.09.25	**Period of Analysis**	02.09.25 TO 25.10.25		**Zone of Station:** **Buffer Zone**	**AREA** **Industrial Area**

Sl. No.	Parameter	Method of Analysis	Observed Values (in µg/m³) A4485	Observed Values (in µg/m³) A4563	Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
1	PM_{10}	IS -5182(Part 23):2006, R-2017	72	73	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	31	32	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	21	28	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

** LDL indicates Lower Detection Limit,*
***All units are in µg/m3, 24 hourly Average,*

(Gaurav Kant)

ANALYSED BY ***REVIEWED BY*** ***Authorised Signatory***

(Kumar Vaibhav)

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
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Ambient Air Quality Test Report

Test Report for Ambient Air Samples

Month & Year	**09/ 2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002132F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.25**
Project	**Regional Hospital Baghmara (A42)**	**Sample Ref. No.**	**REM/BCCL/2025/ 09**	**Sampling Method**	**CMPDI/RI-II/LPM 11 , (IS 5182)**
Date of Sampling 03.09.2025 to 18.09.2025	**Period of Analysis**	03.09.25 TO 25.10.25		**Zone of Station:** **Buffer Zone**	**AREA** **Residential Area**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values (in µg/m³)**		**Range Of Testing**	**LDL**	**MoEF Standards Notification dated 25th September,2000 (GSR 742 E)**	**NAAQS, 2009**
			A4491	**A4570**				
1	PM_{10}	IS -5182(Part 23):2006, R-2017	73	80	10 µg/m³ - 1000 µg/m³	10 µg/m³	300	100
2	$PM_{2.5}$	IS -5182(Part 24):2019	31	36	10 µg/m³ - 400 µg/m³	10 µg/m³	Not Specified	60
3	SO_2	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 µg/m³ - 1050 µg/m³	10 µg/m³	120	80
4	NO_2	IS-5182 (Part-6): 2006 , R-2017	30	30	06 µg/m³ - 420 µg/m³	06 µg/m³	120	80

**All units are in µg/m3, 24 hourly Average * LDL indicates Lower Detection Limit,

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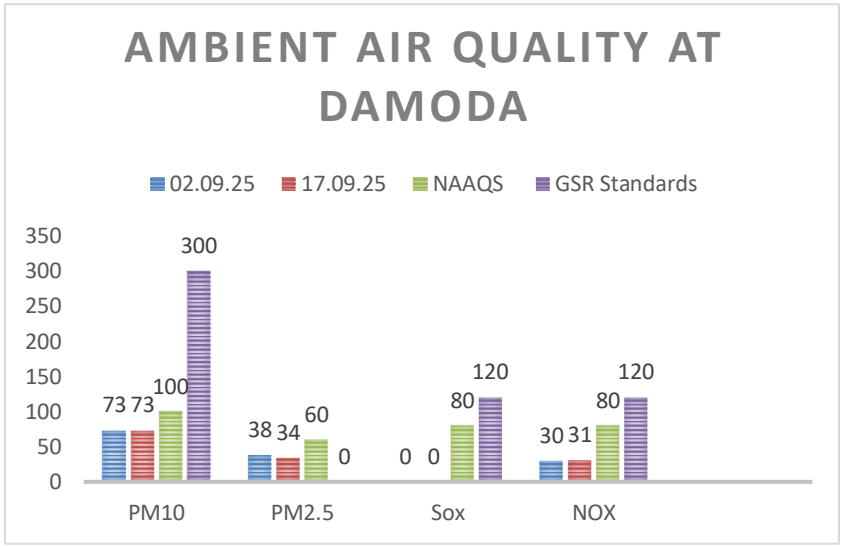
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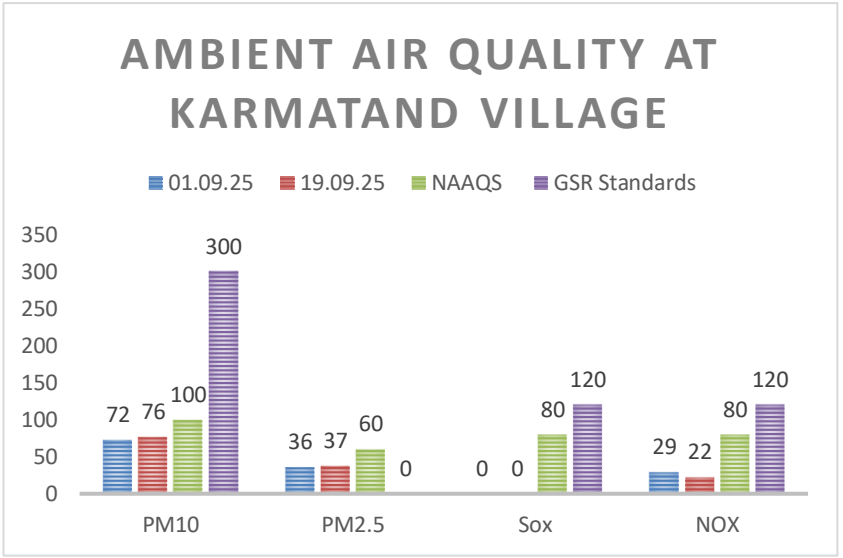
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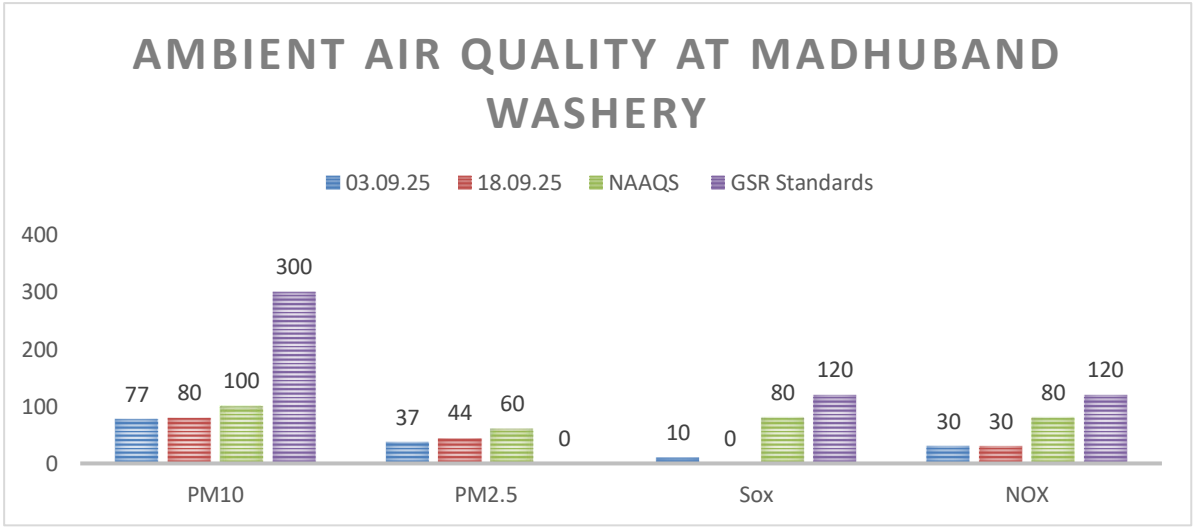
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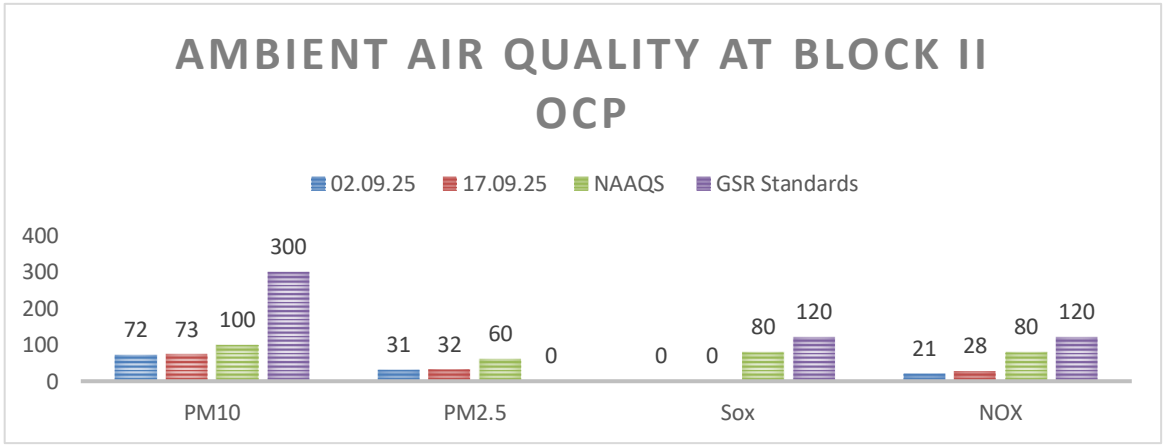
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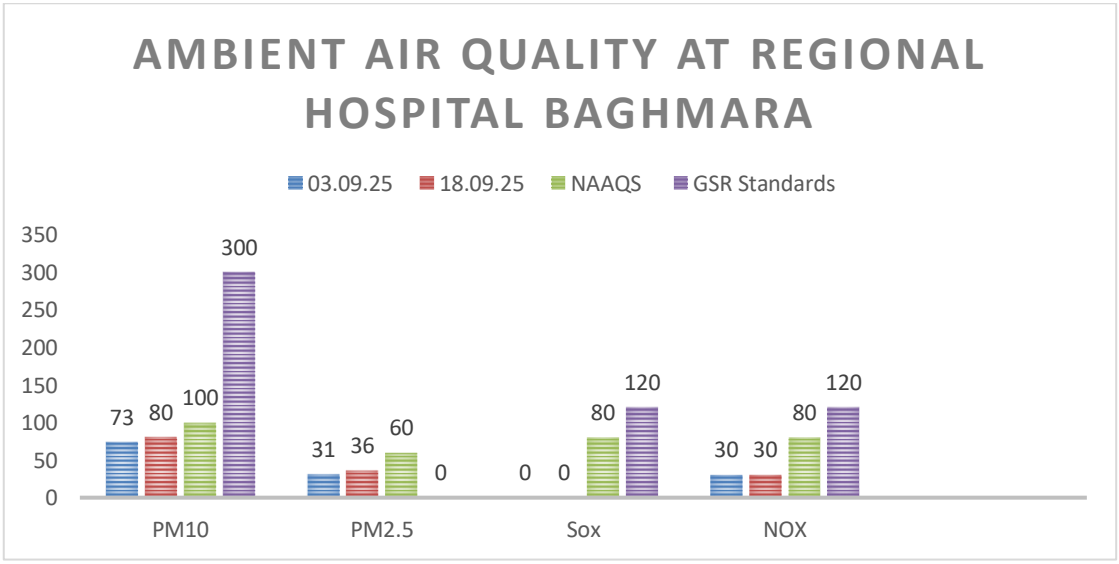
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AMBIENT AIR QUALITY AT DAMODA
02.09.25
17.09.25
NAAQS
GSR Standards
350
300
250
200
150
100
50
0
73 73 100 300
38 34 60 0
0 0 80 120
30 31 80 120
PM10
PM2.5
Sox
NOX


AMBIENT AIR QUALITY AT KARMATAND VILLAGE
01.09.25
19.09.25
NAAQS
GSR Standards
350
300
250
200
150
100
50
0
72 76 100 300
36 37 60 0
0 0 80 120
29 22 80 120
PM10
PM2.5
Sox
NOX


AMBIENT AIR QUALITY AT MADHUBAND WASHERY
03.09.25
18.09.25
NAAQS
GSR Standards
400
300
200
100
0
77 80 100 300
37 44 60 0
10 0 80 120
30 30 80 120
PM10
PM2.5
Sox
NOX


AMBIENT AIR QUALITY AT BLOCK II OCP
02.09.25
17.09.25
NAAQS
GSR Standards
400
300
200
100
0
72
73
100
300
31
32
60
0
0
0
80
120
21
28
80
120
PM10
PM2.5
Sox
NOX


AMBIENT AIR QUALITY AT REGIONAL HOSPITAL BAGHMARA
03.09.25
18.09.25
NAAQS
GSR Standards
350
300
250
200
150
100
50
0
73
80
100
300
31
36
60
0
0
0
80
120
30
30
80
120
PM10
PM2.5
Sox
NOX

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) Mine Discharge of Damoda (MW1)

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

ii) Mine Discharge of Madhuband (MW23)

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analysed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

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MINE EFFLUENT TEST REPORT

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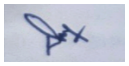
Test Report for Mine Effluent samples

Month & Year	**09/ 2025**	**Cluster**	**Cluster I**	**ULR NO.**		**TC1432125000002150F**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**31.10.2025**
Project	**Damoda**	**Sampling Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
Period of Analysis	**Damoda**		**Date of Sampling**		**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			15.09.25	29.09.25	Period of Analysis	15.09.2025 TO 30.09.2025	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			M1737	**M1764**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	41	44	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.88	7.89	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	44	40	*250 (Max)*	4

*****All units in mg/L unless specified otherwise *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,***

***Grab sampling carried out for water samples.*



ANALYSED BY



(Gaurav Kant)
REVIEWED BY



(Kumar Vaibhav)
Authorised Signatory

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MINE EFFLUENT TEST REPORT

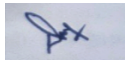
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Test Report for Mine Effluent samples

Month & Year	**09/2025**	**Cluster**	**Cluster I**	**ULR NO.**		**TC1432125000002150F**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**31.10.2025**
Project	**Madhuband**	**Sampling Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**		**IS 3025 (Part-1)**	**CMPDI/RI-II/LPM 13**
station	**Madhuband**		**Date of Sampling**		**Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent**		
			08.09.25	22.09.25	Period of Analysis	08.09.2025 TO 30.09.2025	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**		**STANDARDS FOR COAL MINES (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)**	**LDL**
			M1718	**M1745**		
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	49	43	*100 (Max)*	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.77	7.69	*5.5 - 9.0*	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0	*10 (Max)*	2
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	40	36	*250 (Max)*	4

***All units in mg/L unless specified otherwise *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*
***Grab sampling carried out for water samples.*

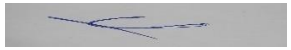


ANALYSED BY



(Gaurav Kant)

REVIEWED BY



(Kumar Vaibhav)

Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Karmatand village (N1)**

ii) **Damoda Colliery(N2)**

iii) **Madhuband Washery (N3)**

iv) **Block – II OCP (N4)**

V) **Regional Hospital Baghmara (N42):**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.2 Results & Interpretations

Ambient noise levels were recorded during day time & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

Month & Year	**09/2025**	**Cluster**	**CLUSTER I**	**ULR NO.**	**TC1432125000002166F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.2025**
Project	**Karmatand village**	**Sample Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**	**CMPDI/RI-II/LPM 22**
Station	**Karmatand**	**Date of Sampling**	01.09.25 – 19.09.25	**Zone Category of Station:**	**Buffer Zone**

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	39.8	39.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial	75
2		07:00 - 08:00	39.6	40.9				Commercial	65
3		08:00 - 09:00	40.8	41.5				Residential	55
4		09:00 – 10:00	41.7	43.5				Silence	50
5		10:00 - 11:00	42.1	43.1					
6		11:00 - 12:00	42.8	42.9					
7		12:00 - 13:00	45.2	45.9					
8		13:00 - 14:00	46.4	46.5					
9		14:00 - 15:00	47.3	45.9					
10		15:00 - 16:00	47.4	46.8					
11		16:00 - 17:00	45.8	46.2					
12		17:00 - 18:00	46.2	45.9					
13		18:00 - 19:00	45.6	45.5					
14		19:00 - 20:00	43.4	43.2					
15		20:00 - 21:00	40.7	42.3					
16		21:00 - 22:00	39.4	40.1					
		Leq DAY	44.2	44.3					
1	Noise Level dB(A)Leq -Night	22:00-23:00	38	36.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial	70
2		23:00- 00:00	37.7	35.5				Commercial	55
3		00:00- 01:00	34.1	34.4				Residential	45
4		01.00-02.00	33.9	33.8				Silence	50
5		02.00-03.00	33.7	33.7					
6		03.00-04.00	34.2	33.6					
7		04.00-05.00	34.2	33.5					
8		05:00-06:00	36.6	33.1					
		Leq NIGHT	35.7	34.5					

***All noise measurements are integrated for a 01 hour period, All units in dB(A) *LDL indicates Lower Detection Limit*

Sampling Assistants
ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

TC-14321

Month & Year	**09/ 2025**	**Cluster**	**Cluster I**			**ULR NO.**	**TC1432125000002166F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**31.10.2025**
Project	**Damoda Colliery**	**Sample Ref. No.**	**REM/BCCL/2025/ 09**		**Sampling Method**	**CMPDI/RI-II/LPM 22**	
			Date of Sampling	02.09.25	17.09.25	**Zone Category of Station:**	**Core Zone**

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	51.1	51.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	54.6	55.6					
3		08:00 - 09:00	56.6	57.9					
4		09:00 – 10:00	62.9	64.2					
5		10:00 - 11:00	63.6	65.6					
6		11:00 - 12:00	64.4	63.9					
7		12:00 - 13:00	65.5	66.4					
8		13:00 - 14:00	64.1	65.8					
9		14:00 - 15:00	58.4	57.7					
10		15:00 - 16:00	57	57.6					
11		16:00 - 17:00	55.5	55.9					
12		17:00 - 18:00	54.3	56					
13		18:00 - 19:00	53.6	54.5					
14		19:00 - 20:00	52	54.1					
15		20:00 - 21:00	51.6	51.9					
16		21:00 - 22:00	50.2	52					
		Leq DAY	60.1	61.1					
1	Noise Level dB(A)Leq -Night	22:00-23:00	49.2	49.4	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	44.7	45.6					
3		00:00- 01:00	44	44.3					
4		01.00-02.00	43	43					
5		02.00-03.00	42.4	42.4					
6		03.00-04.00	42	41.9					
7		04.00-05.00	41.9	42.5					
8		05:00-06:00	42.5	42.4					
		Leq NIGHT	44.5	44.7					

**LDL indicates Lower Detection Limit*

***All noise measurements are integrated for a 01 hour period, All units in dB(A)*

Sampling Assistants
ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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TC-14321

cmpdi A Mini Ratna Company

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
Ambient Noise Level Test Report

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Month & Year	**09/ 2025**	**Cluster**	**Cluster I**	**ULR NO.**	**TC1432125000002166F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.2025**
Project	**Madhuband Washery**	**Sample Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**	**CMPDI/RI-II/LPM 22**

				Date of Sampling	03.09.25	18.09.25	**Zone Category of Station:**		**Buffer Zone**
Sl. No.	**Parameter**	**Hour / Time of day**	**Observed Values (in Leq dB(A)) First Fortnight**	**Observed Values (in Leq dB(A)) Second Fortnight**	**Method of Analysis**	**Range Of Testing**	**LDL**	**NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards**	
								Zones	**Limits in dB**
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	46.6	47.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	47.1	47.2					
3		08:00 - 09:00	49.2	49.7					
4		09:00 – 10:00	58.1	59.6					
5		10:00 - 11:00	62.7	62.3					
6		11:00 - 12:00	61.3	60.3					
7		12:00 - 13:00	64.1	65					
8		13:00 - 14:00	63.6	62.6					
9		14:00 - 15:00	64.6	66					
10		15:00 - 16:00	64.7	63.3					
11		16:00 - 17:00	57.9	59.8					
12		17:00 - 18:00	52.9	51.6					
13		18:00 - 19:00	50.9	50.4					
14		19:00 - 20:00	49.8	49.6					
15		20:00 - 21:00	50	48.9					
16		21:00 - 22:00	48.6	48.1					
		Leq DAY	60.0	60.1					
1	Noise Level dB(A)Leq -Night	22:00-23:00	56.4	57.2	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	56.1	56.2					
3		00:00- 01:00	55.7	55.9					
4		01.00-02.00	55.3	55.6					
5		02.00-03.00	55.1	54.4					
6		03.00-04.00	54.2	54.3					
7		04.00-05.00	54.3	54.3					
8		05:00-06:00	54.4	55.3					
		Leq NIGHT	55.3	55.5					

**LDL indicates Lower Detection Limit*

***All noise measurements are integrated for a 01 hour period, All units in dB(A)*

Sampling Assistants
ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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TC-14321

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

Ambient Noise Level Test Report

04/2023	09/2025	Cluster	Cluster II	ULR NO.	TC1432125000002166F
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	31.10.2025
Project	Block – II OCP	Sample Ref. No.	REM/BCCL/2025/09	Sampling Method	CMPDI/RI-II/LPM 22
		Date of Sampling	02.09.25 – 17.09.25	Zone Category of Station:	Buffer Zone

Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	46.8	48.3	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial	75
2		07:00 - 08:00	47.1	46.8				Commercial	65
3		08:00 - 09:00	47.2	47.3				Residential	55
4		09:00 – 10:00	50.4	48.8				Silence	50
5		10:00 - 11:00	55.7	56.5					
6		11:00 - 12:00	57.5	57.8					
7		12:00 - 13:00	62.2	61.8					
8		13:00 - 14:00	59.9	60.5					
9		14:00 - 15:00	61.2	62.8					
10		15:00 - 16:00	63.6	65.5					
11		16:00 - 17:00	64.6	67.1					
12		17:00 - 18:00	50.6	49.7					
13		18:00 - 19:00	47.5	48.4					
14		19:00 - 20:00	46.9	47.5					
15		20:00 - 21:00	47.1	46.8					
16		21:00 - 22:00	48.3	47.3					
		Leq DAY	58.2	59.7					
1	Noise Level dB(A)Leq -Night	22:00-23:00	57.7	55.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial	70
2		23:00- 00:00	57.2	54.7				Commercial	55
3		00:00- 01:00	50.4	51.2				Residential	45
4		01.00-02.00	50.1	50.2				Silence	50
5		02.00-03.00	49.5	49.2					
6		03.00-04.00	50.7	51.3					
7		04.00-05.00	51.1	51.2					
8		05:00-06:00	51.8	52.3					
		Leq NIGHT	53.6	52.4					

**LDL indicates Lower Detection Limit*

***All noise measurements are integrated for a 01 hour period, All units in dB(A)*

Sampling Assistants
ANALYSED BY

(Gaurav Kant)
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(Kumar Vaibhav)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

Ambient Noise Level Test Report

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Month & Year	**09/ 2025**	**Cluster**	**CLUSTER I**	**ULR NO.**	**TC1432125000002166F**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**31.10.2025**
Project	**Regional Hospital Baghmara**	**Sample Ref. No.**	**REM/BCCL/2025/09**	**Sampling Method**	**CMPDI/RI-II/LPM 22**

			Date of Sampling	03.09.25	18.09.25	**Zone Category of Station:**	**Buffer Zone**	
Sl. No.	**Parameter**	**Hour / Time of day**	**Observed Values (in Leq dB(A))**	**Observed Values (in Leq dB(A))**	**Method of Analysis**	**Range Of Testing**	**LDL**	**NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards**
			First Fortnight	**Second Fortnight**				**Zones** / **Limits in dB**
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	33.4	33.9	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial 75 Commercial 65 Residential 55 Silence 50
2		07:00 - 08:00	41.8	42.7				
3		08:00 - 09:00	43.9	44.1				
4		09:00 – 10:00	44.9	44.3				
5		10:00 - 11:00	46.2	49.1				
6		11:00 - 12:00	46.5	48.3				
7		12:00 - 13:00	46.9	44.8				
8		13:00 - 14:00	47.1	50.5				
9		14:00 - 15:00	47.2	48.3				
10		15:00 - 16:00	47	44.4				
11		16:00 - 17:00	44.1	43.8				
12		17:00 - 18:00	43.8	43.9				
13		18:00 - 19:00	43	45.7				
14		19:00 - 20:00	42.8	43.4				
15		20:00 - 21:00	41.6	42.7				
16		21:00 - 22:00	41.3	40.3				
		Leq DAY	44.8	45.7				
1	Noise Level dB(A)Leq -Night	22:00-23:00	35.6	36	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial 70 Commercial 55 Residential 45 Silence 50
2		23:00- 00:00	36	35.8				
3		00:00- 01:00	35.6	34.8				
4		01.00-02.00	34.1	34.4				
5		02.00-03.00	33.4	33.5				
6		03.00-04.00	34.4	34.6				
7		04.00-05.00	34.1	34.7				
8		05:00-06:00	36	35.1				
		Leq NIGHT	35.0	34.9				

**LDL indicates Lower Detection Limit*

***All noise measurements are integrated for a 01 hour period, All units in dB(A)*

Sampling Assistants
ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

** 24hourly/8hourly values shall be met 92% of the time in a year. However, 8% of the time it may exceed but not on two consecutive days.

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th November 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

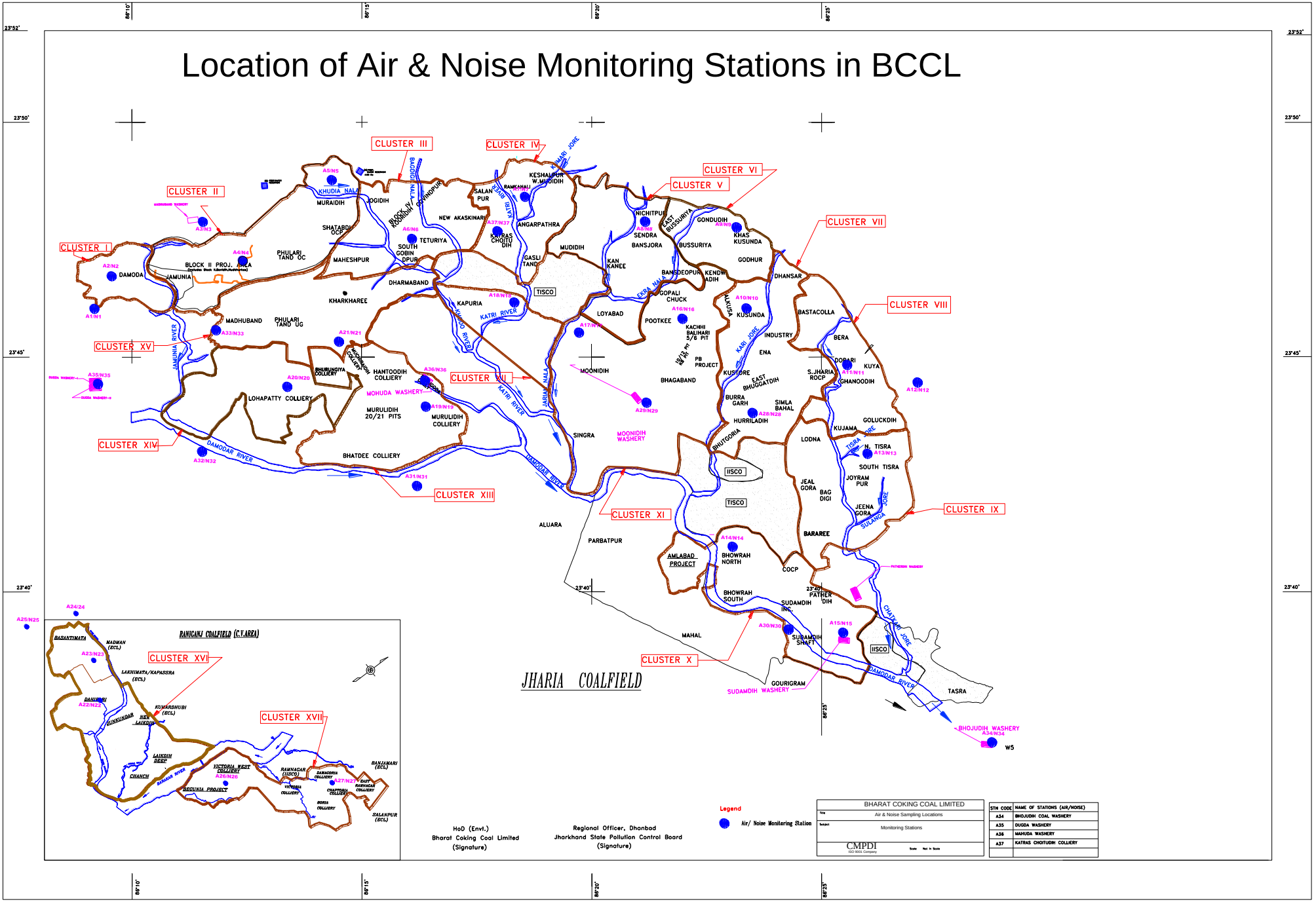
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified ($NaOH$-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
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.

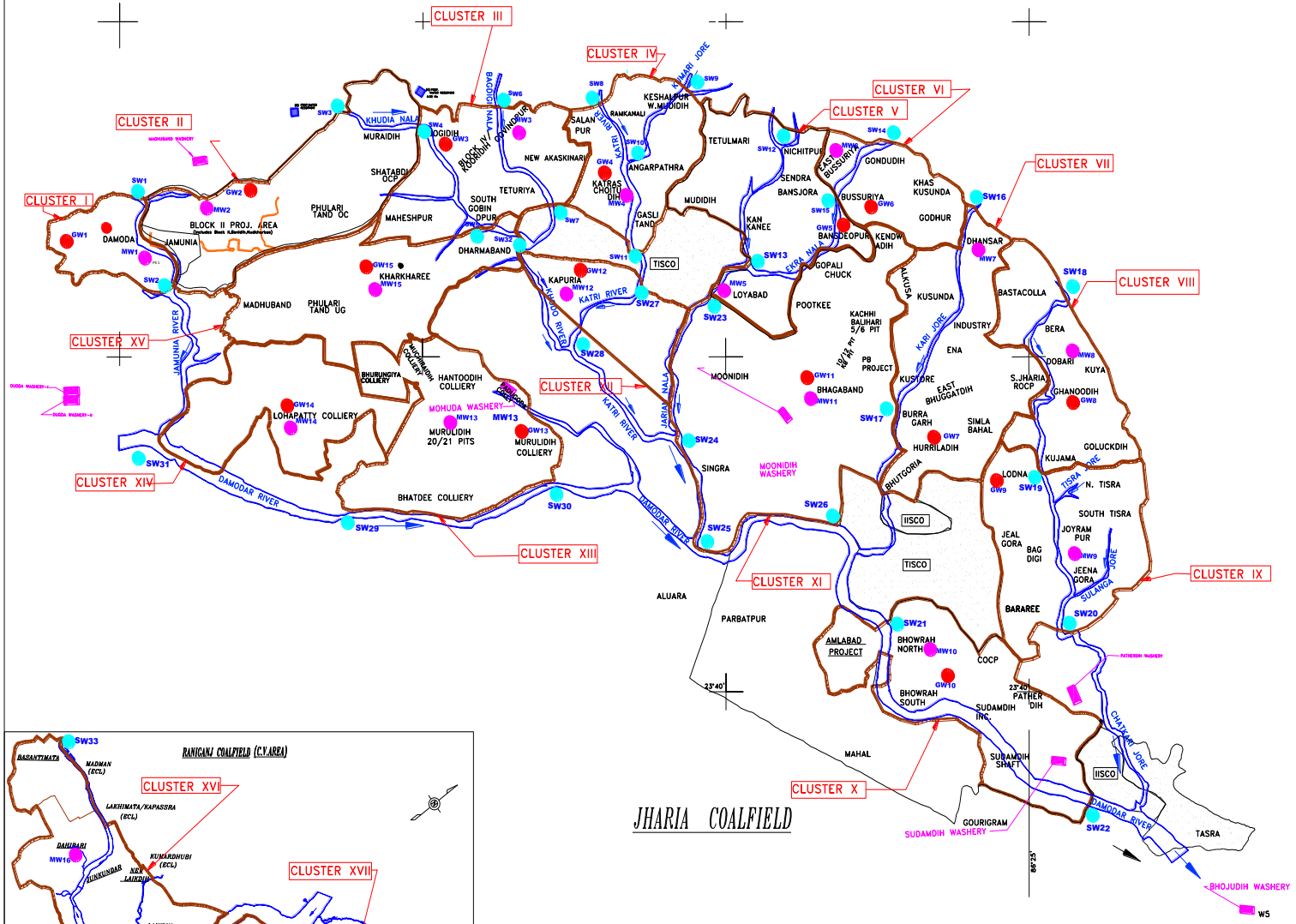
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer	BHARAT COKING COAL LIMITED
Title	WATER SAMPLING LOCATIONS
Subject	MONITORING STATIONS
CMPDI (ISO 9001 Company)	Scale: Not to Scale

Annexure VI A

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The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL/ Government.

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTERS OF MINES, BCCL

(Assessment year – 2024-25)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV, XVI & XVII of Mines, BCCL]

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

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(Accredited by NABL, CMPDI, RI-II, Lab)

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Annexure – I

DETAILS OF THE REPORT

Sl No.	ITEMS	INFORMATIONS
1	Geographical Area	Jharia Coalfield (JCF): 453.0 sq. km. Raniganj Coalfield (BCCL area): 19.64 sq. km.
2	Major Physiographic Units	Dissected Pediplain with surface Reduced Level (RL) varies from 160 m to 220 m above mean sea level (AMSL) in JCF and 100 m to 140 m AMSL in RCF part
3	Drainage System	Damodar River is the master drainage flowing along western boundary of the JCF. Jamunia River, Khudia River, Katri River, Jarian Nala, Ekra Jore, Kari Jore, Kashi Jore, Chatkari Jore and their tributaries are flowing through the JCF area. Damodar River, Barakar River is the master drainage of the part of RCF area (CV Area).
4	Annual Rainfall (IMD-report)	Jharkhand State: 1185.40 mm (year 2024) Rainfall data given in **Annexure-IV**.
5	Geological Formations	Gondwana Formation (Talchir Formation, Barakar Formation, Barren Measure Formation & Raniganj Formation)
6	Aquifer System	Unconfined/Phreatic Aquifer – thickness 25 m (Avg.) Semi-confined to confined Aquifer – thickness from 50 m upto 650 m
7	Hydrogeological properties (Aquifer Pump Test)	Unconfined Aquifer: Hydraulic Conductivity – 0.50 - 0.90 m/day Transmissivity – 10 - 42 m^2/day
		Semi-confined to confined Aquifer: Hydraulic Conductivity – 0.0006-1.44 (0.05 avg.) m/day Transmissivity – 0.06 – 15.0 m^2/day
8	Groundwater Level Monitoring Network	Out of total 139 nos. of monitoring stations 73 nos. located within core mining area and rest comes within Buffers zone. 55 Nos. of Groundwater monitoring well (Dug Wells) network established by CMPDI to record groundwater level data in and around the Core Zone of JCF and 18 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 1.70 to 11.38 m (Avg. 6.33 m bgl) in '2023-24 Post-monsoon – 0.60 to 8.03 m (Avg. 3.77 m bgl) in '2023-24 RCF area (part): Pre-monsoon – 2.10 to 9.50 m (Avg. 5.22 m bgl) in '2023-24 Post-monsoon – 1.50 to 5.18 m (Avg. 3.06 m bgl) in '2023-24
10	Groundwater Quality	Potable as per BIS (**Annexure- VIII**)
11	Piezometers	Piezometers (23 nos.) to monitor impact of coal mining on groundwater regime within the coalfield area (JCF & part of RCF)
12	Stage of Groundwater Development (CGWB)	Dhanbad District-Safe to Over-exploited category (GWRE:2023-24)

GROUNDWATER LEVEL & QUALITY REPORT FOR CLUSTER OF MINES OF BCCL

1.0 INTRODUCTION

1.1 LOCATION DETAILS AND BRIEF ABOUT THE PROJECT

The 16 nos. Cluster of mines (Cluster-I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV XVI and XVII) of BCCL is located in the Jharia coalfield in Bokaro and Dhanbad districts of Jharkhand and part of Raniganj coalfield in Dhanbad district of Jharkhand.

The area of Jharia Coalfield (JCF) is 453 sq. km. and Raniganj Coalfield (RCF part) is 19.64 sq. km. (CV area). Located about 3.0 km south-west of Dhanbad town and 10.0 km north-east of Bokaro town. The coalfield bounded by Jamunia River in the west, Damodar river in the south, and Metamorphics (hard rock) in the north and east side. **(Plate-I)**.

1.2 OBJECTIVE OF THE STUDY:

The objective of the report is to conduct hydrogeological study by quarterly monitoring of groundwater level and quality of the Jharia coalfield and Raniganj coalfield (part) within BCCL command area for 16 Cluster of mines. The data collected shall be submitted to the MoEF&CC, CPCB & SPCB within stipulated timeframe. The work is being done yearly and required to be continued as per the specific condition mentioned invariably in Environmental Condition (EC) for all of the Clusters of BCCL.

1.3 SCOPE OF THE STUDY:

The following scope has been taken into account for hydro-geological investigation of the study area.

i) To monitor the groundwater levels four times/year during (May, August, Nov and Jan).
ii) To monitor the groundwater quality during May including Arsenic and Fluoride.
iii) To evaluate the status of ground water level condition in the area.
iv) To study the ground water flow direction in the mining areas.
v) To study the depth to ground water level condition in the mining areas.
vi) To study the ground water quality data and interpretation in the mining areas.

File No. 08HBDD/JRRI/BCCL/ENV/0003/2018-BD Divn.-CMPDI (Computer No. 68378)
Receipt No : 188686/2018/O/e HEAD OF BUSINESS DEVELOPMENT, CMPDI HQ

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कंपनी
(कोल इंडिया लिमिटेड का एक अंग)
कोयलाभवन, कोयलानगर,धनबाद –826005

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Regd.Off: Koyla Bhawan, Koyla Nagar
CIN: U10101JH1972GOI000918
Environment Department

पत्र संख्या भाकोकोलि/उप महाप्रबंधक(पर्या0)/संचिका-/18/1086-1088/H) दिनांक : 14.06.2018

सेवा में,
महाप्रबंधक
व्यापार विकास
सीएमपीडीआई - कांके रोड रांची ८३४०३१-

Sub: For work of Ground water level and quality monitoring

महोदय,

This is with reference to earlier letter ref no. BCCL/HOD(Env)/F-Env/13/161 dated 11.02.2014 regarding conducting hydrological study by quarterly monitoring of groundwater level and quality of the study to be carried out by establishing a network of existing wells. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) season and for quality including Arsenic and Fluoride during month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to Central Pollution Control Board/SPCB quarterly within one month of monitoring.

The above work is being done yearly and required to be continued as per the specific condition mentioned invariably in Environment Clearance order of all clusters of BCCL.

This is for your kind information and further necessary action

भवदीय

14/6/18

उप-महाप्रबंधक (पर्यावरण)

Copy To:
१ महाप्रबंधक (गवेषण), कांके रोड रांची ८३४०३१-

1.4 TOPOGRAPHY AND DRAINAGE

Northern part of the JCF area covered with hills and thin forest. In general, the altitude varies from 220 m above mean sea level (AMSL) in Barora area (Cluster-I) to 160 m AMSL in Sudamdih area (Cluster-X). Pediplains developed over sedimentary rocks or Gondwana formation consisting of Sandstone, Shale, coal, etc. Dissected pediplains developed over Gondwana formations found in Jharia, Baghmara, Katras areas etc. However, in RCF (part) area, the altitude varies from 100 m to 140 m AMSL (Cluster-XVI). The general slope of the topography is towards south, i.e. Damodar River.

The drainage pattern of the area is dendritic in nature. The drainage system of the area is the part of Damodar sub-basin. All the rivers that originate or flow through the coalfield area have an easterly or southeasterly course and ultimately joins Damodar River - the master drainage. The drainage of the JCF is mainly controlled by Jamuniya River (5th order), Khudia nala (3rd order), Katri River (4th) and Chatkari nala (3rd order) flowing from north to south and joins Damodar River. Whereas, Barakar River and Khudia River are controlling the drainage pattern of RCF (part) and joins Damodar River in the south. Damodar River is the main drainage channel and flows from west to east along the southern boundary of JCF and RCF.

The drainage map of the JCF and part of RCF has been prepared on topographic map of scale 1:50,000 (***Plate-I***). The watershed of all tributary rivers (Jamuniya River to Barakar River) falls within the north-western part of Damodar sub-basin which comes under Lower Ganga Basin.

Besides, a large number of ponds/tanks distributed in and around JCF, out of which one prominent lake is located at Topchanchi in the north-west part. Two reservoirs, Maithon dam on Barakar River and Panchet dam on Damodar River near to Chanch Victoria Area of BCCL (part of RCF), are the main source of water supply to the nearby area. Jharia Water Board, Damodar Water Supply Scheme and Mineral Area Development Authority (MADA) are supplying water.

1.5 DETAILS REGARDING WETLANDS

A **wetland** is a distinct ecosystem that gets flooded by water, either permanently or seasonally. The primary factor that distinguishes **wetlands** from other landforms or water bodies is its characteristic vegetation (aquatic plants). Wetland are protective ecosystem as per new guidelines of CGWA & MoEF&CC. There are no Wetlands in and around the area (Jharia coalfield and Raniganj coalfield) as per the list available on official website of MoEF&CC, Govt. of India. The list enclosed as **Annexure-III.**

1.6 CLIMATE & RAINFALL

The Jharia Coalfield (JCF) and part of Raniganj Coalfield (RCF) area in Dhanbad District belongs to sub-humid tropical climatic region. The maximum temperature during summer shoots up to 45^{o} C and falls between 10^{o} C to 5^{o} C in winter. The maximum rainfall occurs during the period between June and September. Rainfall data of IMD Dhanbad and Mine Rescue Station Dhanbad given in ***Annexure-IV***.

In Jharkhand state, Daily Rainfall data from 1989 to 2018 considered for analysis of trend variability and mean rainfall patterns. From the daily rainfall data, monthly rainfall series of each station is computed and then monthly district rainfall series is constructed by considering arithmetic average of all the station rainfall values within the district. The monthly rainfall series of the state is computed by using area weighted rainfall values of all the districts within the state. The objective of the analysis is to:

1. Identify the spatial pattern of the mean rainfall
2. Understand district wise observed rainfall trend and variability in annual and SW monsoon season (June, July, August and September).

Daily station rainfall data is utilized for identification of the mean spatial patterns and rainfall intensity trends. From mean and standard deviation (SD), the coefficient of variation (CV) is calculated using following equation:

Coefficient of variation (CV) = [Standard Deviation / Mean] × 100

The analysis has done in two parts. For identification of the spatial pattern mean rainfall and variability and observed trends we have used district rainfall series and results have been brought out for four southwest monsoon months viz. June, July, August, September, for the southwest monsoon season and also for annual.

Table shows the mean rainfall (mm) and coefficient of variation of the state for the monsoon months, southwest monsoon season and annual during the period 1989-2018. It can be seen that the state gets highest rainfall (31%) of southwest monsoon rainfall in July month while the August month get 28% of the southwest monsoon rainfall. June and September receive 19% and 22% of southwest monsoon rainfall. Also more than 84% of annual rainfall receives during the southwest monsoon season only. The variability of monsoon or annual rainfall is also very less.

Jharkhand State

	June	July	August	September	Sub-total	Annual
Mean	190.3	313.9	289.2	225.7	1019.1	1211.4
CV	44.4	29.0	24.8	37.0	18.7	16.9

Dhanbad District

	June	July	August	September	Sub-total	Annual
Mean	203.9	327.7	302.5	271.5	1105.6	1332.2
CV	41.0	35.0	33.5	48.7	20.8	19.4

Fig. 1 and 2 show the time series of rainfall in mm for the months of June, July, August and September along with southwest monsoon season and annual rainfall. The trend lines are displayed for each of the series. Neither monthly rainfall nor seasonal rainfall shows any significant increasing/decreasing trend while annual rainfall shows significant decreasing trend. The monthly rainfall during June, July, August and September as well as seasonal rainfall show decreasing trend. During the last 30 years, highest rainfall of 390.3 mm was received in June in the year 1994, 492.1 mm was received in July in the year 2017, 431.5 mm was received in August in the year 1997, while highest rainfall of 395.2 in September was received in the year 1995. Highest annual rainfall of 1587.9 mm was received in the year 1999 and highest southwest monsoon rainfall of 1364.6 mm was received in the year 1994 (Climate Research and Services, IMD, Ministry of Earth Sciences, Pune, Jan'2020).

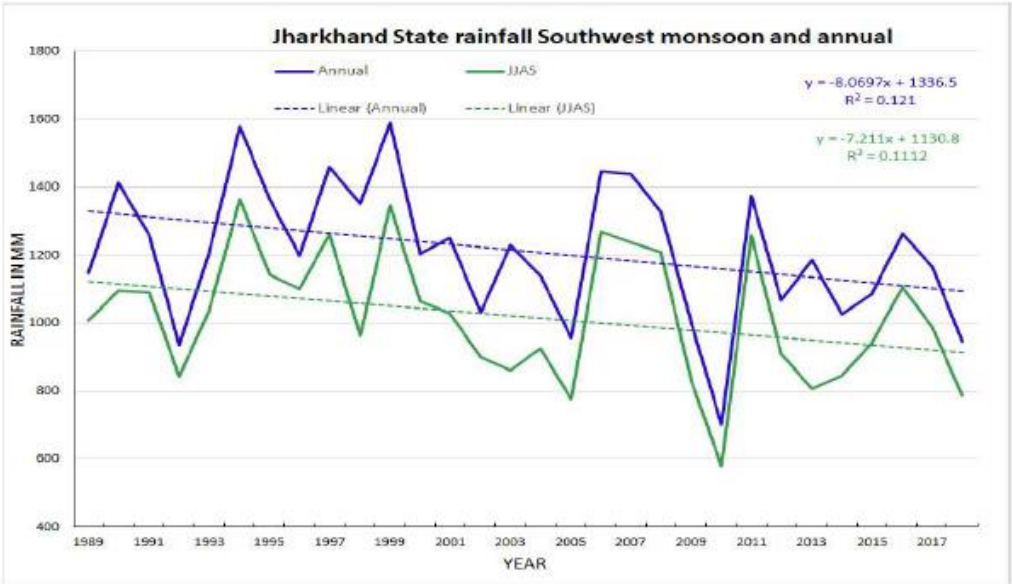


Fig-1.

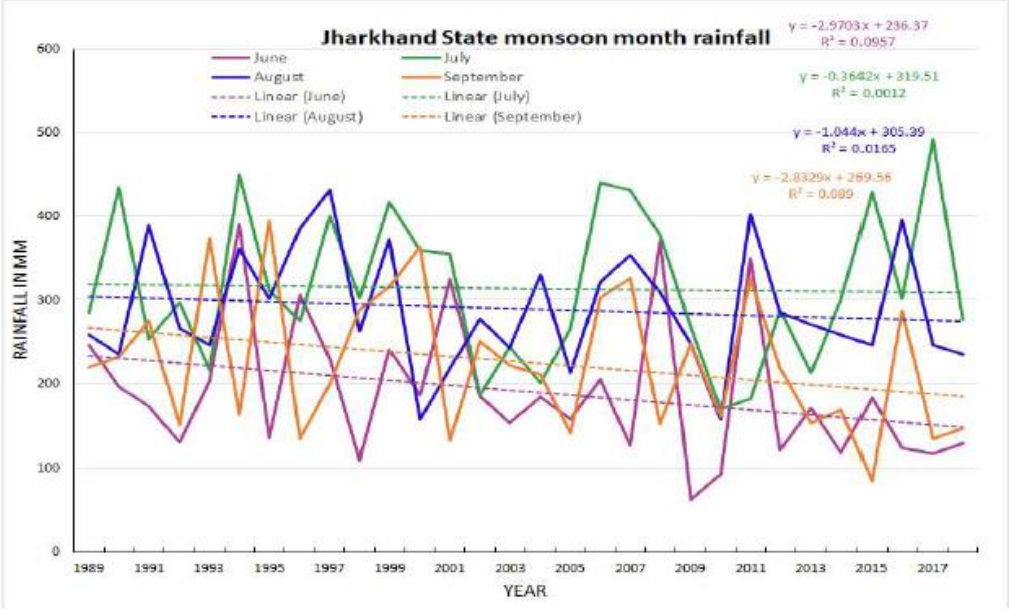


Fig-2.

2.0 GEOLOGY AND HYDROGEOLOGICAL SETUP OF THE AREA

2.1 REGIONAL GEOLOGY

The Jharia Coalfield covering an area of 453 sq. km. is located in Dhanbad District, Jharkhand. The non-coal bearing Talchir Formation is exposed in patches along the northern fringe of the Coalfield. The Barakar Formation (Coal Bearing horizon) overlies the Talchir and covers the most part of the Jharia Coalfield and have an area of 218 sq. km. This is successively overlain by the non-coal bearing Barren Measures Formation which is mainly exposed in the central part of the Coalfield. This, in turn, is overlain by the Raniganj Formation (Coal Bearing horizon) in the south-west part of the Coalfield and covers an area of 54 sq. km.

Chanch-Victoria Area is located in the western part of Raniganj Coalfield. The Raniganj coalfield represents the eastern most coal basin in the Damodar Valley Region, located at the border of Dhanbad District of Jharkhand and Bardhaman District of West Bengal. The Coalfield is almost elliptical in shape and covers an area of about 1530 sq. km. Out of this, only 35 sq. km. comes under leasehold area of BCCL within which 19.64 sq. km is the study area (Cluster-XVI only). The coal bearing formations of the area belongs to Barakar Formation of the Lower Gondwana in **Table-1**.

Table – 1: Regional Geological Succession of Jharia Coalfield

Geological Formations		Age
Quaternary/Recent	Soil cover/Weathered mantle	Recent
Post-Gondwana	Dolerite	Upper Cretaceous
	Lamprophyres	Jurassic
Damoda Group	Raniganj Formation	Upper Permian
	Barren Measures Formation	Middle Permian
	Barakar Formation	Lower Permian
	Karharbari	
	Talchir Formaton	Upper Carboniferous
----------Unconformity----------		
Metamorphics		Proterozoic

2.2 HYDROGEOLOGICAL SET- UP

The permeable formations, mainly composed of sandstone, behave as aquifer units. The coal seam and shales developed in the area act as impermeable beds i.e. aquiclude. The aquifer materials of Gondwana Formation constitute of fine to coarse grain sandstone having primary porosity of inter-granular void space. The secondary porosity formed due to presence of faults, fracture, joints, etc. Sandstones of Gondwana formation in JCF and RCF are very hard, compact and cemented and form less potential aquifer, particularly in deeper aquifer system. The secondary porosity along with primary porosity forms a conduit system making these formations good aquifers for movement and storage of ground water.

2.3 AQUIFERS DESCRIPTION

The aquifer system for shallow and deeper aquifer has been established through hydrogeological studies, exploration, surface and subsurface geophysical studies in the JCF and RCF (part) covering all geological formations. The aquifer can be divided into two zones – Un-confined/Phreatic (shallow) and Semi-confined to confined (deeper) aquifer.

PHREATIC/UN-CONFINED AQUIFER

The top aquifer occurred above the top most coal seam/shale bed is called un-confined or water table aquifer and it consists of relatively permeable formation such as weathered sandstone and loose soil. The thickness of the un-confined aquifer is varying from few meters to 50 m. This un-confined aquifer is more potential than semi-confined to confined aquifer.

SEMI-CONFINED TO CONFINED AQUIFER

The semi-confined to confined aquifer consisting of sandstone bed is sandwiched between coal seams/shale beds and thus, multiple aquifer system developed due to presence of multiple number of coal seams/shale beds. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are poor in potentiality.

Table –2: Generalized Hydrogeological Units developed in the study Area

Sl. No.	Type of Aquifer	Depth range (m)	Core zone (within 2 km)	Buffer zone (within 10 km)
1.	Unconfined	0 – 50 (Avg. 25)	Alluvium, weathered sandstone	Alluvium, weathered sandstone
2.	Semiconfined/ confined	50 to 650 m	Multiple Sandstone horizons in Barakar formation	Multiple Barakar sandstone, Barren Measure, Raniganj sandstone, Talchir shale and Metamorphics

2.4 GENERAL AQUIFER PARAMETERS

PHREATIC/UN-CONFINED AQUIFER

The wells tested by CMPDI for determination of aquifer parameters in Damuda (BJ Section) and Block-III area of JCF. The hydraulic conductivity of the un-confined aquifer is 0.50 to 0.90 m/day as computed from pumping tests on the wells. The transmissivity of the unconfined aquifer ranges from 10.68 m^2 /day to 41.48 m^2 /day.

SEMI-CONFINED TO CONFINED AQUIFER

The sandstone partings in-between impervious layers of shale and coal seams is designated as semi-confined / confined aquifers. The sandstones in these aquifers are fine to coarse grained, hard and compact with very low porosity. Mostly groundwater occurs in the weak zones formed due to weathering, fracture, faults, which create the secondary porosity. The hydrogeological parameter has determined by CMPDI in Sitanala Block by conducting aquifer performance test (APT) and also various piezometers within Cluster of mines BCCL during 2022-23. The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation ranges from 0.0006 m/day to 1.44 m/day. The hydrogeological parameter has also been determined at Kumari OCP Block in the central JCF by conducting aquifer performance test. The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation in this area ranges from 0.0027 m/day to 0.05 m/day.

Table – 3: Aquifer parameters determined from piezometers constructed in BCCL

Sl no.	Piezometer No.	Aquifer / Formation	Depth of the well (Meters)	Aquifer thickness (Meters)	Static Water Level (Meters)	Discharge (LPS)	Test duration (Minutes)	**K** (m/day)	**T** (m^2/day)
1	PZ-1A	Phreatic Aquifer	40	15	12.15	4.70	275	9.71×10^{-1}	14.6
2	PZ-1B	Barakar Formation (JCF)	115	30	27	2.85	275	6.33×10^{-2}	1.9
3	PZ-2A		87	15	28.1	1.5	960	5.88×10^{-2}	0.88
4	PZ-3A		172	42	17.55	3.0	157	4.04×10^{-2}	1.70
5	PZ-4A		70	18	15.55	1.65	167	5.00×10^{-2}	0.89
6	PZ-8A		140	24	68.72	1.05	275	6.53×10^{-2}	1.57
7	PZ-9B		100	30	34.68	2.45	390	6.68×10^{-2}	2.00
8	PZ-10A		135	30	5	4.7	865	1.52×10^{-1}	4.55
9	PZ-11A	Barren Measure Formation (JCF)	300	66	60.60	3.05	300	3.9×10^{-2}	2.57
10	PZ-13A	Ranigunj Formation (JCF)	80	24	30.9	1.75	400	6.37×10^{-2}	1.53
11	PZ-14B		162	24	12.15	2.75	475	7.48×10^{-2}	1.80
12	PZ-16A	Barakar Formation (part of RCF)	90	18	31.5	2.0	385	5.59×10^{-2}	1.01

3.0 GROUND WATER LEVEL MONITORING

To collect the representative groundwater levels in the study area, CMPDI has established a monitoring network of total 139 monitoring stations out of which 73 located within core zone and rest falls in Buffer zone. Total 105 nos. dug well within JCF and 34 nos. dug well within RCF (part) area (Details of the Hydrograph stations & water level given in **Annexure-V, VA** & **VB**) spread over the entire BCCL leasehold area, **Plate-I**. Water level data collection in all monitoring stations has been done on quarterly basis (May'24, Aug'24, Nov'24 and Jan'25).

Depth to water level of the water table depict the inequalities in the position of water table with respect to ground surface and is useful in delineating recharge / discharge areas, planning of artificial recharge structure and shows the overall status of the groundwater level in the area. Historical groundwater level (GWL) of entire JCF and part of RCF with fluctuation, GWL of Non-mining / Mining areas and GWL of the Cluster of Mines of BCCL are shown in this report to assess the effect of Coal mining activity on the groundwater regime in and around the Coalfield area.

Mining is a dynamic phenomenon. The mining activity creates dis-equilibrium in environmental scenario of the area and disturbs the groundwater conditions/regime in particular. The impact on shallow water regime due to mining activity can be broadly viewed as under:

- Historical GWL with annual fluctuation over the years
- GWL scenario in Non-mining and Mining area (OC/UG mines)
- GWL scenario of Cluster of mines of BCCL

3.1 HISTORICAL GROUNDWATER LEVEL (GWL)

Historical GWL of JCF and part of RCF of CMPDI monitoring stations given from 2005 to 2024 (total 64 stations within Coalfield area). Pre-monsoon and Post-monsoon GWL with Fluctuation has been mentioned below in the table.

Table – 4: Historical Groundwater Level

Period		(Water level in metre below ground level)								
		Pre-Monsoon (April/May)			Post-Monsoon (Nov/Dec)			Fluctuation		
		From	To	Average	From	To	Average	From	To	Average
JCF	2005	0.07	19.08	6.29	0.84	12.13	3.20	0.12	12.45	3.21
	2007	0.40	19.27	5.66	0.35	8.21	2.87	0.02	16.15	2.96
	2008	0.45	18.35	5.42	0.35	14.20	3.62	0.03	9.22	2.45
	2010	0.85	14.47	5.24	0.10	15.88	4.48	0.02	5.55	1.54
	2012	1.27	18.68	5.58	0.15	7.80	2.72	0.08	13.45	2.96
	2013	0.70	19.20	5.65	0.45	8.35	2.77	0.29	15.88	3.17
	2014	0.70	16.28	4.92	0.75	14.98	3.27	0.25	10.15	2.17
	2015	1.38	17.20	6.00	0.45	14.58	3.92	0.28	7.62	2.15
	2016	0.78	16.73	5.64	0.30	12.43	3.19	0.23	6.35	2.88
	2017	0.67	16.28	5.61	0.15	6.97	2.41	0.10	12.10	3.25
	2018	1.20	14.58	5.55	0.40	7.17	2.83	0.20	9.45	2.68
	2019	0.95	15.88	5.46	0.45	5.95	2.34	0.20	13.40	3.05
	2020	0.80	16.25	4.95	0.75	10.10	3.26	0.25	11.05	2.15
	2021	0.62	11.26	5.23	0.05	7.62	2.28	0.15	9.03	2.94
	2022	0.42	11.90	5.12	0.29	11.12	3.32	0.03	7.2	1.80
	2023	1.70	11.38	6.33	0.60	8.03	3.77	0.10	6.55	2.56
	2024	1.95	12.50	6.73	0.65	8.22	3.80	1.30	4.28	2.93
RCF (part)	2008	5.02	10.50	7.59	2.85	4.90	3.71	1.82	6.60	3.87
	2010	2.20	8.85	4.74	2.78	9.58	4.63	0.68	1.10	0.89
	2011	3.57	8.02	4.98	2.50	6.21	3.75	0.55	1.90	1.23
	2012	3.10	7.34	4.59	1.55	7.00	3.66	0.05	2.78	0.94
	2013	1.70	9.87	6.54	2.90	8.85	4.71	1.02	5.54	2.84
	2014	3.27	6.48	4.57	2.13	3.03	2.63	0.54	3.45	1.94
	2015	3.38	9.52	5.33	2.68	8.20	5.11	1.06	1.32	1.81
	2016	3.61	10.65	6.24	0.90	6.50	3.18	1.63	4.40	3.06
	2017	1.93	5.80	3.25	1.63	3.78	2.47	1.63	3.78	0.78
	2018	2.34	8.70	4.35	1.75	5.70	2.75	0.41	2.55	1.59
	2019	1.60	9.35	5.29	0.80	3.88	2.10	0.80	5.47	3.20
	2020	2.30	9.70	4.30	1.75	5.50	2.70	0.40	2.75	1.60
	2021	2.00	6.20	3.34	1.10	5.25	2.44	0.80	0.95	0.90
	2022	1.73	2.68	2.20	1.63	2.2	1.91	0.10	0.48	0.29
	2023	2.10	9.50	5.22	1.50	5.18	3.06	0.60	4.32	2.16
	2024	2.14	10.26	5.17	1.14	7.34	3.10	1.00	2.92	2.07

3.2 DEPTH TO WATER LEVEL & HYDRAULIC GRADIENT

Depth to water level (DTW) range in different formations with respect to mining and non-mining areas is summarized in the Table-5.

Table – 5: Avg. Depth to water table

Formation	*Area*	*DTW (bgl, m) [Year-2024-25]*	
		Pre-monsoon (May'24)	*Post-monsoon (Nov'24)*
Sedimentary (Gondwana Formation / Core Zone)	Non-mining	1.95-11.90	0.65-8.22
	Mining	1.95-10.6	0.65-7.34
Metamorphics (Hard rock)	Peripheral part of the Coalfield	3.17-12.5	1.14-7.77

The study revealed that water table is in shallow depth and there is no significant stress in the water table due to coal mining activity. Mining and Non-mining areas shows barely any difference in water table condition in JCF and RCF (part) area. The average hydraulic gradient of the water table within mining and non-mining areas is given in Table-6. No significant change in hydraulic gradient is observed. Relatively steep gradient near active opencast mining areas w.r.t., non-mining, underground mines and Metamorphics areas is observed.

Table – 6: Average hydraulic gradient

Sl. No	*Formation*	*Area*	*Average hydraulic gradient*
1	Sedimentary (Gondwana Formation / Core Zone)	Non-Mining	1.0×10^{-3} to 2×10^{-3}
		Mining	1.0×10^{-2} to 1.5×10^{-3}
2	Metamorphics (Buffer Zone)	Peripheral part of the Coalfield	1.0×10^{-3} to 3.5×10^{-3}

3.3 GROUND WATER LEVEL DATA OF THE CLUSTER OF MINES OF BCCL

A GROUND WATER LEVEL OF CLUSTER-I

Cluster-I (Damuda Group of Mines consisting of Damuda UG, Albion OCP, Proposed BJ Section OCP and Abandoned Gutway OCP) of Barora area, BCCL is located in the western most part of Jharia coalfield in Bokaro district of Jharkhand. The life of the project has been worked out to be up to 15 years considering annual target production of 1.17 MTPA. It is located in the extreme western part of JCF in Bokaro district of Jharkhand (Toposheet no – 73 I/1).

The present leasehold area of Cluster-I is 575.0 Ha. The Damuda block area marked by more or less flat and gently undulating topography. The RL varies from 179 m to 208 m AMSL and the general slope of topography is towards east. Jamuniya River, Kari Jore, Podo Jore and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Jamuniya River.

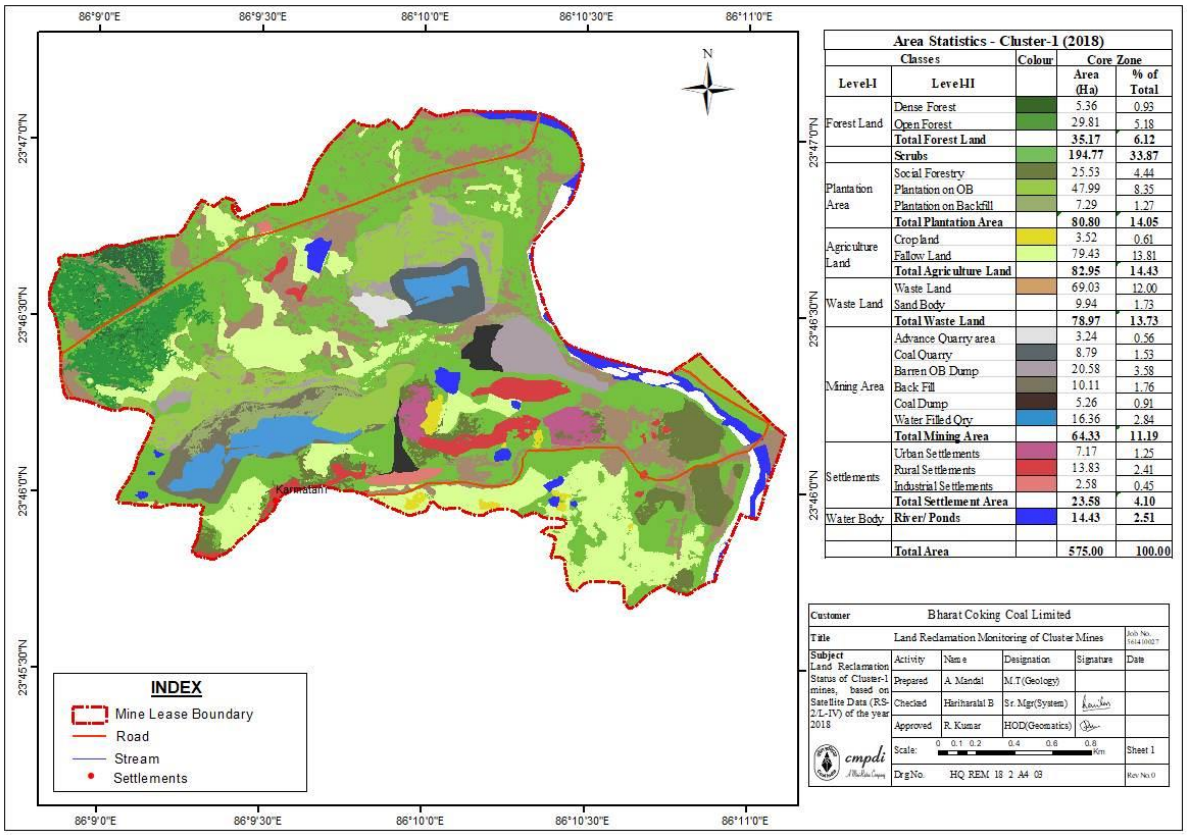
Monitoring stations (**B015, B051 and B053**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl	Well	Location	Water level (bgl in meters)											
No.	No.		2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B015	Bera Basti	3.35	0.70	0.91	1.54	3.20	0.80	1.00	2.72	3.67	0.45	1.02	2.30
2	B051	Taranga	6.40	2.66	4.47	5.05	5.20	2.51	4.45	4.95	5.06	0.00	4.57	2.87
3	B053	Karmatanr	3.10	1.02	1.21	1.45	2.62	1.33	1.13	1.66	4.42	1.78	3.54	1.68
Average WL (bgl)			4.28	1.46	2.20	2.68	3.67	1.55	2.19	3.11	4.38	0.74	3.04	2.28

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.62 m Max –6.40 m
Post-monsoon GW Level (m): Min – 0.91 m Max – 4.57 m

LAND USE / LAND COVER MAP OF THE CLUSTER-I MINES, BCCL



Area Statistics - Cluster-1 (2018)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest Land	Dense Forest		5.36	0.93
	Open Forest		29.81	5.18
	Total Forest Land		**35.17**	**6.12**
	Scrubs		**194.77**	**33.87**
Plantation Area	Social Forestry		25.53	4.44
	Plantation on OB		47.99	8.35
	Plantation on Backfill		7.29	1.27
	Total Plantation Area		**80.80**	**14.05**
Agriculture Land	Cropland		3.52	0.61
	Fallow Land		79.43	13.81
	Total Agriculture Land		**82.95**	**14.43**
Waste Land	Waste Land		69.03	12.00
	Sand Body		9.94	1.73
	Total Waste Land		**78.97**	**13.73**
Mining Area	Advance Quarry area		3.24	0.56
	Coal Quarry		8.79	1.53
	Barren OB Dump		20.58	3.58
	Back Fill		10.11	1.76
	Coal Dump		5.26	0.91
	Water Filled Qry		16.36	2.84
	Total Mining Area		**64.33**	**11.19**
Settlements	Urban Settlements		7.17	1.25
	Rural Settlements		13.83	2.41
	Industrial Settlements		2.58	0.45
	Total Settlement Area		**23.58**	**4.10**
Water Body	River/ Ponds		14.43	2.51
	Total Area		**575.00**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 5614.0002
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Cluster-I mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Prepared	A. Mandal	M.T(Geology)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	HOD(Geomatics)		
cmpdi	Scale: 0 0.1 0.2 0.4 0.6 0.8 Km				Sheet 1
	Drg No. HQ REM 18 2 A4 03				Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	393.69 x 10^4	0.0	393.69 x 10^4
2	Open Land	204.89 x 10^4	0.0	204.89 x 10^4
3	Road/ Paved Area	09.0 x 10^4	0.0	09.0 x 10^4
4	Rooftop area of building/ sheds	14.58 x 10^4	0.0	14.58 x 10^4
5	Total	575.00 x 10^4	0.0	575.00 x 10^4

B. GROUND WATER LEVEL OF CLUSTER-II

Cluster-II consists of seven mines namely; Block II Mixed mines (OCP & UGP), Jamunia OCP, Shatabdi OCP, Muraidih Mixed mines (OCP & UGP), and Phularitand OCP of BCCL is located in the western most part of Jharia coalfield in Bokaro district and Dhanbad district of Jharkhand. The life of the project has been worked out to be up to 30 years considering annual target production of 20.215 MTPA. It is located in the extreme western part of Jharia Coalfield in Dhanbad district of Jharkhand (Toposheet no- 73 I/1 and I/5).

The present leasehold area of Cluster-II is 2260.54 Ha. The Damuda block area marked by more or less flat and gently undulating topography. The RL varies from 176 m to 235 m AMSL. Jamuniya River, Khudia River and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Jamuniya River and Khudia River.

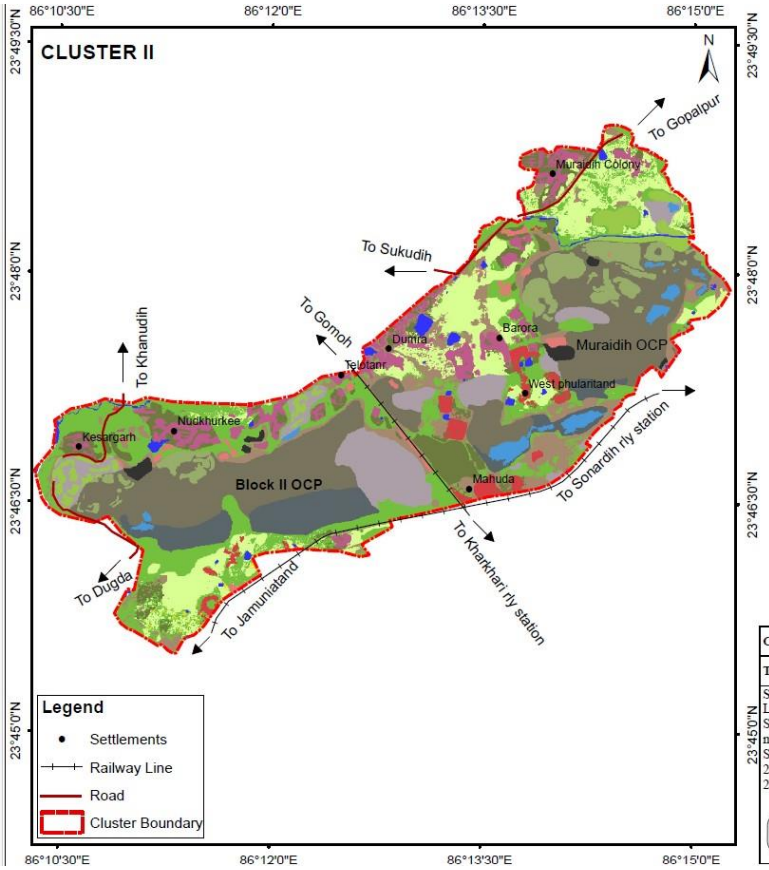
Monitoring stations (**B001, B059, B060 and B062**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl	Well	Location	Water level (bgl in meters)											
No.	No.		2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B001	Muraidih	4.12	1.82	2.58	2.83	3.22	1.25	2.45	2.7	2.1	1.65	1.81	2.73
2	B059	Khodovaly	2.98	0.50	0.65	1.12	1.88	0.5	0.7	1.12	4.5	0.44	1.14	1.04
3	B060	Bahiyardih	9.10	2.70	5.77	9.04	10.73	5.31	5.73	9.51	10.53	1.08	5.8	9.38
4	B062	Sadiyardih	4.97	3.01	3.19	3.80	4.8	2.35	3.1	4	6.45	1.77	4.91	5.15
Average WL (bgl)			5.29	2.01	3.05	4.20	5.16	2.35	3	4.33	5.9	1.24	3.42	4.58

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.88m Max – 10.73 m
Post-monsoon GW Level (m): Min – 0.65 m Max – 5.80 m

LAND USE / LAND COVER MAP OF THE CLUSTER-II MINES, BCCL



Area Statistics - Cluster-II (2022)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**381.65**	**18.84**
Plantation Area	Social Forestry		128.03	6.32
	Plantation on OB		47.29	2.33
	Plantation on Backfill		87.42	4.32
	Total Plantation (C)		**262.74**	**12.97**
	Total Vegetation (A+B+C)		**644.39**	**31.81**
Agriculture Land	Crop land		2.51	0.12
	Fallow Land		254.68	12.57
	Total Agriculture Land		**257.19**	**12.70**
Waste Land	Waste Land		191.19	9.44
	Sand Body		2.01	0.10
	Total Waste Land		**193.20**	**9.54**
Mining Area	Advance Quarry Site		0.00	0.00
	Coal Quarry		116.08	5.73
	Barren OB Dump		146.93	7.25
	Back Fill		422.00	20.83
	Coal Dump		15.58	0.77
	Water Filled Qry		32.77	1.62
	Total Mining Area		**733.36**	**36.20**
Settlements	Urban Settlements		111.11	5.48
	Rural Settlements		41.15	2.03
	Industrial Settlements		19.35	0.96
	Total Settlement Area		**171.61**	**8.47**
Water Body	**River/ Ponds**		**25.96**	**1.28**
	Total Area		**2025.71**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 564922120
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Cluster-II mines, based on Satellite Data (RS-2A/L-IV) of the year 2022	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Hariharalal B	Ch. Mgr(System)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.5 1 2 Km				Sheet 1
	Drg No. HQ REM 22 2 A4 02				RevNo 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	977.33×10^4	0.0	977.33×10^4
2	Open Land	1072.08×10^4	0.0	1072.08×10^4
3	Road/ Paved Area	140.32×10^4	0.0	140.32×10^4
4	Rooftop area of building/ sheds	70.81×10^4	0.0	70.81×10^4
5	Total	2260.54×10^4	0.0	2260.54×10^4

C. GROUND WATER LEVEL OF CLUSTER-III

Cluster-III consists of nine mines namely, Jogidih UG, Govindpur UG, Maheshpur UG, Kooridih/Block-IV Mixed Mine, New Akashkinaree Mixed Mine, South Govindpur UG (closed), and Teturiya UG (closed) mines. The life of the project has been worked out to be up to 60 years considering annual production target of 3.60 MTPA. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand (Toposheet no – 73 I/5).

The present leasehold area of Cluster-III is 1552.53 Ha. The area is plain with gentle undulation with RL varying from 160 m to 208.80 m AMSL. The general slope of the area is towards south. Khudia River, Baghdigi Jore, Katri River and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Khudia River.

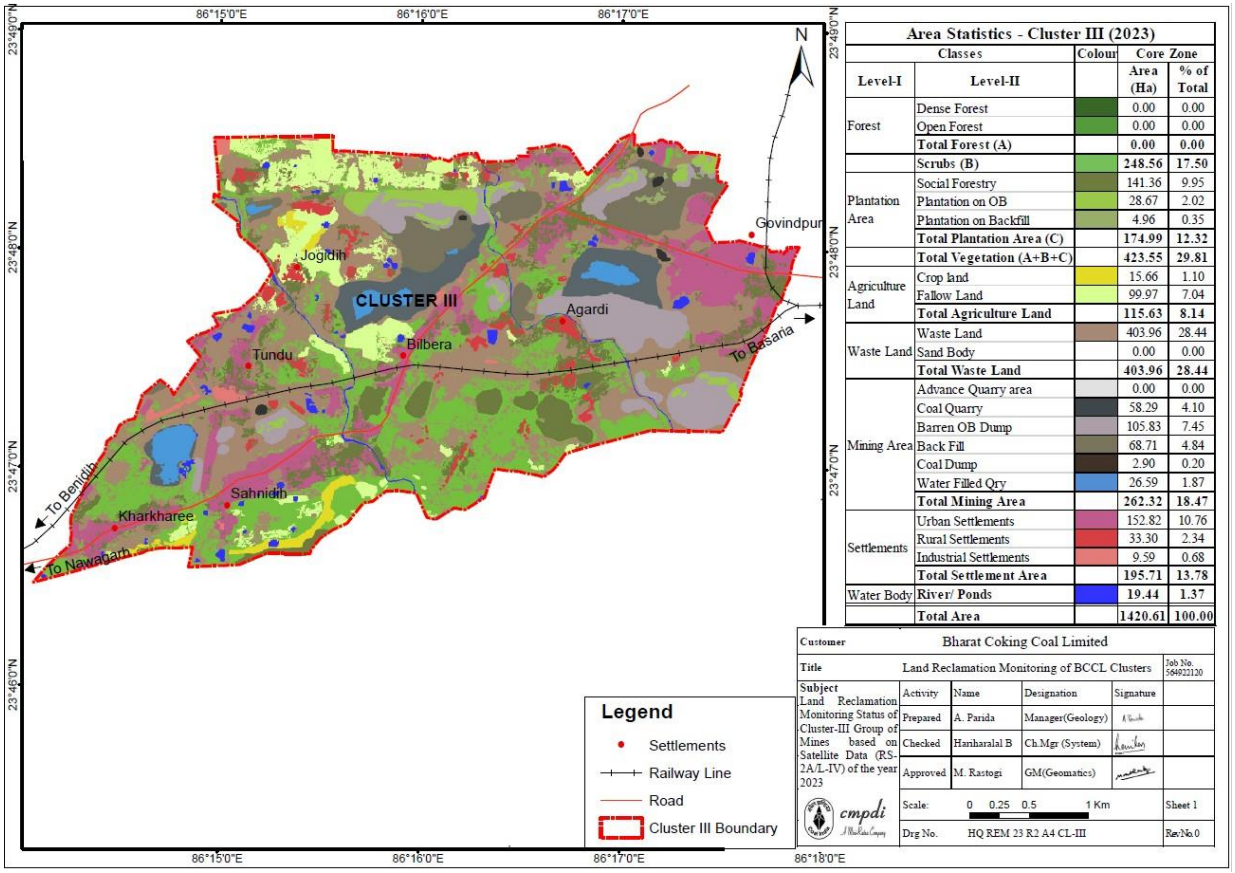
Monitoring stations (**A025, A029, B014 and B060**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
							May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A025	Sinidih	4.85	1.39	2.65	2.98	2.93	1.09	2.6	2.7	3.31	1.33	2.08	2.51
2	A029	Dharmaband	3.06	1.01	2.80	2.88	5.6	2.1	3.2	4.08	4.6	1.2	1.15	1.12
3	B014	Mathadih	3.40	0.93	2.27	2.45	2.84	1.12	2.34	2.42	3.24	0.09	2.6	2.55
4	B060	Sonardih	9.10	2.70	5.77	9.04	10.73	5.31	5.73	9.51	10.53	1.08	5.8	9.38
Average WL (bgl)			5.10	1.51	3.37	4.34	5.53	2.41	3.47	4.68	5.42	0.93	2.91	3.89

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.84 m Max – 10.73 m
Post-monsoon GW Level (m): Min – 1.15 m Max – 5.80 m

LAND USE / LAND COVER MAP OF THE CLUSTER-III MINES, BCCL



Area Statistics - Cluster III (2023)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
Plantation Area	**Scrubs (B)**		**248.56**	**17.50**
	Social Forestry		141.36	9.95
	Plantation on OB		28.67	2.02
	Plantation on Backfill		4.96	0.35
	Total Plantation Area (C)		**174.99**	**12.32**
	Total Vegetation (A+B+C)		**423.55**	**29.81**
Agriculture Land	Crop land		15.66	1.10
	Fallow Land		99.97	7.04
	Total Agriculture Land		**115.63**	**8.14**
Waste Land	Waste Land		403.96	28.44
	Sand Body		0.00	0.00
	Total Waste Land		**403.96**	**28.44**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		58.29	4.10
	Barren OB Dump		105.83	7.45
	Back Fill		68.71	4.84
	Coal Dump		2.90	0.20
	Water Filled Qry		26.59	1.87
	Total Mining Area		**262.32**	**18.47**
Settlements	Urban Settlements		152.82	10.76
	Rural Settlements		33.30	2.34
	Industrial Settlements		9.59	0.68
	Total Settlement Area		**195.71**	**13.78**
Water Body	**River/ Ponds**		**19.44**	**1.37**
	Total Area		**1420.61**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564922120
Subject	Activity	Name	Designation	Signature	
Land Reclamation Monitoring Status of Cluster-III Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2023	Prepared	A. Parida	Manager(Geology)		
	Checked	Hariharalal B	Ch.Mgr (System)		
	Approved	M. Rastogi	GM(Geomatics)		
cmpdi	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 23 R2 A4 CL-III			Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	580.21 x 10^4	0.0	580.21 x 10^4
2	Open Land	770.61 x 10^4	0.0	770.61 x 10^4
3	Road/ Paved Area	164.97 x 10^4	0.0	164.97 x 10^4
4	Rooftop area of building/ sheds	36.74 x 10^4	0.0	36.74 x 10^4
5	Total	1552.53 x 10^4	0.0	1552.53 x 10^4

D. GROUND WATER LEVEL OF CLUSTER-IV

Cluster-IV consists of six mines namely, Amalgamated Keshalpur & West Mudidih colliery, Amalgamated Angarpathra & Ramkanali colliery, Katras-Choitudih Colliery, Salanpur colliery and Gaslitand colliery of Katras area, BCCL. It is located in the north-central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be more than 30 years considering annual target production of 9.55 MTPA (Toposheet no – 73 I/5).

The present leasehold area of Cluster-IV is 1123.79 Ha. The area has a general undulating topography, with an overall gentle south-west slope. The RL varies from 182 m to 216 m AMSL. Katri River, Kumari Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Katri River.

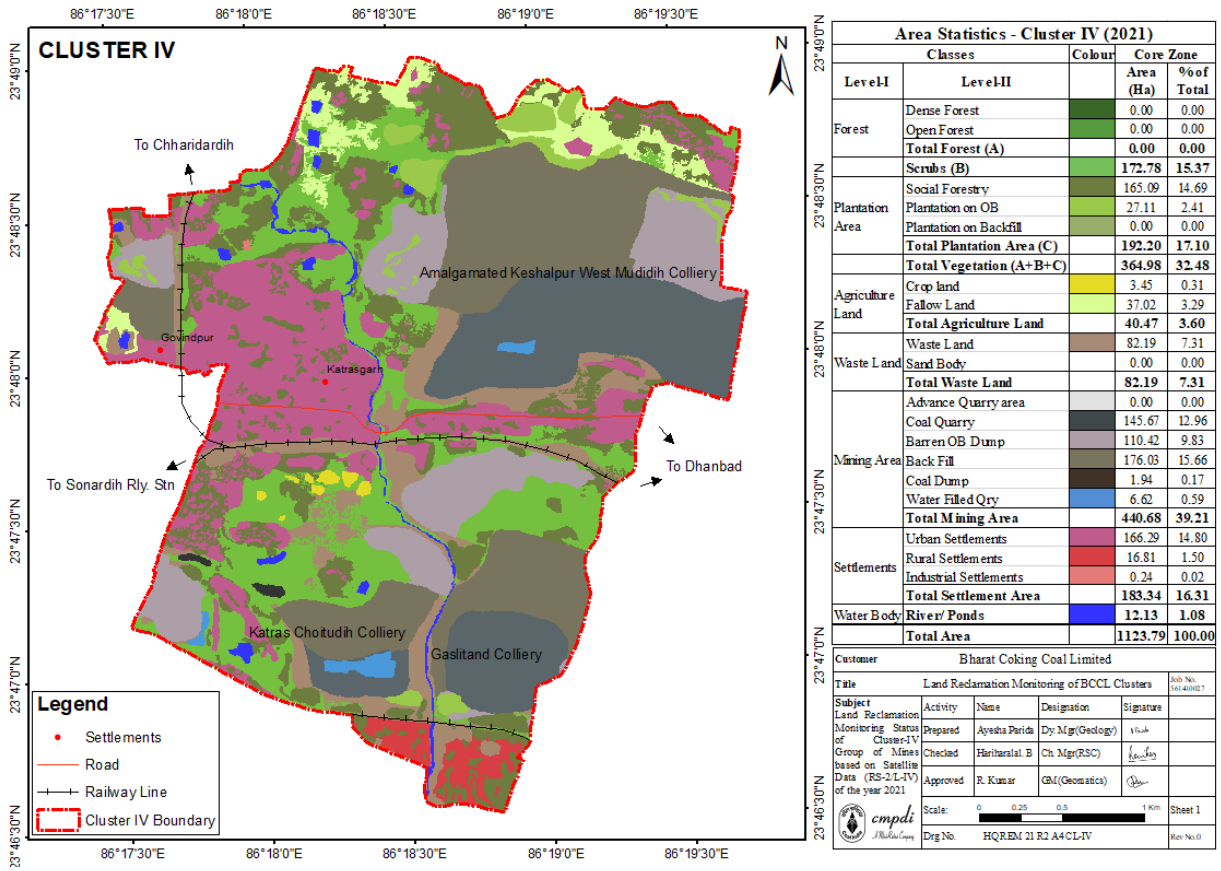
Monitoring stations (**A026, A028 and B065**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A026	Malkhera	7.00	3.18	3.72	4.35	8.4	3.87	3.83	5.5	6.42	2.83	4.31	3.62
2	A028	Lakarka	4.30	3.30	3.49	3.78	3.45	3.13	3.35	3.4	4.23	2.85	3.3	3.57
3	B065	Jhinjipahari	10.60	2.22	2.45	4.01	8.45	1.95	2.35	4.93	7.45	0.5	2.27	3.45
Average WL (bgl)			7.30	2.90	3.22	4.05	6.77	2.98	3.18	4.61	6.03	2.06	3.29	3.55

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.45 m Max – 10.60 m
Post-monsoon GW Level (m): Min – 2.27 m Max – 4.31 m

LAND USE / LAND COVER MAP OF THE CLUSTER-IV MINES, BCCL



Area Statistics - Cluster IV (2021)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	%of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**172.78**	**15.37**
Plantation Area	Social Forestry		165.09	14.69
	Plantation on OB		27.11	2.41
	Plantation on Backfill		0.00	0.00
	Total Plantation Area (C)		**192.20**	**17.10**
	Total Vegetation (A+B+C)		**364.98**	**32.48**
Agriculture Land	Crop land		3.45	0.31
	Fallow Land		37.02	3.29
	Total Agriculture Land		**40.47**	**3.60**
Waste Land	Waste Land		82.19	7.31
	Sand Body		0.00	0.00
	Total Waste Land		**82.19**	**7.31**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		145.67	12.96
	Barren OB Dump		110.42	9.83
	Back Fill		176.03	15.66
	Coal Dump		1.94	0.17
	Water Filled Qry		6.62	0.59
	Total Mining Area		**440.68**	**39.21**
Settlements	Urban Settlements		166.29	14.80
	Rural Settlements		16.81	1.50
	Industrial Settlements		0.24	0.02
	Total Settlement Area		**183.34**	**16.31**
Water Body	**River/ Ponds**		**12.13**	**1.08**
	Total Area		**1123.79**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 541400027
Subject	Activity	Name	Designation	Signature	
Land Reclamation Monitoring Status of Cluster-IV Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2021	Prepared	Ayesha Parida	Dy. Mgr(Geology)		
	Checked	Hariharalal. B	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ/REM/21/R2/A4/CL-IV				Rev No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	385.15 x 10^4	0.0	385.15 x 10^4
2	Open Land	555.43 x 10^4	0.0	555.43 x 10^4
3	Road/ Paved Area	160.59 x 10^4	0.0	160.59 x 10^4
4	Rooftop area of building/ sheds	22.63 x 10^4	0.0	22.63 x 10^4
5	Total	1123.79 x 10^4	0.0	1123.79 x 10^4

E. GROUND WATER LEVEL OF CLUSTER-V

Cluster-V consists of twelve mines namely; Tetulmari OC & UG mines, Mudidih OC & UG mines, Nichitpur OC mine, Sendra Bansjora OC & UG mines, Bansdeopur OCP (proposed) & UG Mines, Kankanee OC & UG mines and Loyabad UG mine (closed) of Sijua area, BCCL. This Cluster of mines is located in northern part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be more than 30 years considering annual production target of 6.311 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-V is 1724.52 Ha. The area has a general undulating topography, with an overall gentle south-west slope. The RL varies from 210 m to 170 m AMSL. Jarian Nala, Nagri Jore, Ekra Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Jarian Nala and Ekra Jore.

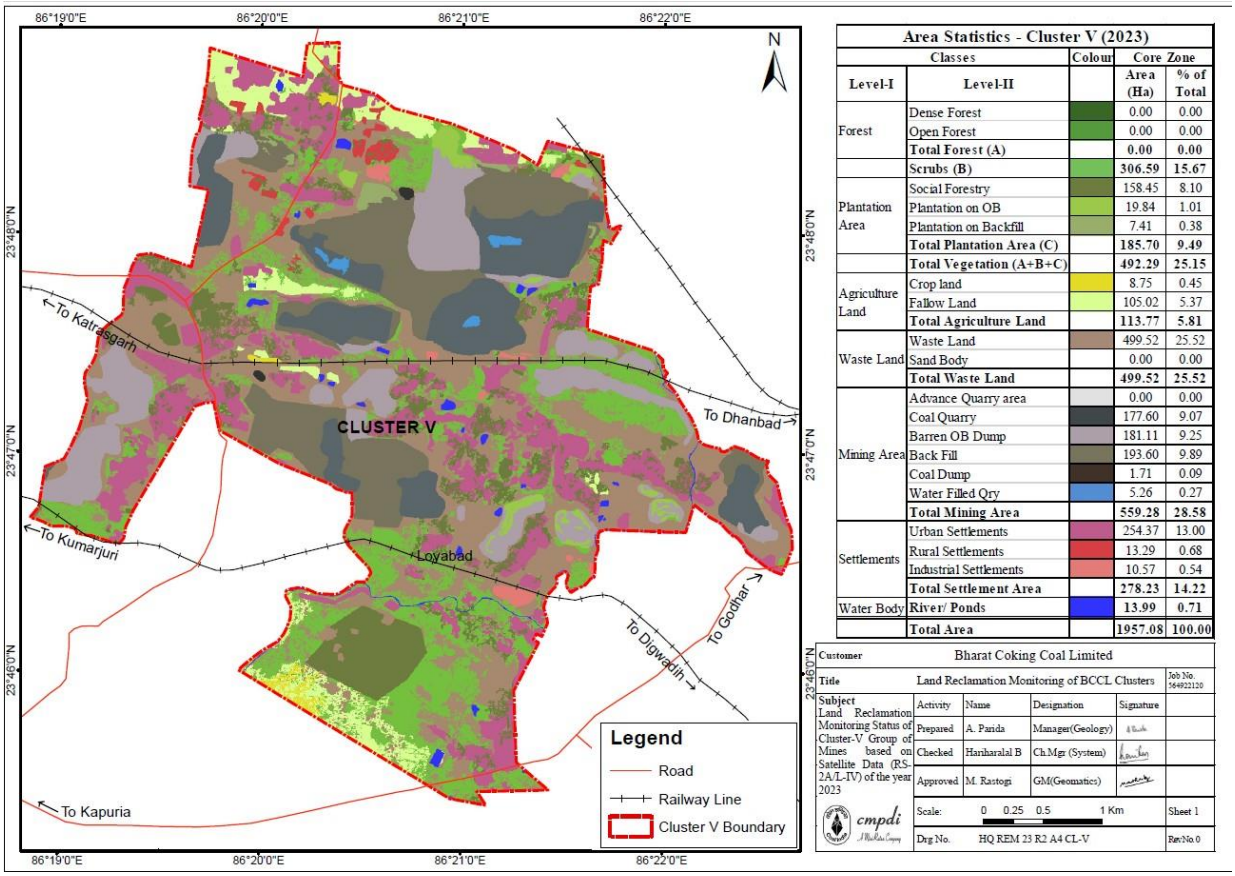
Monitoring stations (**A016 and A027**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A016	Ekra	4.56	3.29	3.49	3.81	5.55	1.35	3.52	4.3	5.8	1.35	3.08	2.99
2	A027	Tetulmari	7.00	3.18	3.72	4.35	1.7	0.55	1.6	1.8	1.9	0.1	1.33	1.5
Average WL (bgl)			5.78	3.24	3.61	4.08	3.63	0.95	2.56	3.05	3.85	0.73	2.21	2.25

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.70 m Max – 7.00 m
Post-monsoon GW Level (m): Min – 1.33 m Max – 3.72 m

LAND USE / LAND COVER MAP OF THE CLUSTER-V MINES, BCCL



Area Statistics - Cluster V (2023)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**306.59**	**15.67**
Plantation Area	Social Forestry		158.45	8.10
	Plantation on OB		19.84	1.01
	Plantation on Backfill		7.41	0.38
	Total Plantation Area (C)		**185.70**	**9.49**
	Total Vegetation (A+B+C)		**492.29**	**25.15**
Agriculture Land	Crop land		8.75	0.45
	Fallow Land		105.02	5.37
	Total Agriculture Land		**113.77**	**5.81**
Waste Land	Waste Land		499.52	25.52
	Sand Body		0.00	0.00
	Total Waste Land		**499.52**	**25.52**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		177.60	9.07
	Barren OB Dump		181.11	9.25
	Back Fill		193.60	9.89
	Coal Dump		1.71	0.09
	Water Filled Qry		5.26	0.27
	Total Mining Area		**559.28**	**28.58**
Settlements	Urban Settlements		254.37	13.00
	Rural Settlements		13.29	0.68
	Industrial Settlements		10.57	0.54
	Total Settlement Area		**278.23**	**14.22**
Water Body	**River/ Ponds**		**13.99**	**0.71**
	Total Area		**1957.08**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564922120
Subject: Land Reclamation Monitoring Status of Cluster-V Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2023	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Manager(Geology)		
	Checked	Hariharalal B	Ch.Mgr (System)		
	Approved	M. Rastogi	GM(Geomatics)		
cmpdi	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 23 R2 A4 CL-V			Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	527.26×10^4	0.0	527.26×10^4
2	Open Land	973.52×10^4	0.0	973.52×10^4
3	Road/ Paved Area	217.50×10^4	0.0	217.50×10^4
4	Rooftop area of building/ sheds	24.24×10^4	0.0	24.24×10^4
5	Total	1724.52×10^4	0.0	1724.52×10^4

F. GROUND WATER LEVEL OF CLUSTER-VI

Cluster–VI consists of four coal mines namely, East Bassuriya opencast (OC), Bassuriya underground (UG), Gondudih Khas-Kusunda OC and Godhur Mixed Mines (OC and UG) of BCCL. This Cluster of mines is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be more than 30 years considering annual production target of 7.631 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-VI is 831.83 Ha. The area has a general undulating topography with general slope towards south. The RL varies from 180 m to 240 m AMSL. Ekra Jore, Kari Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Ekra Jore and Kari Jore.

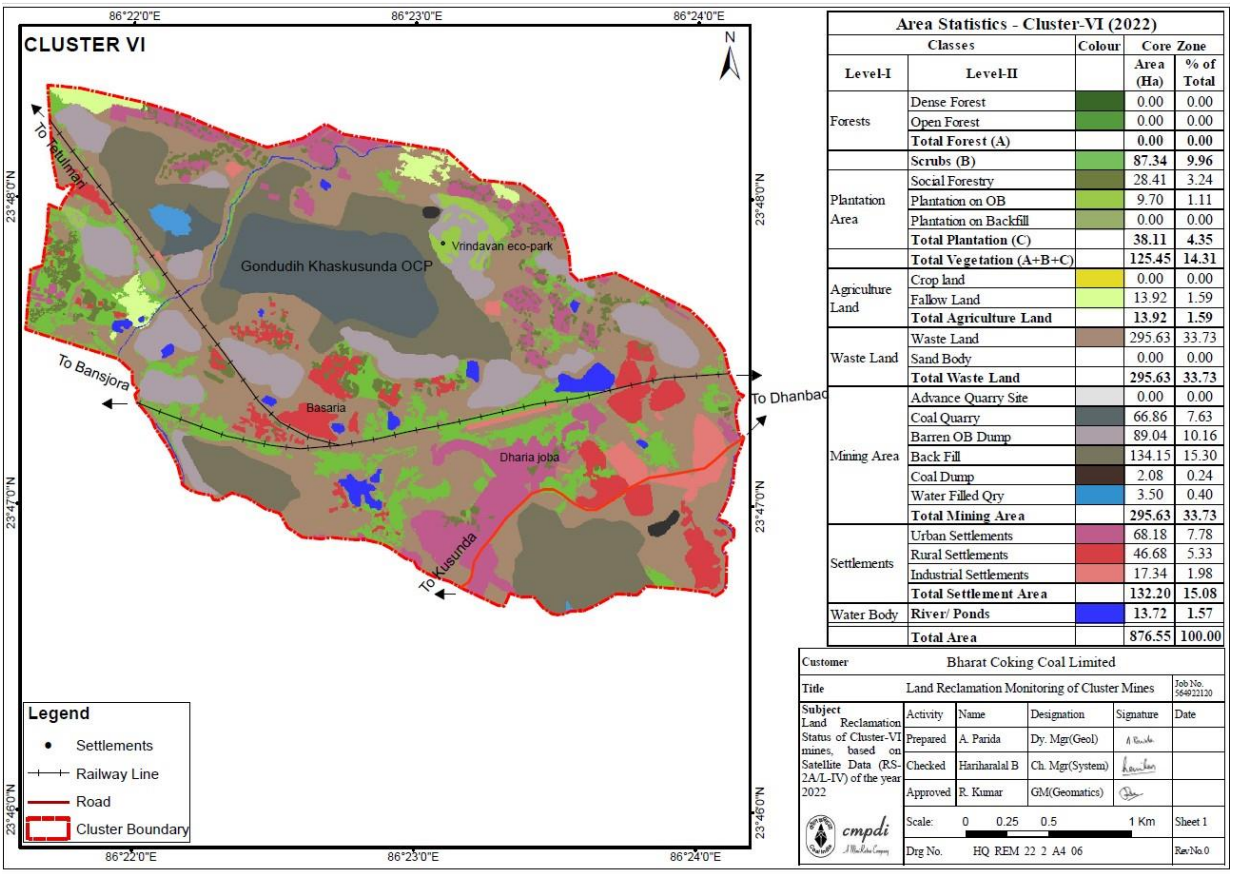
Monitoring stations (**D025, D030 and D034**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D025	Godhur	6.33	3.24	3.47	5.20	4.40	1.80	3.40	4.20	11.90	2.58	4.70	5.30
2	D030	Borkiboa	4.12	1.39	2.28	2.88	4.08	2.10	2.20	3.44	4.37	1.80	2.29	4.15
3	D034	Kusunda	4.30	2.12	2.63	2.99	3.80	1.80	2.50	2.89	5.00	2.15	3.15	3.22
Average WL (bgl)			4.92	2.25	2.79	3.69	4.09	1.90	2.70	3.51	7.09	2.18	3.38	4.22

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.80 m Max – 11.90 m
Post-monsoon GW Level (m): Min – 2.20 m Max – 4.70 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VI MINES, BCCL



Area Statistics - Cluster-VI (2022)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
Plantation Area	Scrubs (B)		87.34	9.96
	Social Forestry		28.41	3.24
	Plantation on OB		9.70	1.11
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		**38.11**	**4.35**
	Total Vegetation (A+B+C)		**125.45**	**14.31**
Agriculture Land	Crop land		0.00	0.00
	Fallow Land		13.92	1.59
	Total Agriculture Land		**13.92**	**1.59**
Waste Land	Waste Land		295.63	33.73
	Sand Body		0.00	0.00
	Total Waste Land		**295.63**	**33.73**
Mining Area	Advance Quarry Site		0.00	0.00
	Coal Quarry		66.86	7.63
	Barren OB Dump		89.04	10.16
	Back Fill		134.15	15.30
	Coal Dump		2.08	0.24
	Water Filled Qry		3.50	0.40
	Total Mining Area		**295.63**	**33.73**
Settlements	Urban Settlements		68.18	7.78
	Rural Settlements		46.68	5.33
	Industrial Settlements		17.34	1.98
	Total Settlement Area		**132.20**	**15.08**
Water Body	**River/ Ponds**		**13.72**	**1.57**
	Total Area		**876.55**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 5640/22120
Subject: Land Reclamation Status of Cluster-VI mines, based on Satellite Data (RS-2A/L-IV) of the year 2022	Activity	Name	Designation	Signature	Date
	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Hariharalal B	Ch. Mgr(System)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 22 2 A4 06				Rev/No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	122.39 X 10^4	0.0	122.39 X 10^4
2	Open Land	581.14 X 10^4	0.0	581.14 X 10^4
3	Road/ Paved Area	68.81 X 10^4	0.0	68.81 X 10^4
4	Rooftop area of building/ sheds	59.49 X 10^4	0.0	59.49 X 10^4
5	Total	831.83 X 10^4	0.0	831.83 X 10^4

G. GROUND WATER LEVEL OF CLUSTER-VII

Cluster-VII consists of fourteen mines within Kusunda Area, Bastacolla Area and PB Area, B.C.C.L, Jharia Coalfield. Coal mines namely Dhansar UG, Dhansar OCP, Kusunda OCP and Viswakarma OCP (proposed) are under the administrative control of Kusunda Area and Industry UG (closed), Alkusa UG, Ena OCP, S.Jharia/Rajapur OCP, Burragarh UG, Simlabahal UG, Hurriladih UG, Bhutgoria UG (Re-opening), Kustore UG (closed) and E.Bhuggatdih UG (closed) are under Bastacolla and PB Area. This Cluster of mines is located in east central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be more than 30 years considering annual production target of 8.226 MTPA (Toposheet no – 73 I/6).

The present leasehold area of Cluster-VII is 2127.70 Ha. The area has a general undulating topography with general slope towards south. The RL varies from 172 m to 221 m above M.S.L. Kari Jore, Chatkari Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Kari Jore and Chatkari Jore.

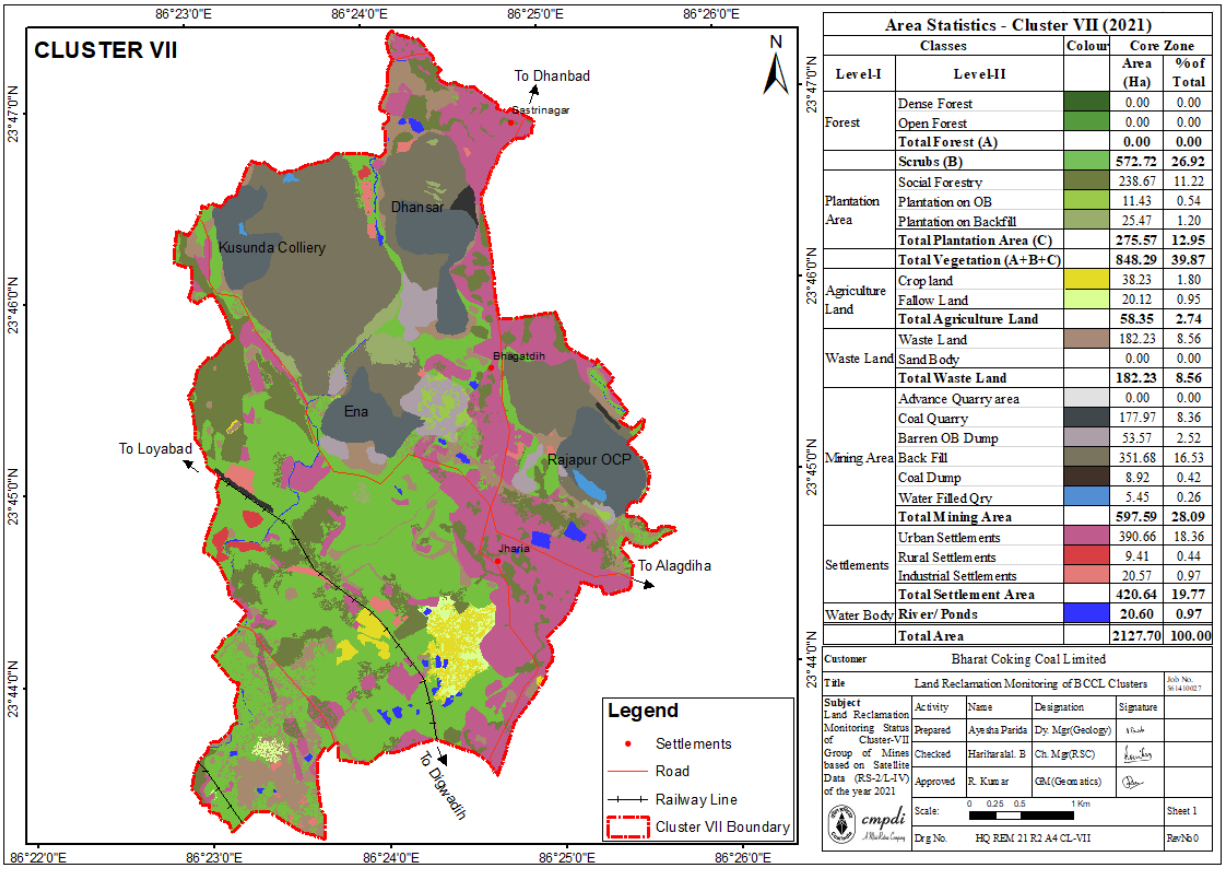
Monitoring stations (**D003, D034, D047 and D080**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D003	Dhansar	1.95	0.87	1.71	1.88	3.15	1.22	1.85	2.28	5.96	0.55	1.32	1.34
2	D034	Kusunda	4.30	2.12	2.63	2.99	3.8	1.8	2.5	2.89	5	2.15	3.15	3.22
3	D047	Parastanr	4.32	2.14	3.38	3.65	4.45	2.57	3.27	3.85	6.55	5.32	5.85	11.4
4	D080	Bastacolla	3.66	2.14	2.55	2.71	4.75	1.75	2.6	3.42	3.3	2.4	3.08	1.8
Average WL (bgl)			3.56	1.82	2.57	2.81	4.04	1.84	2.56	3.11	5.2	2.61	3.35	4.44

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.95 m Max – 6.55 m
Post-monsoon GW Level (m): Min – 1.32 m Max – 5.85 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VII MINES, BCCL



Area Statistics - Cluster VII (2021)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	%of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**572.72**	**26.92**
Plantation Area	Social Forestry		238.67	11.22
	Plantation on OB		11.43	0.54
	Plantation on Backfill		25.47	1.20
	Total Plantation Area (C)		**275.57**	**12.95**
	Total Vegetation (A+B+C)		**848.29**	**39.87**
Agriculture Land	Crop land		38.23	1.80
	Fallow Land		20.12	0.95
	Total Agriculture Land		**58.35**	**2.74**
Waste Land	Waste Land		182.23	8.56
	Sand Body		0.00	0.00
	Total Waste Land		**182.23**	**8.56**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		177.97	8.36
	Barren OB Dump		53.57	2.52
	Back Fill		351.68	16.53
	Coal Dump		8.92	0.42
	Water Filled Qry		5.45	0.26
	Total Mining Area		**597.59**	**28.09**
Settlements	Urban Settlements		390.66	18.36
	Rural Settlements		9.41	0.44
	Industrial Settlements		20.57	0.97
	Total Settlement Area		**420.64**	**19.77**
Water Body	**River/ Ponds**		**20.60**	**0.97**
	Total Area		**2127.70**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 36141002?
Subject: Land Reclamation Monitoring Status of Cluster-VII Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2021	Activity	Name	Designation	Signature	
	Prepared	Ayesha Parida	Dy. Mgr(Geology)		
	Checked	Hariharalal. B	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 21 R2 A4 CL-VII				Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	968.53 x 10^4	0.0	968.53 x 10^4
2	Open Land	746.72 x 10^4	0.0	746.72 x 10^4
3	Road/ Paved Area	380.73 x 10^4	0.0	380.73 x 10^4
4	Rooftop area of building/ sheds	31.71 x 10^4	0.0	31.71 x 10^4
5	Total	2127.70 x 10^4	0.0	2127.70 x 10^4

H. GROUND WATER LEVEL OF CLUSTER-VIII

Cluster - VIII of B.C.C.L mines are under administrative control of Bastacolla Area, Jharia Coalfield. Cluster-VIII consists of ten mines namely Bastacolla mixed mines (OC & UG), Bera mixed mines (OC&UG), Dobari UG, Kuya mixed mines (OC&UG), Proposed Goluckdih (NC) OC mine, Ghanoodih OC mine and Kujama OC mine. This cluster is located in west part of Jharia Coalfield in Dhanbad district of Jharkhand. All the above mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of mining activities. The life of the project has been worked out to be up to 25 years considering annual production target of 6.383 MTPA (toposheet no. 73 I/5 and I/6).

The present leasehold area of Cluster-VIII is 1331.95 Ha. The area has a general undulating topography with general slope towards south and south-west. The ground elevation in the area ranges from 175 m to 221 m AMSL. Chatkari Jore, Tisra Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Chatkari Jore.

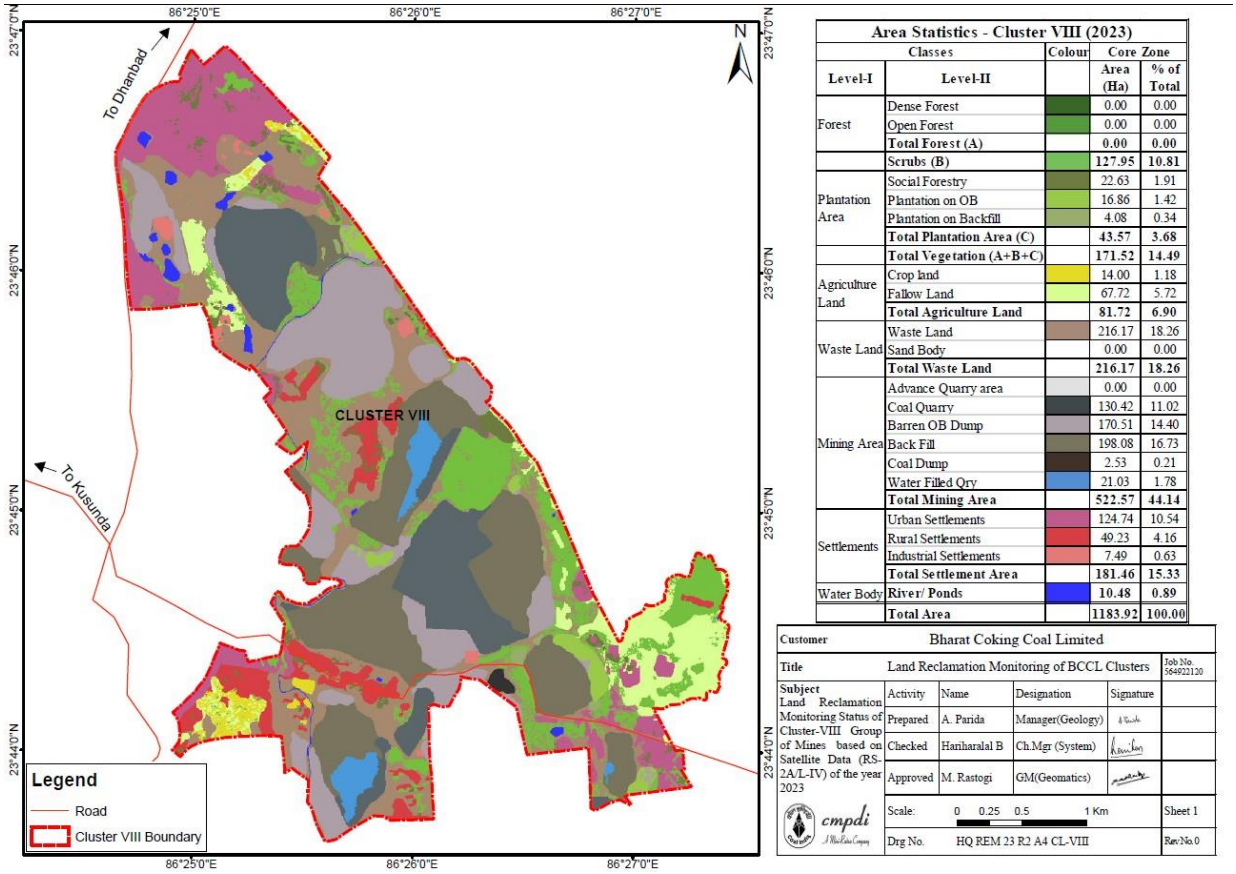
Monitoring stations (**D008 and D039**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D008	Alokdiha	8.90	2.74	4.82	5.47	7.70	4.42	4.82	6.75	6.32	4.25	5.42	6.34
2	D039	Tilaboni	3.20	2.51	2.77	2.87	8.52	2.52	3.28	5.75	7.50	1.85	3.05	1.75
Average WL (bgl)			6.05	2.63	3.80	4.17	8.11	3.47	4.05	6.25	6.91	3.05	4.24	4.05

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.20 m Max – 8.90 m
Post-monsoon GW Level (m): Min – 2.77 m Max – 5.42 m

LAND USE / LAND COVER MAP OF THE CLUSTER-VIII MINES, BCCL



Area Statistics - Cluster VIII (2023)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**127.95**	**10.81**
Plantation Area	Social Forestry		22.63	1.91
	Plantation on OB		16.86	1.42
	Plantation on Backfill		4.08	0.34
	Total Plantation Area (C)		**43.57**	**3.68**
	Total Vegetation (A+B+C)		**171.52**	**14.49**
Agriculture Land	Crop land		14.00	1.18
	Fallow Land		67.72	5.72
	Total Agriculture Land		**81.72**	**6.90**
Waste Land	Waste Land		216.17	18.26
	Sand Body		0.00	0.00
	Total Waste Land		**216.17**	**18.26**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		130.42	11.02
	Barren OB Dump		170.51	14.40
	Back Fill		198.08	16.73
	Coal Dump		2.53	0.21
	Water Filled Qry		21.03	1.78
	Total Mining Area		**522.57**	**44.14**
Settlements	Urban Settlements		124.74	10.54
	Rural Settlements		49.23	4.16
	Industrial Settlements		7.49	0.63
	Total Settlement Area		**181.46**	**15.33**
Water Body	**River/ Ponds**		**10.48**	**0.89**
	Total Area		**1183.92**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564922120
Subject: Land Reclamation Monitoring Status of Cluster-VIII Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2023	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Manager(Geology)		
	Checked	Hariharalal B	Ch.Mgr (System)		
	Approved	M. Rastogi	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 23 R2 A4 CL-VIII				Rev No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	279.69 x 10^4	0.0	279.69 x 10^4
2	Open Land	886.66 x 10^4	0.0	886.66 x 10^4
3	Road/ Paved Area	97.19 x 10^4	0.0	97.19 x 10^4
4	Rooftop area of building/ sheds	68.43 x 10^4	0.0	68.43 x 10^4
5	Total	1331.95 x 10^4	0.0	1331.95 x 10^4

I. GROUND WATER LEVEL OF CLUSTER-IX

Mines of cluster-IX are under administrative control of Lodna Area of B.C.C.L in western part of Jharia Coalfield which is located in Dhanbad district of Jharkhand. Cluster- IX consists of eight mines namely; North Tisra/South Tisra OCP, Jeenagora OCP, North Tisra UG, Lodna UG, Bagdigi UG, Bararee UG, Joyrampur UG and Jealgora UG (closed). Among them N. Tisra/S. Tisra OCP, Jeenagora OCP and N. Tisra UG mine will be amalgamated and will form North Tisra/South Tisra Expansion OCP. All above the mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of mining activities. The life of the project has been worked out to be up to 30 years considering annual production target of 8.513 MTPA (toposheet no. 73 I/6).

The present leasehold area of Cluster-IX is 1967.22 Ha. The topography of the area is undulating with gentle slope towards south. The RL varies from 221 m to 188.44 m AMSL. Chatkari Jore, Tisra Jore, Sulunga Jore and their tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Chatkari Jore.

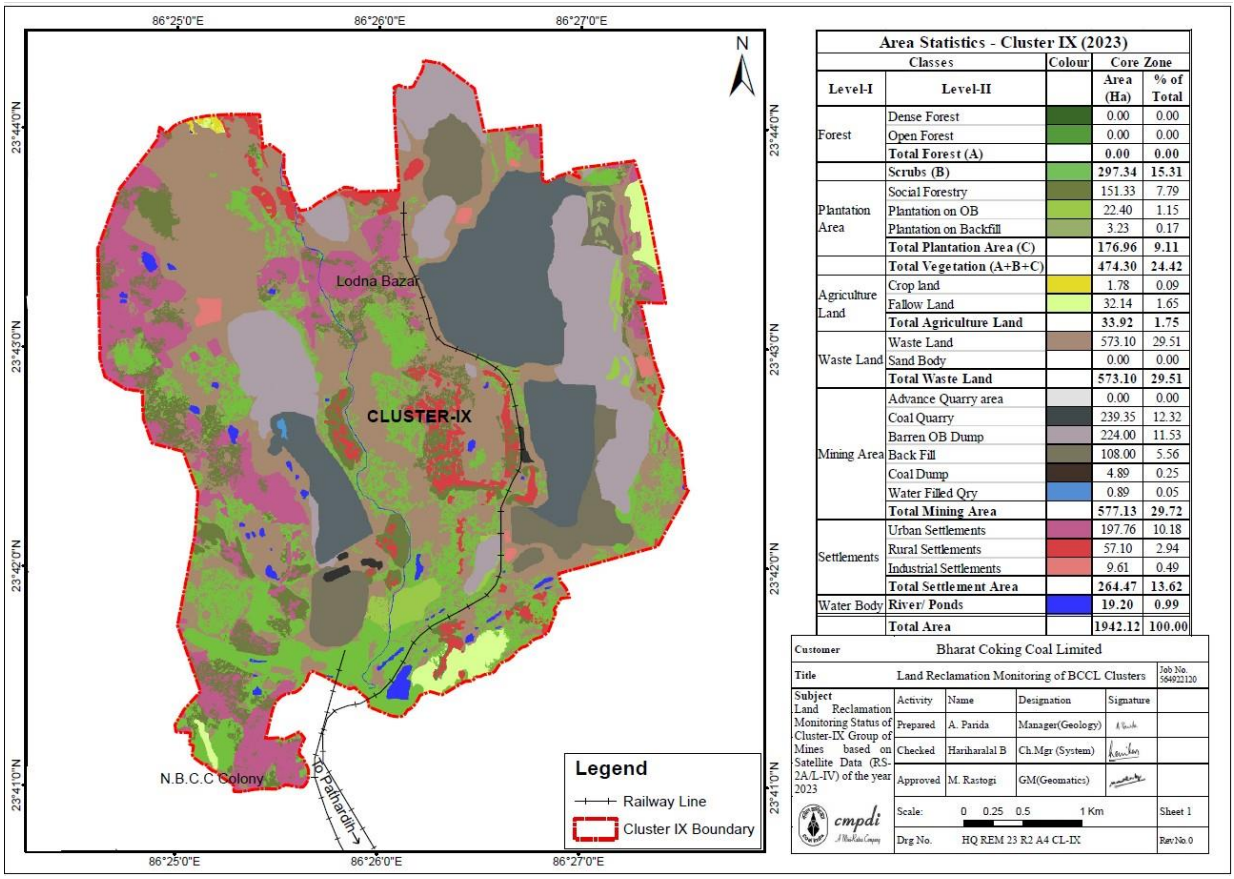
Monitoring stations (**D005, D007, D039 and D074**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	D005	Jiyalgora	8.70	4.53	6.02	7.35	8.20	4.08	5.90	6.54	8.40	3.36	7.01	8.95
2	D007	Golden Pahari	9.82	2.70	3.52	5.67	9.03	1.88	3.64	5.18	9.03	2.17	5.67	6.57
3	D039	Tilaboni	3.20	2.51	2.77	2.87	8.52	2.52	3.28	5.75	7.50	1.85	3.05	1.75
4	D074	BhulanBararee	4.74	2.65	3.73	3.89	4.57	3.10	3.54	4.09	6.17	3.20	5.77	7.90
Average WL (bgl)			6.62	3.10	4.01	4.95	7.58	2.90	4.09	5.39	7.78	2.65	5.38	6.29

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.20 m Max – 9.82 m
Post-monsoon GW Level (m): Min – 2.77 m Max – 7.01 m

LAND USE / LAND COVER MAP OF THE CLUSTER-IX MINES, BCCL



Area Statistics - Cluster IX (2023)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**297.34**	**15.31**
Plantation Area	Social Forestry		151.33	7.79
	Plantation on OB		22.40	1.15
	Plantation on Backfill		3.23	0.17
	Total Plantation Area (C)		**176.96**	**9.11**
	Total Vegetation (A+B+C)		**474.30**	**24.42**
Agriculture Land	Crop land		1.78	0.09
	Fallow Land		32.14	1.65
	Total Agriculture Land		**33.92**	**1.75**
Waste Land	Waste Land		573.10	29.51
	Sand Body		0.00	0.00
	Total Waste Land		**573.10**	**29.51**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		239.35	12.32
	Barren OB Dump		224.00	11.53
	Back Fill		108.00	5.56
	Coal Dump		4.89	0.25
	Water Filled Qry		0.89	0.05
	Total Mining Area		**577.13**	**29.72**
Settlements	Urban Settlements		197.76	10.18
	Rural Settlements		57.10	2.94
	Industrial Settlements		9.61	0.49
	Total Settlement Area		**264.47**	**13.62**
Water Body	**River/ Ponds**		**19.20**	**0.99**
	Total Area		**1942.12**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 584922120
Subject: Land Reclamation Monitoring Status of Cluster-IX Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2023	Activity	Name	Designation	Signature	
	Prepared	A. Parida	Manager(Geology)		
	Checked	Hariharalal B	Ch.Mgr (System)		
	Approved	M. Rastogi	GM(Geomatics)		
	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 23 R2 A4 CL-IX				Rev No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	601.52×10^4	0.0	601.52×10^4
2	Open Land	1076.47×10^4	0.0	1076.47×10^4
3	Road/ Paved Area	232.31×10^4	0.0	232.31×10^4
4	Rooftop area of building/ sheds	56.92×10^4	0.0	56.92×10^4
5	Total	1967.22×10^4	0.0	1967.22×10^4

J. GROUND WATER LEVEL OF CLUSTER-X

Cluster-X consists of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) and Sudamdih Coal Washery which comes under the administrative control of Eastern Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). This cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be more than 30 years considering annual production target of 2.289 MTY.

Cluster-X mine involves leasehold area of about 2057.47 Ha of land. It is covered in Survey of India toposheet no. 73 I/6. The area of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) are 280.83 Ha, 571.58 Ha, 498.61 Ha, 391.50 Ha and 386.95 Ha respectively.

The present leasehold area of Cluster-X is 2057.47 Ha. The area has an undulating topography with gentle slope towards south and south-east. The RL varies from 185 m to 150.0 m AMSL. Gaurkuthi Nala and few seasonal streams are controlling the drainage pattern of the area. The area comes under the watershed of Damodar River.

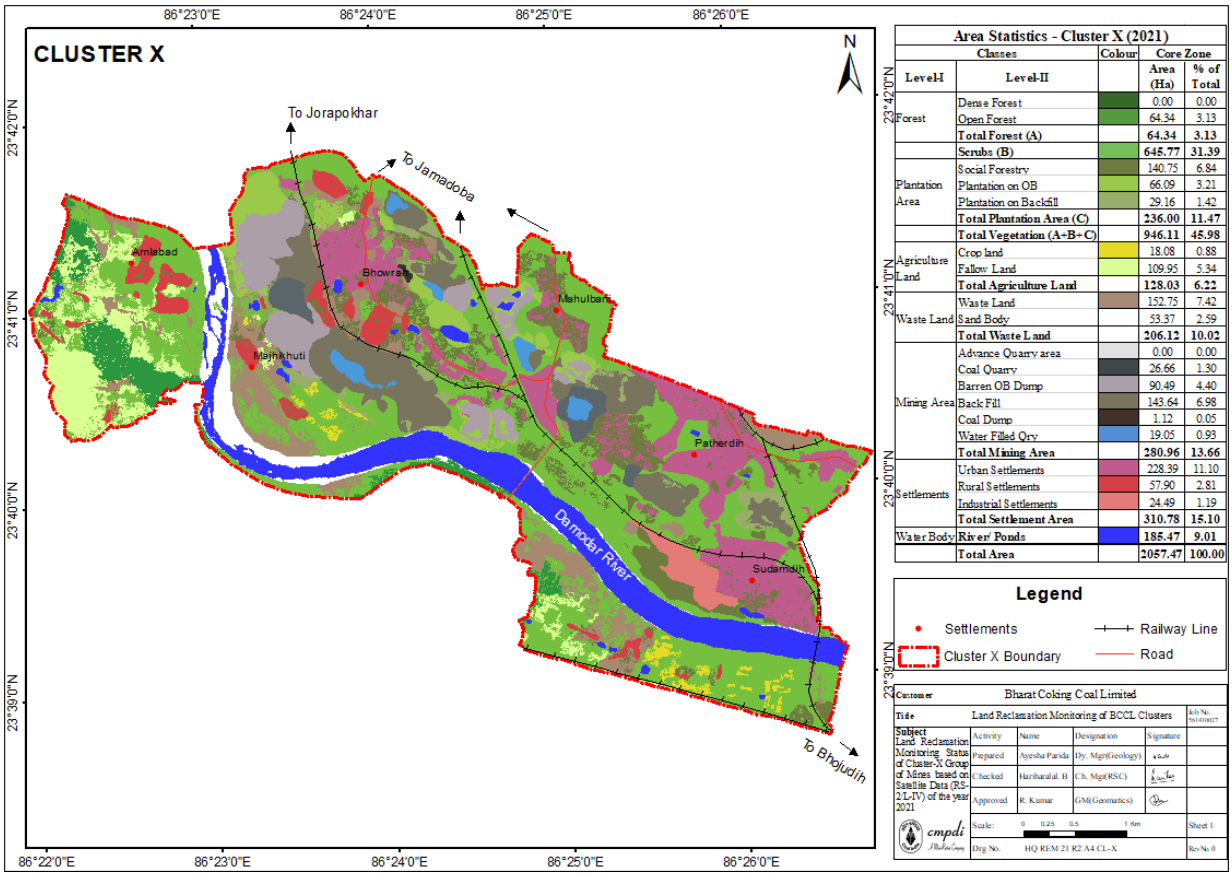
Monitoring stations (**A019, D035, D036 and D077**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24, the Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A019	Bhowrah	3.12	2.49	2.51	2.77	2.90	2.10	2.60	2.73	4.10	1.82	2.54	1.79
2	D035	Patherdih	5.16	3.28	4.10	4.70	5.23	3.45	3.90	4.10	6.10	3.70	4.68	5.50
3	D036	Sudamdih	2.64	0.45	0.74	1.13	1.85	0.50	0.60	1.00	3.25	0.15	0.60	1.44
4	D077	Amlabad	6.15	3.80	4.01	4.76	5.98	3.90	3.93	5.07	6.50	3.40	4.70	6.00
Average WL (bgl)			4.27	2.51	2.84	3.34	3.99	2.49	2.76	3.23	4.99	2.27	3.13	3.68

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.85 m Max – 6.50 m
Post-monsoon GW Level (m): Min – 0.60 m Max – 4.70 m

LAND USE / LAND COVER MAP OF THE CLUSTER-X MINES, BCCL



Area Statistics - Cluster X (2021)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		64.34	3.13
	Total Forest (A)		**64.34**	**3.13**
	Scrubs (B)		**648.77**	**31.39**
Plantation Area	Social Forestry		140.75	6.84
	Plantation on OB		66.09	3.21
	Plantation on Backfill		29.16	1.42
	Total Plantation Area (C)		**236.00**	**11.47**
	Total Vegetation (A+B+C)		**946.11**	**45.98**
Agriculture Land	Crop land		18.08	0.88
	Fallow Land		109.95	5.34
	Total Agriculture Land		**128.03**	**6.22**
Waste Land	Waste Land		152.75	7.42
	Sand Body		53.37	2.59
	Total Waste Land		**206.12**	**10.02**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		26.66	1.30
	Barren OB Dump		90.49	4.40
	Back Fill		143.64	6.98
	Coal Dump		1.12	0.05
	Water Filled Qry		19.05	0.93
	Total Mining Area		**280.96**	**13.66**
Settlements	Urban Settlements		228.39	11.10
	Rural Settlements		57.90	2.81
	Industrial Settlements		24.49	1.19
	Total Settlement Area		**310.78**	**15.10**
Water Body	**River/ Ponds**		**185.47**	**9.01**
	Total Area		**2057.47**	**100.00**

Legend

Settlements — Railway Line

Cluster X Boundary — Road

Customer	Bharat Coking Coal Limited
Title	Land Reclamation Monitoring of BCCL Clusters
Subject	Land Reclamation Monitoring Status of Cluster-X Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2021

Activity	Name	Designation	Signature
Prepared	Ayesha Parida	(Dy. Mgr(Geology))	
Checked	Hariharalal. B	(Ch. Mgr(RSC))	
Approved	R. Kumar	GM(Geomatics)	

empdi

Scale: 0 0.25 0.5 1 Km

Drg No. HQ REM 21 R2 A4 CL-X

Sheet 1

Rev No. 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1085.72 x 10^4	0.0	1085.72 x 10^4
2	Open Land	661.04 x 10^4	0.0	661.04 x 10^4
3	Road/ Paved Area	228.39 x 10^4	0.0	228.39 x 10^4
4	Rooftop area of building/ sheds	82.32 x 10^4	0.0	82.32 x 10^4
5	Total	2057.47 x 10^4	0.0	2057.47 x 10^4

K. GROUND WATER LEVEL OF CLUSTER-XI

Cluster–XI consists of eight coal mines; Moonidih UG, Gopalichak UG Project, Kachi Balihari 10/12 Pit UG, Pootkee Balihari Project UG, Bhagaband UG, Kendwadih UG (closed), Pootkee UG (closed), Kachi Balihari 5/6 Pit UG (closed) which are under the administrative control of Western Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). The Cluster- XI is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project has been worked out to be up to 50 years considering annual production target of 6.604 MTPA (toposheet no. no. 73 I/5 7 73 I/6).

The present leasehold area of Cluster-XI is 3527.58 Ha. The area has an undulating topography with gentle slope towards south. The RL varies from 201 m to 166 m AMSL. Katri River, Jarian Nala, Ekra Jore and Kari Jore are controlling the drainage of the area. The area comes under the watershed of Katri River and Kari Jore.

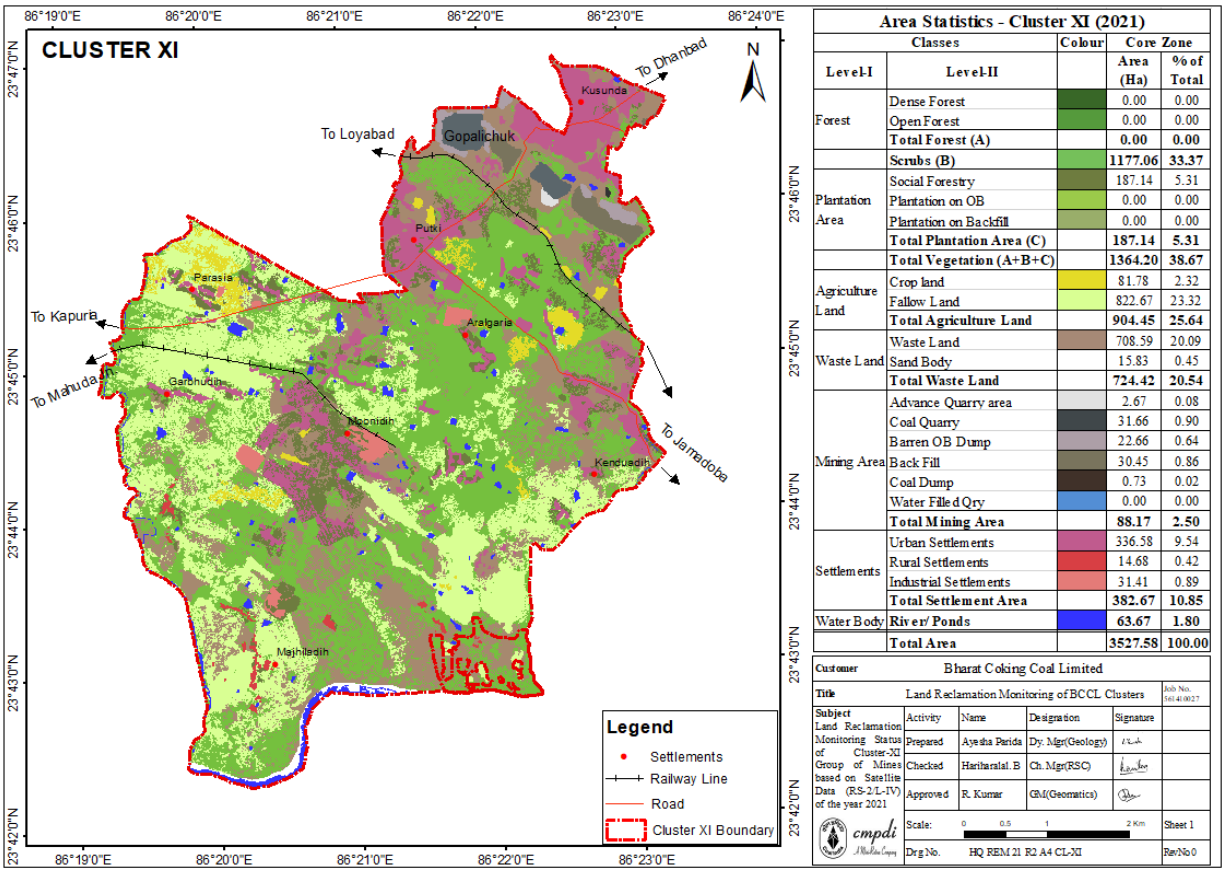
Monitoring stations (**A017, A020 and A032**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A017	Kachi Balihari	3.18	2.11	2.26	2.51	2.41	1.78	2.19	2.57	2.62	2.06	2.59	2.64
2	A020	Gorbudih	7.90	4.15	4.30	5.10	8.02	4.05	4.20	7.27	5.59	3.18	3.54	5.27
3	A032	Baludih	3.51	1.59	1.72	2.15	3.83	0.95	1.60	2.09	2.25	0.65	1.75	2.79
Average WL (bgl)			4.86	2.62	2.76	3.25	4.75	2.26	2.66	3.98	3.49	1.96	2.63	3.57

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 2.25 m Max – 8.02 m
Post-monsoon GW Level (m): Min – 1.60 m Max – 4.30 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XI MINES, BCCL



Area Statistics - Cluster XI (2021)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**1177.06**	**33.37**
Plantation Area	Social Forestry		187.14	5.31
	Plantation on OB		0.00	0.00
	Plantation on Backfill		0.00	0.00
	Total Plantation Area (C)		**187.14**	**5.31**
	Total Vegetation (A+B+C)		**1364.20**	**38.67**
Agriculture Land	Crop land		81.78	2.32
	Fallow Land		822.67	23.32
	Total Agriculture Land		**904.45**	**25.64**
Waste Land	Waste Land		708.59	20.09
	Sand Body		15.83	0.45
	Total Waste Land		**724.42**	**20.54**
Mining Area	Advance Quarry area		2.67	0.08
	Coal Quarry		31.66	0.90
	Barren OB Dump		22.66	0.64
	Back Fill		30.45	0.86
	Coal Dump		0.73	0.02
	Water Filled Qry		0.00	0.00
	Total Mining Area		**88.17**	**2.50**
Settlements	Urban Settlements		336.58	9.54
	Rural Settlements		14.68	0.42
	Industrial Settlements		31.41	0.89
	Total Settlement Area		**382.67**	**10.85**
Water Body	**River/ Ponds**		**63.67**	**1.80**
	Total Area		**3527.58**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 561410027
Subject	Activity	Name	Designation	Signature	
Land Reclamation Monitoring Status of Cluster-XI Group of Mines based on Satellite Data (RS-2/L-IV) of the year 2021	Prepared	Ayesha Parida	Dy. Mgr(Geology)		
	Checked	Hariharalal. B	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.5 1 2 Km				Sheet 1
	Drg No. HQ REM 21 R2 A4 CL-XI				Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1060.61 x 10^4	0.0	1293.46 x 10^4
2	Open Land	1518.33 x 10^4	0.0	1509.06 x 10^4
3	Road/ Paved Area	171.08 x 10^4	0.0	171.08 x 10^4
4	Rooftop area of building/ sheds	777.56 x 10^4	0.0	563.06 x 10^4
5	Total	3527.58 x 10^4	0.0	3527.58 x 10^4

L. GROUND WATER LEVEL OF CLUSTER-XIII

Cluster-XIII, consists of one running mine (Murulidih 20/21 pit UG mine) and six abandoned mines i.e. Bhurungiya colliery, Muchraidih colliery, Hantoodih colliery, Padugora colliery, Murulidih colliery and Bhatdee colliery of Western Jharia area, BCCL which is located in the south-western part of Jharia coal field in Dhanbad district of Jharkhand. The area is covered under Survey of India toposheet no. 73 I/6. The life of the project has been worked out to be about 15 years considering annual production target of 0.234 MTPA.

The present leasehold area of Cluster-XIII is 1898.62 Ha. The area has an undulating topography with gentle slope towards south-east. The maximum RL is 224 m AMSL in the north-western part of the area whereas the minimum RL is 179 m AMSL at southern part. The area comes under the watershed area of Jamunia River and Katri River.

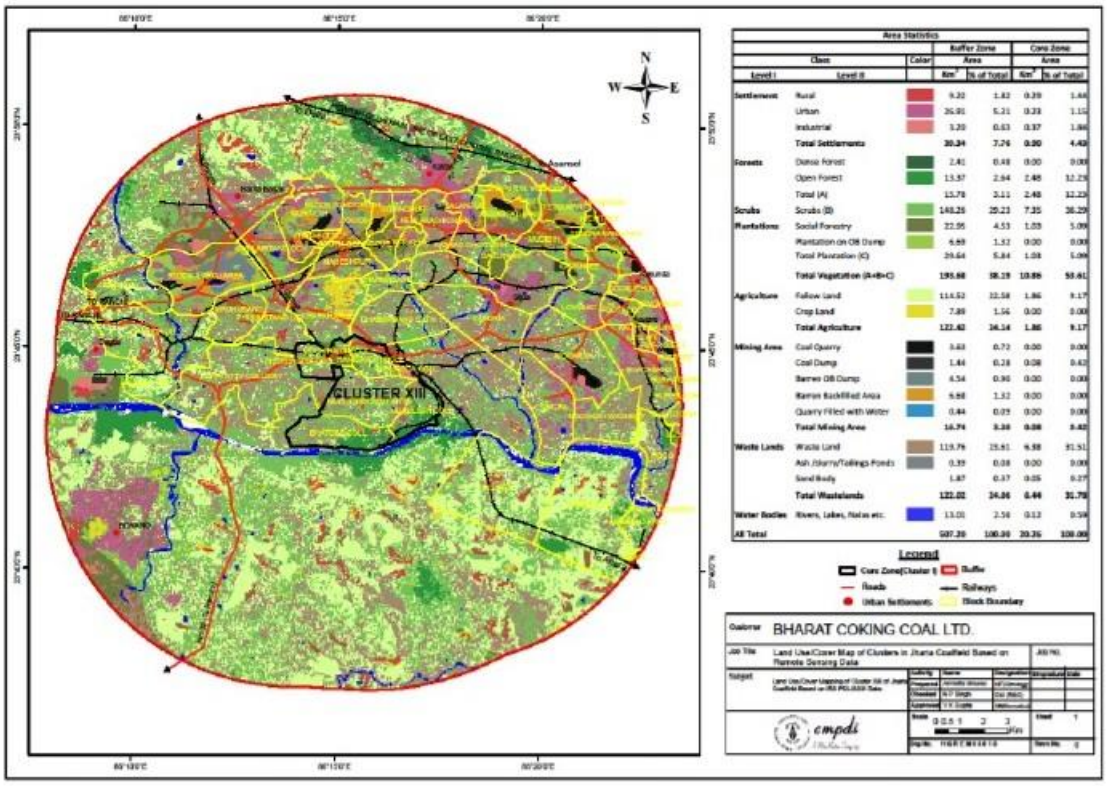
Monitoring stations (**A023, A034 and B048**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A023	Machhayara	10.44	2.72	5.72	6.95	9.00	5.10	5.71	7.90	7.97	1.14	4.79	6.67
2	A034	Mahuda vil.	6.54	1.82	3.90	4.92	6.54	2.98	4.01	4.85	8.20	3.65	6.35	6.95
3	B048	Mahuda	5.99	4.58	4.95	5.23	6.13	4.55	5.05	5.57	6.85	0.65	6.25	5.80
Average WL (bgl)			7.66	3.04	4.86	5.70	7.22	4.21	4.92	6.11	7.67	1.81	5.80	6.47

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 5.99 m Max – 10.44 m
Post-monsoon GW Level (m): Min – 3.90 m Max – 6.35 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XIII MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1484.41×10^4	0.0	1570.48×10^4
2	Open Land	183.28×10^4	0.0	97.22×10^4
3	Road/ Paved Area	71.84×10^4	0.0	71.83×10^4
4	Rooftop area of building/ sheds	159.09×10^4	0.0	159.09×10^4
5	Total	1898.62×10^4	0.0	1898.62×10^4

M. GROUND WATER LEVEL OF CLUSTER-XIV

Mines of Cluster-XIV are under administrative control of Western Jharia Area of B.C.C.L (Jharia Coalfield) which is located in Dhanbad district of Jharkhand. This cluster consists of Lohapatty UG and Lohapatty OC patch (proposed). The life of the project has been worked out to be up to 08 years considering annual production target of 0.526 MTPA. It is covered in Survey of India toposheet no. 73 I/2.

The present leasehold area of Cluster-XIV is 1418.25 Ha. The topography of the area is undulating with slope towards south west. The maximum RL is 224 m in the north-eastern part whereas the minimum RL is 170 m above mean sea level on the south-western part of the area. Jamunia River and its tributaries are controlling the drainage of the area. The area comes under the watershed area of Jamunia River.

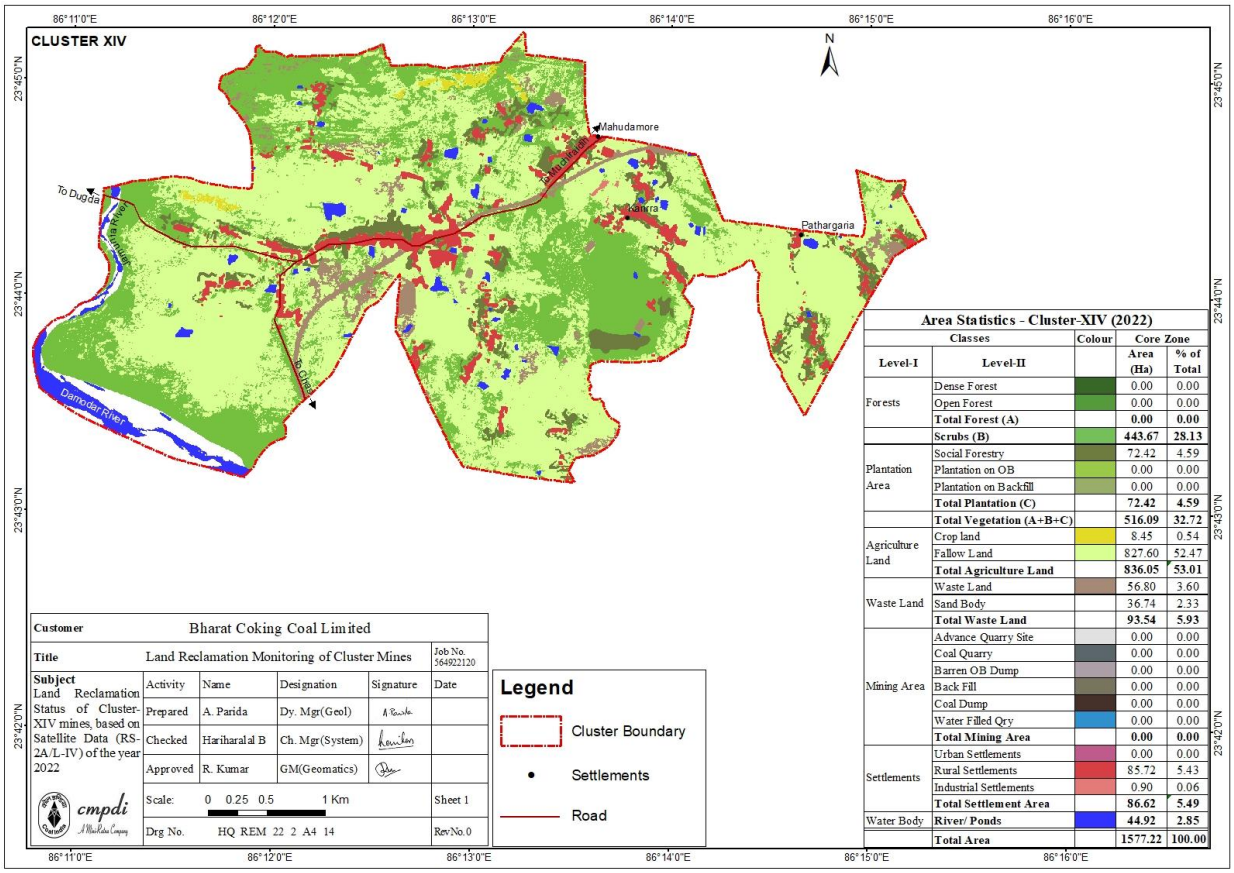
Monitoring stations (**B024 and B067**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2023-24				2022-23				2021-22			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	B024	Telmuchu	4.63	3.13	3.24	3.93	5.53	1.34	3.46	4.23	5.68	1.55	2.08	3.07
2	B067	Simatanr	8.05	3.85	5.32	6.27	8.50	3.55	6.30	7.35	8.95	2.45	2.95	3.65
Average WL (bgl)			6.34	3.49	4.28	5.1	7.02	2.45	4.88	5.79	7.32	2.00	2.52	3.36

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 4.63 m Max – 8.50 m
Post-monsoon GW Level (m): Min – 3.22 m Max – 6.30 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XIV MINES, BCCL



Area Statistics - Cluster-XIV (2022)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**443.67**	**28.13**
Plantation Area	Social Forestry		72.42	4.59
	Plantation on OB		0.00	0.00
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		**72.42**	**4.59**
	Total Vegetation (A+B+C)		**516.09**	**32.72**
Agriculture Land	Crop land		8.45	0.54
	Fallow Land		827.60	52.47
	Total Agriculture Land		**836.05**	**53.01**
Waste Land	Waste Land		56.80	3.60
	Sand Body		36.74	2.33
	Total Waste Land		**93.54**	**5.93**
Mining Area	Advance Quarry Site		0.00	0.00
	Coal Quarry		0.00	0.00
	Barren OB Dump		0.00	0.00
	Back Fill		0.00	0.00
	Coal Dump		0.00	0.00
	Water Filled Qry		0.00	0.00
	Total Mining Area		**0.00**	**0.00**
Settlements	Urban Settlements		0.00	0.00
	Rural Settlements		85.72	5.43
	Industrial Settlements		0.90	0.06
	Total Settlement Area		**86.62**	**5.49**
Water Body	**River/ Ponds**		**44.92**	**2.85**
	Total Area		**1577.22**	**100.00**

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1251.76×10^4	0.0	1251.76×10^4
2	Open Land	79.76×10^4	0.0	79.76×10^4
3	Road/ Paved Area	85.83×10^4	0.0	85.83×10^4
4	Rooftop area of building/ sheds	0.90×10^4	0.0	0.90×10^4
5	Total	1418.25×10^4	0.0	1418.25×10^4

N. GROUND WATER LEVEL OF CLUSTER-XV

Mines o Cluster - XV comes under administrative control of Govindpur Area and barora Area of B.C.C.L (Jharia Coalfield) which is located in Dhanbad district of Jharkhand. Cluster–XV consists of four coal mines; Kharkharee UG (underground mine) and Dharmaband UG which are under administrative control of Govindpur Area and Madhuband UG & Phularitand UG which are under the administrative control of Barora Area. The life of the project has been worked out to be up to 30 years considering annual production target of 0.423 MTPA. It is covered in Survey of India toposheet no. 73 I/1 and 73 I/5.

The present leasehold area of Cluster-XV is 1696.55 Ha. The topography of the area is undulating with slope towards south-west. The maximum RL is 235 m in the Kharkharee mine area whereas the minimum RL is 165 m AMSL on the eastern & western part of the Cluster. Jamunia River and Khudia River are controlling the drainage of the area. The area comes under the watershed area of both Jamunia River and Khudia River.

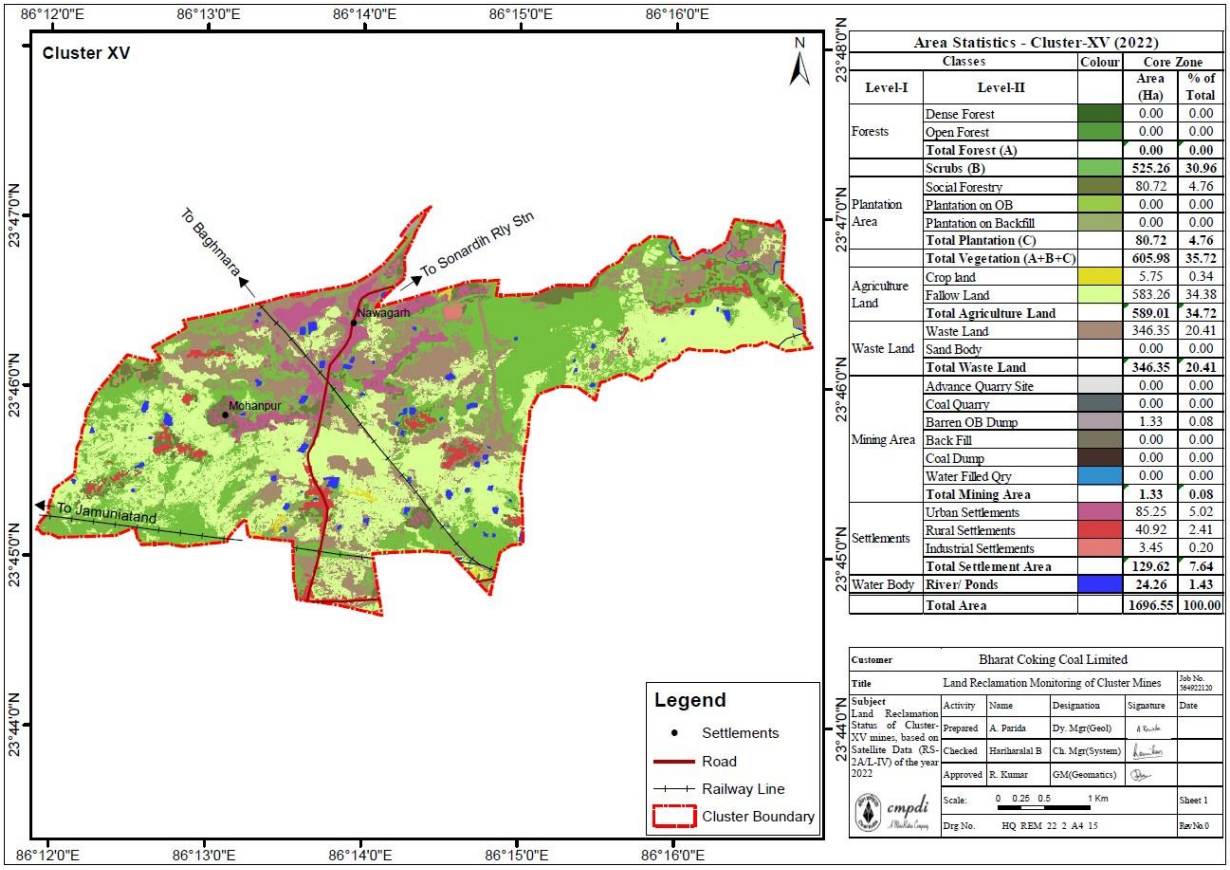
Monitoring stations (**A024, B032 and B062**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	A024	Pipratanr	5.43	3.71	3.96	4.12	5.38	3.60	3.90	5.00	7.28	2.55	4.33	5.32
2	B032	Madhuband	6.60	2.10	3.60	4.82	5.35	3.93	3.60	5.42	4.15	0.70	2.56	4.15
3	B062	Sadiyardih	4.97	3.01	3.19	3.80	4.80	2.35	3.10	4.00	6.45	1.77	4.91	5.15
Average WL (bgl)			5.67	2.94	3.58	4.25	5.18	3.29	3.53	4.81	5.96	1.67	3.93	4.87

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 4.15 m Max – 7.28 m
Post-monsoon GW Level (m): Min – 2.56 m Max – 4.91 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XV MINES, BCCL



Area Statistics - Cluster-XV (2022)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**525.26**	**30.96**
Plantation Area	Social Forestry		80.72	4.76
	Plantation on OB		0.00	0.00
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		**80.72**	**4.76**
	Total Vegetation (A+B+C)		**605.98**	**35.72**
Agriculture Land	Crop land		5.75	0.34
	Fallow Land		583.26	34.38
	Total Agriculture Land		**589.01**	**34.72**
Waste Land	Waste Land		346.35	20.41
	Sand Body		0.00	0.00
	Total Waste Land		**346.35**	**20.41**
Mining Area	Advance Quarry Site		0.00	0.00
	Coal Quarry		0.00	0.00
	Barren OB Dump		1.33	0.08
	Back Fill		0.00	0.00
	Coal Dump		0.00	0.00
	Water Filled Qry		0.00	0.00
	Total Mining Area		**1.33**	**0.08**
Settlements	Urban Settlements		85.25	5.02
	Rural Settlements		40.92	2.41
	Industrial Settlements		3.45	0.20
	Total Settlement Area		**129.62**	**7.64**
Water Body	River/ Ponds		24.26	1.43
	Total Area		**1696.55**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 564922120
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Cluster-XV mines, based on Satellite Data (RS-2A/L-IV) of the year 2022	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Hariharalal B	Ch. Mgr(System)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 22 2 A4 15				Rev No.0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	365.18 x 10^4	0.0	957.34 x 10^4
2	Open Land	1130.53 x 10^4	0.0	538.37 x 10^4
3	Road/ Paved Area	101.67 x 10^4	0.0	101.67 x 10^4
4	Rooftop area of building/ sheds	99.17 x 10^4	0.0	99.17 x 10^4
5	Total	1696.55 x 10^4	0.0	1696.55 x 10^4

O. GROUND WATER LEVEL OF CLUSTER-XVI

Mines of Cluster - XVI (Dahibari-Basantimata Group of mines) are under administrative control of Chanch Victoria Area of B.C.C.L (western part of Raniganj Coalfield) which is located in Dhanbad district of Jharkhand. There are total five collieries within this Cluster- XVI (Dahibari-Basantimata OC, Basantimata UG, New Laikdih OC, Laikdih Deep UG and Chanch UG Colliery). All the above mines are contiguous in nature and the environmental impact is overlapping in ambient environment due to cumulative effect of mining activities. Life of the project has been worked out to be up to 24 years considering annual production target of 1.963 MTPA. It is covered in Survey of India toposheet no. 73 I/14.

The present leasehold area of Cluster-XVI is 2008.40 Ha. The topography of the area is undulating with slope towards south-west. The area is plain with gently undulating with elevation varying from 100 m to 140 m AMSL. The general slope of the area is towards southeast. Barakar River and Khudia River are controlling the drainage of the area. The area comes under the watershed area of Barakar River.

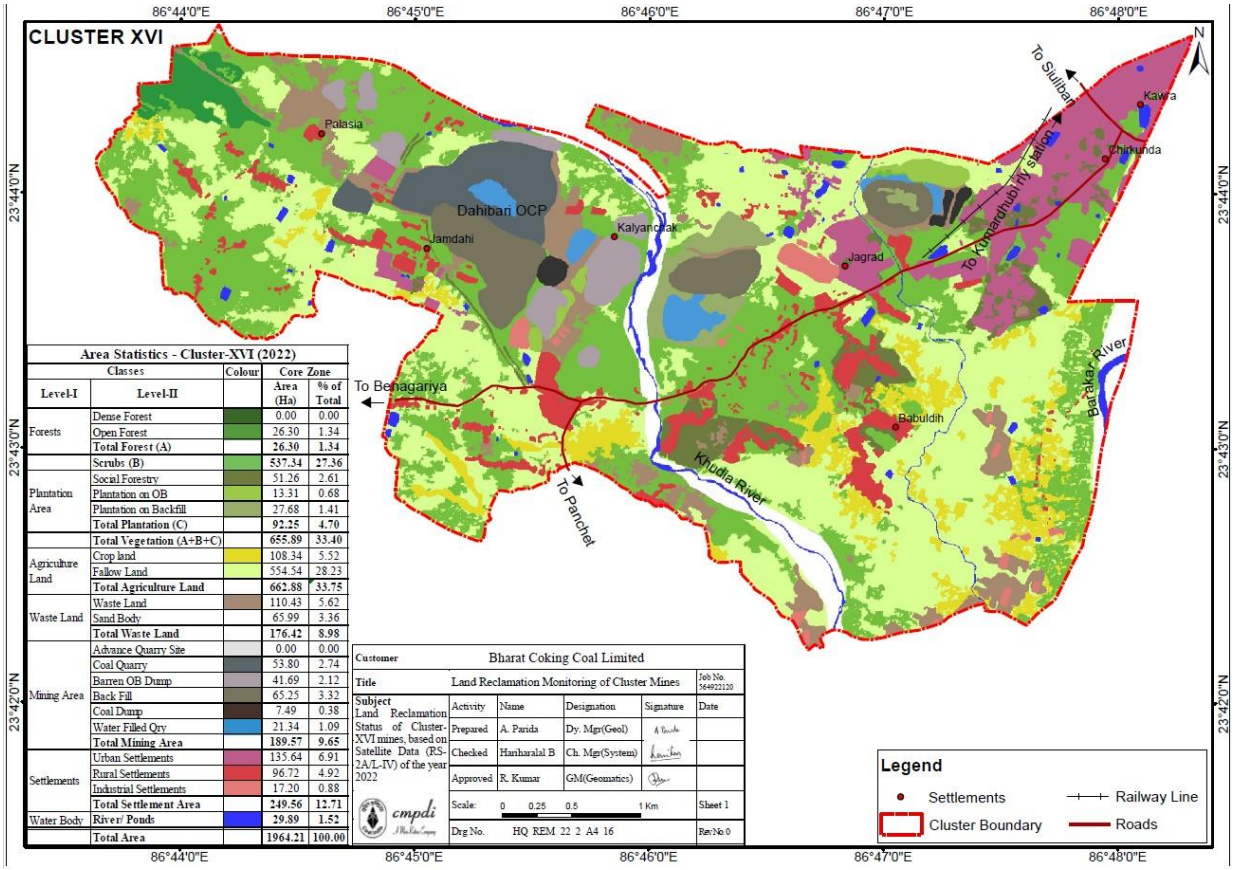
Monitoring stations (**DB022, DB023, DB024 & DB025**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May'23, August'23, and Nov'23 and January'24. The Ground water level data is presented in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	DB022	Dahibari, Basti	4.08	1.63	2.33	3.07	4.25	2.07	2.43	3.31	3.72	1.47	1.99	1.58
2	DB023	Dahibari OC	4.56	1.24	2.79	3.07	4.80	2.61	2.94	4.24	3.56	1.71	2.60	2.40
3	DB024	Dahibari	7.84	3.73	6.92	6.98	8.25	3.50	4.18	6.87	7.08		3.91	
Average WL (bgl)			5.49	2.20	4.02	4.37	5.77	2.73	3.18	4.81	4.79	1.59	2.83	1.99

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 3.56 m Max – 8.25 m
Post-monsoon GW Level (m): Min – 1.99 m Max – 6.92 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XVI MINES, BCCL



Area Statistics - Cluster-XVI (2022)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		26.30	1.34
	Total Forest (A)		**26.30**	**1.34**
	Scrubs (B)		537.34	27.36
Plantation Area	Social Forestry		51.26	2.61
	Plantation on OB		13.31	0.68
	Plantation on Backfill		27.68	1.41
	Total Plantation (C)		**92.25**	**4.70**
	Total Vegetation (A+B+C)		**655.89**	**33.40**
Agriculture Land	Crop land		108.34	5.52
	Fallow Land		554.54	28.23
	Total Agriculture Land		**662.88**	**33.75**
Waste Land	Waste Land		110.43	5.62
	Sand Body		65.99	3.36
	Total Waste Land		**176.42**	**8.98**
Mining Area	Advance Quarry Site		0.00	0.00
	Coal Quarry		53.80	2.74
	Barren OB Dump		41.69	2.12
	Back Fill		65.25	3.32
	Coal Dump		7.49	0.38
	Water Filled Qry		21.34	1.09
	Total Mining Area		**189.57**	**9.65**
Settlements	Urban Settlements		135.64	6.91
	Rural Settlements		96.72	4.92
	Industrial Settlements		17.20	0.88
	Total Settlement Area		**249.56**	**12.71**
Water Body	River/ Ponds		29.89	1.52
	Total Area		1964.21	100.00

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 564922120
Subject	Activity	Name	Designation	Signature	Date
Land Reclamation Status of Cluster-XVI mines, based on Satellite Data (RS-2A/L-IV) of the year 2022	Prepared	A. Parida	Dy. Mgr(Geol)		
	Checked	Hanharalal B	Ch. Mgr(System)		
	Approved	R. Kumar	GM(Geomatics)		
	Scale:	0 0.25 0.5 1 Km			Sheet 1
	Drg No.	HQ REM 22 2 A4 16			Rev No 0

Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1349.29 x 10^4	0.0	1349.29 x 10^4
2	Open Land	401.55 x 10^4	0.0	401.55 x 10^4
3	Road/ Paved Area	142.41 x 10^4	0.0	142.41 x 10^4
4	Rooftop area of building/ sheds	115.15 x 10^4	0.0	115.15 x 10^4
5	Total	2008.40 x 10^4	0.0	2008.40 x 10^4

P. GROUND WATER LEVEL OF CLUSTER-XVII

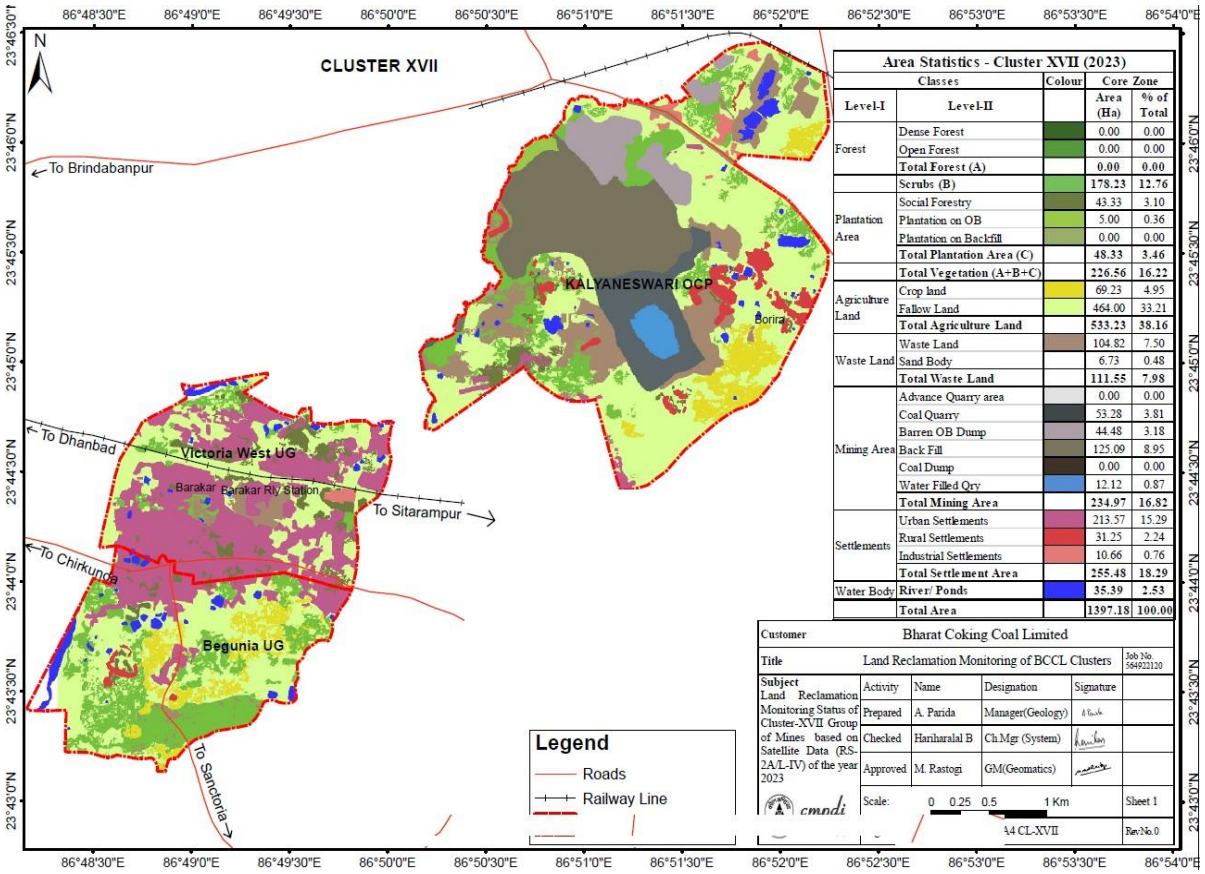
Cluster-XVII mines are under administrative control of Chanch Victoria Area, BCCL, located in western part of Raniganj coalfield in Dhanbad district of Jharkhand. Cluster–XVII consists of two closed Underground (UG) coal mines (Begunia Colliery and Victoria-West Colliery) and one opencast mines [Kalyaneshwari OCP]. The Leasehold area of the Cluster is located between latitude 23^0 43' 08" to 23^0 46' 26" N and longitude 86^0 47' 46" to 85^0 52' 11" E. All the above mines are contiguous in nature and the environmental impact is overlapping in the ambient due to cumulative effect of the mining activities. Leasehold area of the Cluster is 1397.18 ha and the capacity of the project is 4.0 MTPA using opencast method. Cluster-XVII mines is covered in Survey of India toposheet no. 73 I/13. The cluster is approachable both by rail and road. Salanpur and Kulti railway stations of Eastern Railways are at a distance of about 0.6 km from the eastern and southwestern boundary of the cluster respectively. The National Highway No.19 (NH-19) passes through the north eastern part of the cluster and the National Highway No.419 (NH-419) passes along the eastern boundary of the cluster while the Kulti and Barakar townships are about 2 km by road to the south east of the area.The study area has an undulating topography with gentle slope towards south and south west. The buffer zone is predominantly characterized by plain land, with highlands located in parts of the northwest, northeast, and southwest. The area comes under the watershed area of Barakar River.

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2024-25				2023-24				2022-23			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	May	Aug	Nov	Jan
1	DB8	Chungei	5.40	3.06	4.10	4.76	4.50	2.55	3.42	3.97	4.67		2.86	
2	DB9	Barakar	10.26	6.42	7.34	8.93	9.50	4.17	5.18	6.47	9.68		4.85	
3	DB12	Sabanpur	5.60	2.07	2.37	3.27	5.44	2.01	2.30	3.17	4.56		1.89	
4	K26		2.14	1.36	1.53	1.58	2.10	1.33	1.50	1.55	1.93		1.29	
Average WL (bgl)			5.85	3.23	3.84	4.64	5.39	2.52	3.10	3.79	5.21		2.72	

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.93 m Max – 10.26 m
Post-monsoon GW Level (m): Min – 1.29 m Max – 7.34 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XVII MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	336.55 x 10^4	0.0	336.5 x 10^4
2	Open Land	1008.81 x 10^4	0.0	1008.81 x 10^4
3	Road/ Paved Area	26.81 x 10^4	0.0	26.81 x 10^4
4	Rooftop area of building/ sheds	25.06 x 10^4	0.0	25.06 x 10^4
5	Total	1397.23 x 10^4	0.0	1397.23 x 10^4

4.0 GROUND WATER LEVEL SCENARIO

The summarized water level data of all clusters given in **Table – 7**.

Table –7: Groundwater level data (Cluster-wise)

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level Below ground level (May, Aug, Nov'24 & Jan'25)	Avg. Fluctuation (in meters) during 2024	Geological Formation
1	I	3 nos.	0.80 to 5.20 m	1.48 m	Barakar
2	II	4 nos.	0.50 to 10.73 m	2.16 m	Barakar
3	III	4 nos.	1.09 to 10.73 m	2.06m	Barakar
4	IV	3 nos.	1.95 to 8.45 m	3.59 m	Barakar
5	V	2 nos.	0.55 to 5.55 m	1.07 m	Barakar
6	VI	3 nos.	1.80 to 4.40 m	1.39 m	Barakar
7	VII	4 nos.	1.22 to 4.75 m	1.48 m	Barakar
8	VIII	2 nos.	2.52 to 8.52 m	4.06 m	Barakar
9	IX	4 nos.	1.88 to 9.03 m	3.49 m	Barakar
10	X	4 nos.	0.50 to 5.98 m	1.23 m	Barakar
11	XI	3 nos.	0.95 to 8.02 m	2.09 m	Barakar & Barren Measure
12	XIII	3 nos.	2.98 to 9.00 m	2.30 m	Raniganj
13	XIV	2 nos.	3.13 to 8.05 m	2.06 m	Raniganj
14	XV	3 nos.	2.35 to 5.42 m	1.64 m	Barakar & Barren Measure
15	XVI	3 nos.	2.07 to 8.25 m	2.50 m	Barakar

Depth to water level (in bgl) values describe that water level goes down to maximum 10.73 m during summer season and minimum up to 0.50 m during monsoon season of 2023. Un-confined aquifer is affected around 20 m to 30 m of maximum radius close to active opencast mining areas, showing steep gradient towards mine void. Other than that, there is no mining effect in the water level within JCF area and RCF area (part). Historical water level data and hydrograph of permanent observation stations from CGWB is shown in **Annexure–VI**. Water Table contour map and Depth to water level map both during pre & post-monsoon season is shown in **Plate-IV (A, B) & V (A, B)**.

Monitoring of groundwater (quantity & quality) to assess the present condition and resource has been done regularly in the coalfield area. Well hydrographs (**Annexure–VI**) are prepared and studied to identify long-term trends. Hydrograph trend analysis of CGWB monitoring wells and observation wells reveals increasing groundwater level trends in most of the Cluster of mines. However, declining trends in both Pre and Post-monsoon GW level in Cluster-I, Cluster-V, Cluster-VI, Cluster-VIII and Cluster-XIII are recorded but no significant declining trend (>1.0 m/year) of water level is noticed in any particular area for the last 10 years within the coalfield area. Regarding quality monitoring, the water sample location map (**Plate–II**) with collection points details (dug wells) are given in **Annexure–V** and Quality is given in **Annexure–VII**.

5.0 DETAILS OF PIEZOMETERS

A piezometer network is useful for monitoring the impact of mining activity on groundwater regime. Total 23 nos. of Piezometers were constructed during 2022-23 within JCF and RCF to monitor GW level (**Plate-III**). The depth of piezometers varies from 30m to 300m below ground level.

Water level in the piezometers from May23 to Jan24 are furnished below in **Table-8** and the hydrographs (May22 to Jan24) are given in the Annexure VIB.

Table –8: Groundwater level data in Piezometers (Cluster-wise)

PZ ID	Cluster	Lat.	Long.	Depth (m)	May 23	June23	July23	Aug23	Sept 23	Oct 23	Nov 23	Dec 23	Jan24
PZ1A	I	23.7692	86.1754	40	12.26	13.20	8.80	6.75	6.50	7.50	8.65	9.90	11.98
PZ1B	I	23.7692	86.1753	115	30.20	29.10	24.04	19.00	19.90	21.90	24.05	26.90	30.40
PZ2A	II	23.7672	86.1890	87	30.90	31.60	22.50	17.50	16.50	18.90	22.50	25.50	28.33
PZ2B	II	23.7908	86.2470	77	8.02	7.30	5.10	3.50	3.90	4.30	4.50	4.40	4.6
PZ3A	III	23.8015	86.2824	172	89.5	89.1	83.73	76.50	78.85	81.00	82.64	84.00	86.42
PZ3B	III	23.7798	86.2418	30	24.72	23.72	18.0	14.1	13.2	15.12	18.3	20.4	23.23
PZ3C	III	23.8016	86.2824	124	-	-	-	-	-	-	-	-	-
PZ4A	IV	23.7764	86.3123	70	38.1	37.5	32.2	26.5	27.39	29.5	31.3	33.5	34.9
PZ4B	IV	23.7765	86.3125	240	100.9	98.2	94.6	89.9	90.8	91.3	91.6	92.1	92.7
PZ5A	V	23.7817	86.3569	35	8.5	7.8	5.8	2.5	3.5	4.4	4.8	5	5.31
PZ5B	V	23.7999	86.3619	94	90.94	85.5	80.1	75.08	73.2	78.04	82.0	86.1	90.32
PZ7A	VII	23.7701	86.4110	159	109.9	110.1	105.02	98.5	92.9	96.8	98.1	101.8	104.86

PZ7B	VII	23.7400	86.3997	35	29.36	30.02	21.38	16.63	15.68	17.96	21.38	24.23	26.18
PZ7C	VII	23.7342	86.4433	105	92.27	90.88	85.40	78.03	80.43	82.62	84.29	85.68	85.2
PZ8A	VIII	23.7556	86.4271	140	49.23	49.01	46.05	40.08	38.37	42.55	43.45	44.20	46
PZ9A	IX	23.7305	86.4464	84	43.85	44.55	41.87	38.25	39.43	40.50	41.32	42.00	40.32
PZ9B	IX	23.6962	86.4159	100	72.6	71.05	67.5	57.2	58.9	59.8	61.3	63.35	63.7
PZ10A	X	23.6880	86.4051	134	6.9	6.2	4.01	3.1	3.6	4.05	4.6	5.1	6.35
PZ11A	XI	23.7264	86.3419	300	52.7	47.5	37.2	28.09	34.6	37.1	39.05	40.9	53.15
PZ13A	XII	23.7138	86.2516	80	39.9	36.3	32.1	23.6	25.8	26.5	28.1	30.1	31.81
PZ14A	XIV	23.7415	86.2139	30	12.8	10.1	7.9	4.6	5.5	6.1	7.3	7.9	8.39
PZ14B	XIV	23.7415	86.2139	162	14.6	13.5	9.8	5.05	6.3	7.5	9.1	10.5	12.56
PZ16A	XVI	23.7308	86.7605	90	35.58	35.64	32.49	29.60	28.54	30.40	31.06	32.0	32.24

6.0 GROUND WATER QUALITY

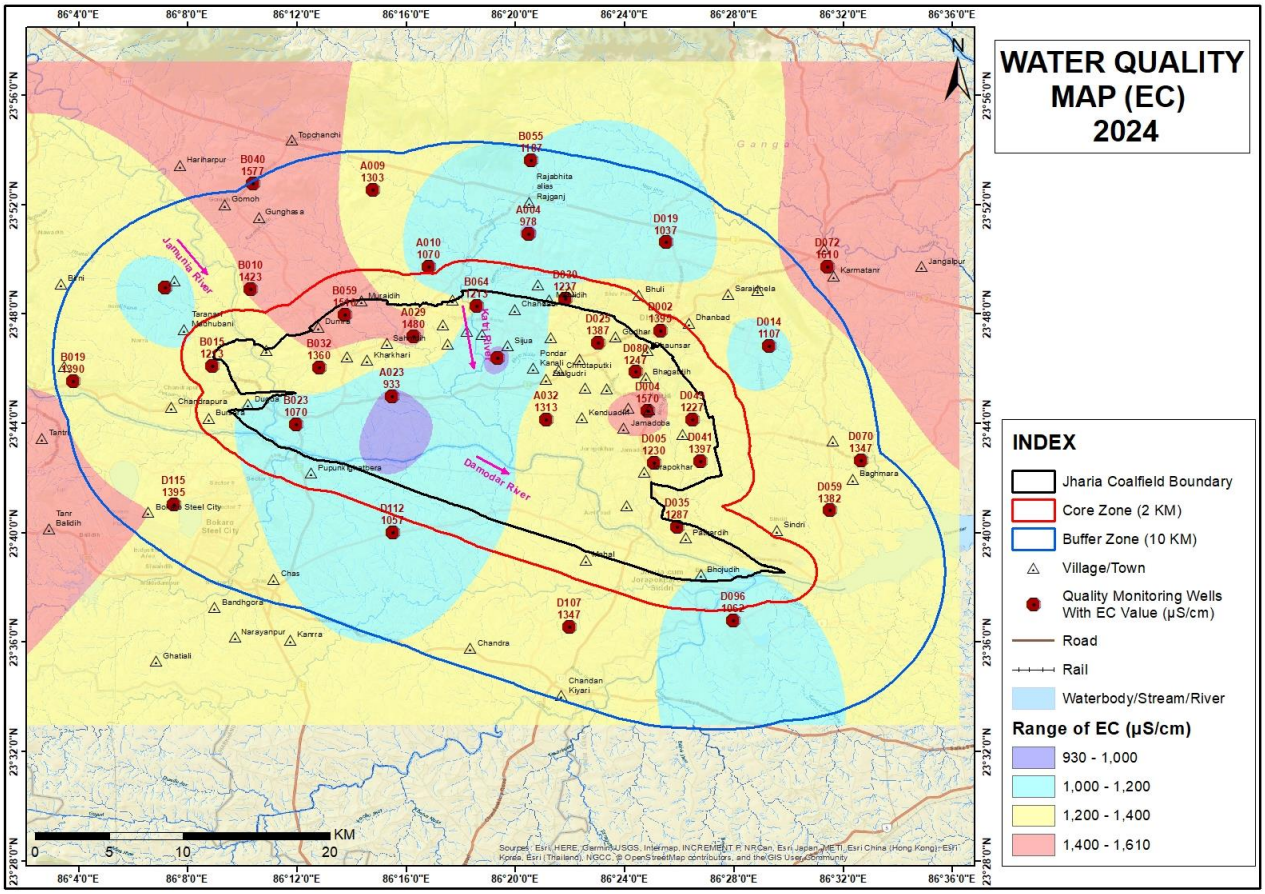
The ground water samples of the study area (16 nos. of Cluster of mines, BCCL) were collected from dug wells and analyzed. Thirty-five ground water samples were analyzed during the month of May'2024 at CMPDI, RI-II, Dhanbad. The water sampling details is given in **Annexure–V** and Water sample locations are shown in **Plate-II**. The water quality data is presented in **Annexure–VII.**

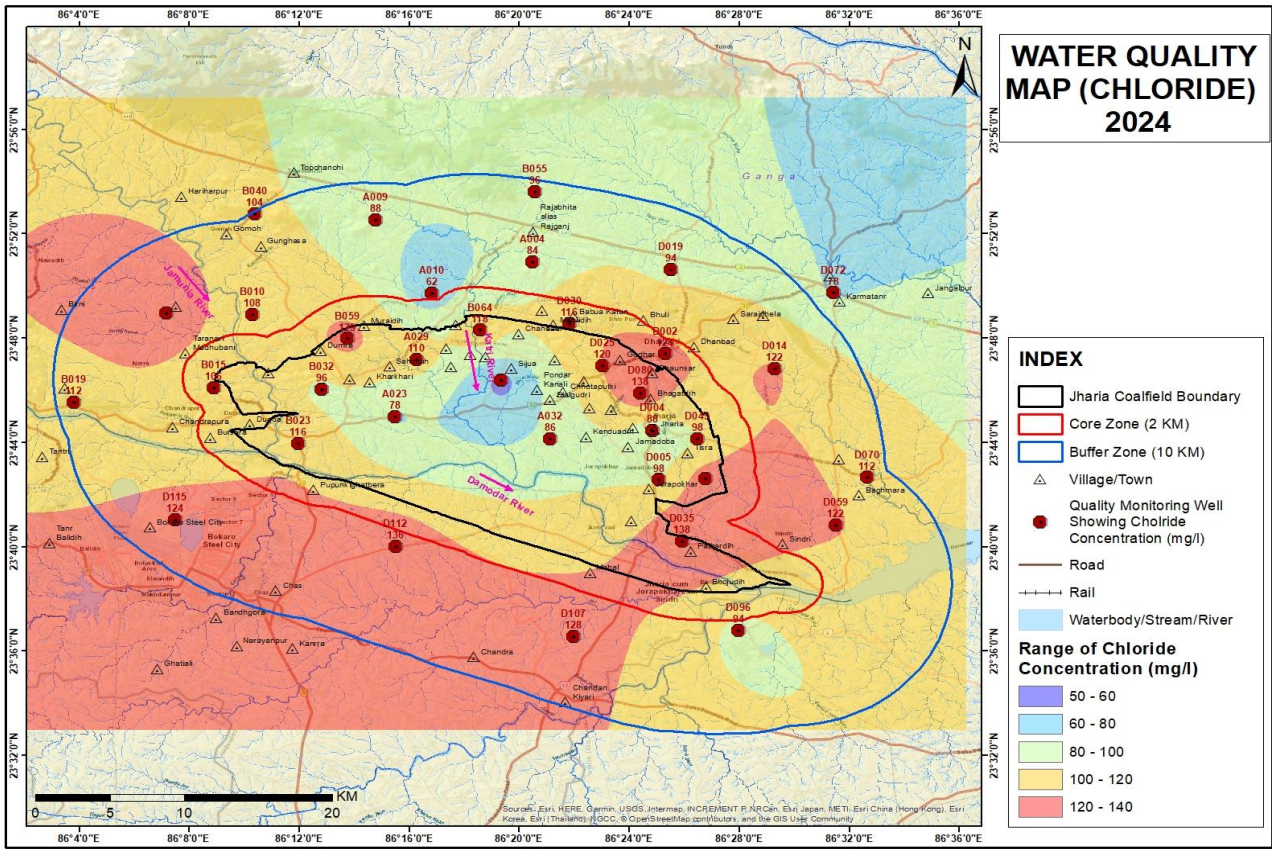
The study of the variations in water quality parameters is described below:

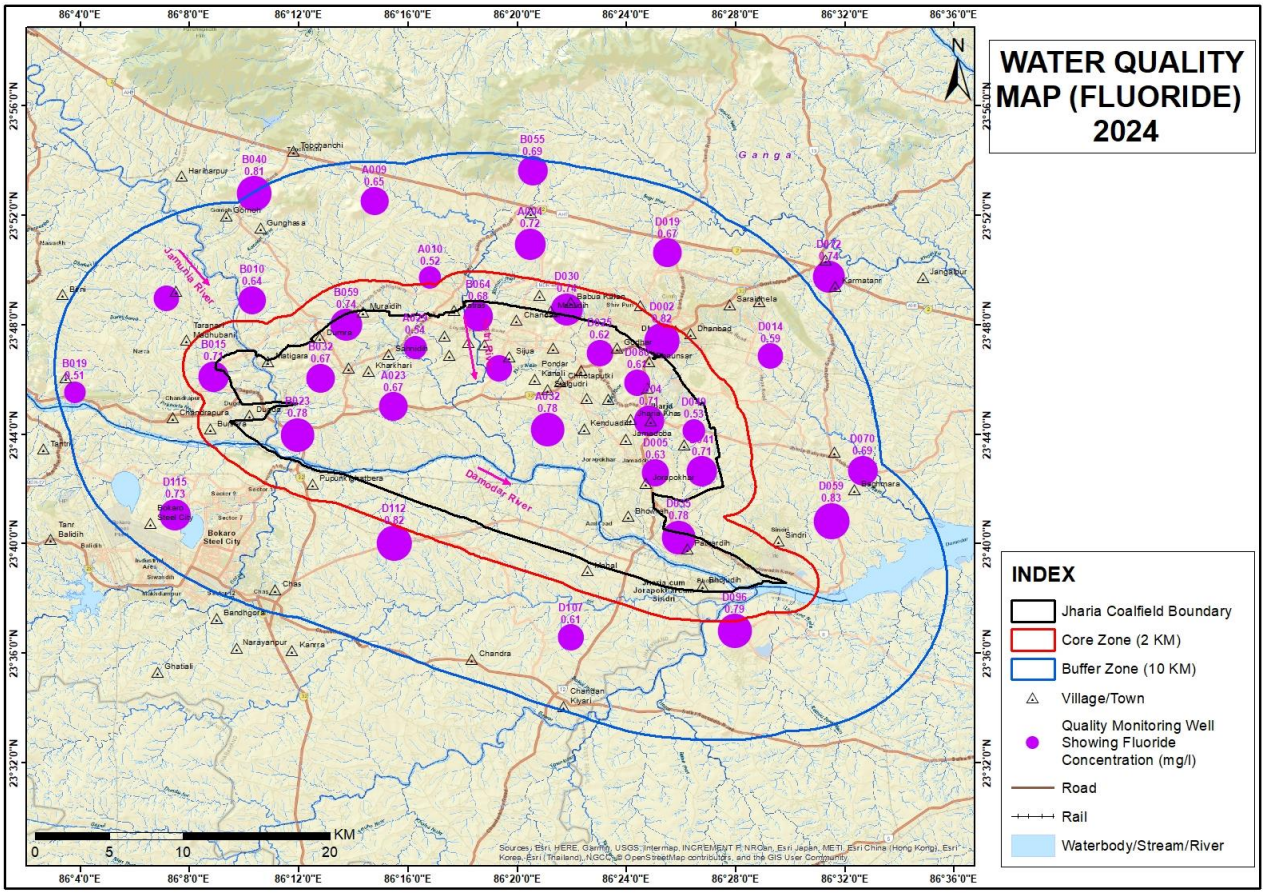
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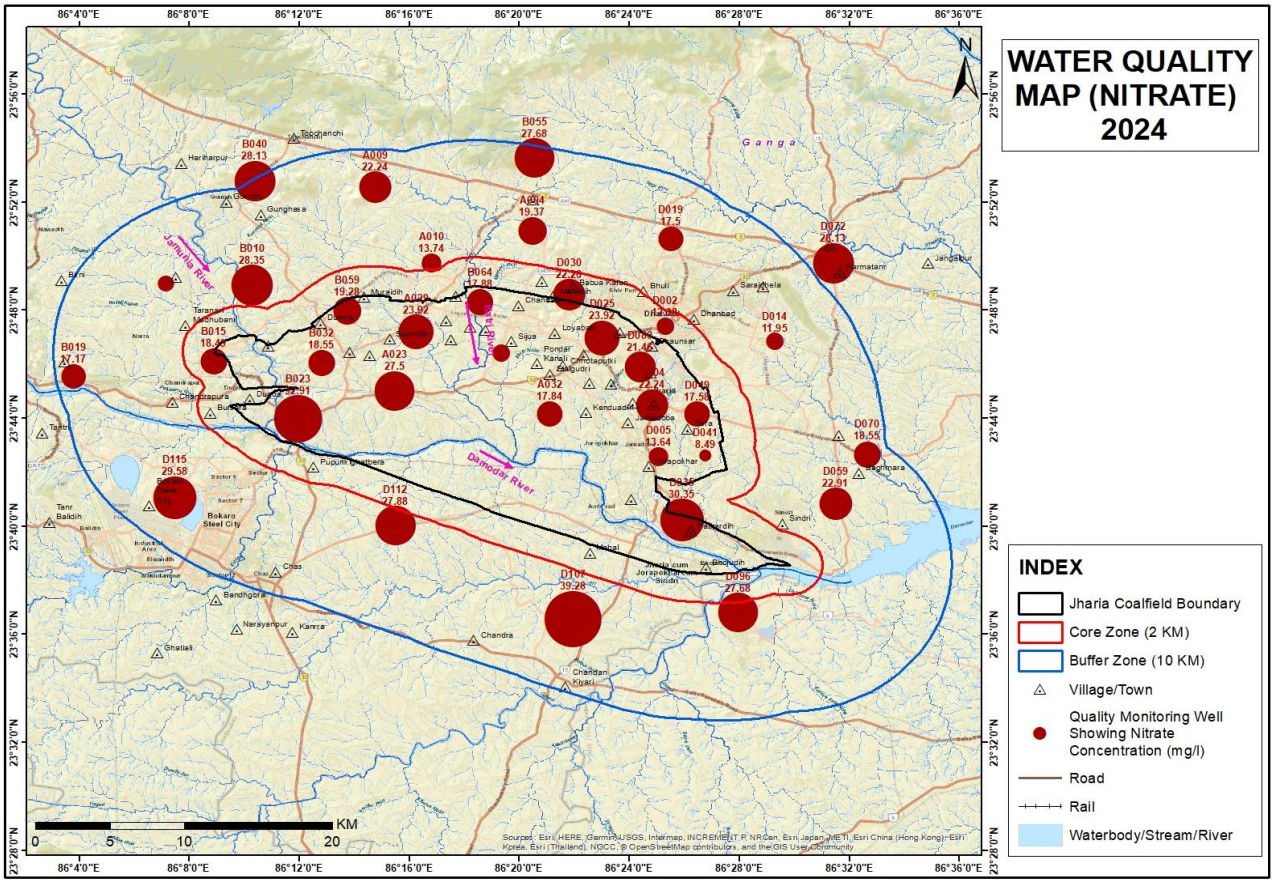
In wells of JCF concentration of magnesium in the water samples varies 103 (D-70) to 125 mg/l (D-4) and is above the permissible limit (100 mg/l) of drinking water standards. The total hardness mg/l ranges from 614 (A-09) to 824 mg/L (D-72) and is above the permissible limit of (600 mg/L) of drinking water standards The Iron, Manganese, Zinc and Chromium concentration in the water samples found to be below the upper IS 10500:2012 limits for drinking water.

In RCF part of BCCL Command area At a few locations, the total hardness value of the analyzed samples exceeds the permissible limit of 600 mg/L, specifically at DB2A (650 mg/L), DB4 (680 mg/L), DB30 (648 mg/L), DB38 (705 mg/L), and DB39 (602 mg/L). The rest of the groundwater quality data indicates that the values are well within the permissible limits as per the IS 10500:2012 drinking water standards.


WATER QUALITY MAP (EC) 2024
INDEX
Jharia Coalfield Boundary
Core Zone (2 KM)
Buffer Zone (10 KM)
Village/Town
Quality Monitoring Wells With EC Value (µS/cm)
Road
Rail
Waterbody/Stream/River
Range of EC (µS/cm)
930 - 1,000
1,000 - 1,200
1,200 - 1,400
1,400 - 1,610
Jamuniya River
Damodar River
Barakar River
Ganga
N
KM
0 5 10 20


WATER QUALITY MAP (CHLORIDE) 2024
INDEX
Jharia Coalfield Boundary
Core Zone (2 KM)
Buffer Zone (10 KM)
Village/Town
Quality Monitoring Well Showing Cholride Concentration (mg/l)
Road
Rail
Waterbody/Stream/River
Range of Chloride Concentration (mg/l)
50 - 60
60 - 80
80 - 100
100 - 120
120 - 140
Jamuniya River
Damodar River
Barakar River
Ganga
N
KM
0 5 10 20


WATER QUALITY MAP (FLUORIDE) 2024
INDEX
Jharia Coalfield Boundary
Core Zone (2 KM)
Buffer Zone (10 KM)
Village/Town
Quality Monitoring Well Showing Fluoride Concentration (mg/l)
Road
Rail
Waterbody/Stream/River
Damodar River
Jamunia River
Ganga
Bokaro Steel City
KM


WATER QUALITY MAP (NITRATE) 2024
INDEX
Jharia Coalfield Boundary
Core Zone (2 KM)
Buffer Zone (10 KM)
Village/Town
Quality Monitoring Well Showing Nitrate Concentration (mg/l)
Road
Rail
Waterbody/Stream/River
Damodar River
Jamunia River
Ganga
Bokaro Steel City
KM

7.0 STAGE OF GROUNDWATER EXTRACTION

The groundwater is mainly utilized for domestic needs and irrigation purposes. The groundwater abstraction is mainly through dug wells and bore wells. The stage of groundwater development in Dhanbad District is 74.34% (as per GWRE 2023-24, INGRES Portal). The highest stage of development is in Baliapur Block (110.03%) & Dhanbad Urban Block (95.65%) and lowest stage of development is in Purbi Tundi Block (26.15%) and Chirkunda Block (34.53%) as per GWRA-2023-24 (Source: Ingres Portal). The Gondwana sandstones in general, known to constitute good aquifers at many places. However, the yield potential of the area adjoining to active mines in the coal belt is poor. The active mines often act as groundwater "sinks". In contrast, the water-logged abandoned mines and pits act as potential sources of groundwater. Block wise data of Dhanbad District given below:

Table–9A: Block wise Stage of Groundwater development

Sl No.	Administrative Unit			Category (GWRA-2017)	Category (GWRA-2022)	Category (GWRA-2023-24)
	State	District	Block			
1	Jharkhand	DHANBAD	BAGHMARA	**Over-exploited**	**Over-exploited**	Semi-Critical
2	Jharkhand	DHANBAD	BALIAPUR	Critical	Safe	**Over Exploited**
3	Jharkhand	DHANBAD	DHANBAD	Semi-Critical	**Over-exploited**	Semi-Critical
4	Jharkhand	DHANBAD	DHANBAD URBAN	**Over-exploited**	Semi-critical	Critical
5	Jharkhand	DHANBAD	JHARIA	**Over-exploited**	Critical	Hilly Area
6	Jharkhand	BOKARO	CHANDRAPURA	Critical	Critical	Safe
7	West Bengal	PASCHIM BARDHAMAN	SALANPUR	Safe	Safe	Safe

- **Dynamic Groundwater Resource Assessment, CGWB as per 2017, 2022 and 2023-24.**

Table–9B: Cluster wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Extraction	Total Water demand (cum/day)				Avg. GW level (bgl in m) 2024-25		GW level declining trend 2005-2023		Remarks
		Mine Discharge + BH pumping	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Chandrapura (SOD: Safe)	2173 (2065+108)	NIL	2112 (1698+414)	61	4.28	2.20	YES	YES	Recharge structure needed
Cluster-II	Baghmara (SOD: Semi Critical)	8350	Jamunia river	6737 (2755+3982)	1613	5.29	3.05	NO	NO	Excess mine water needed to be utilized
Cluster-III		12760 (10960+1800)	NIL	8946 (7849+1097)	3814	5.10	3.37	YES	NO	
Cluster-IV		5900	MADA	5100 (3605+1495)	800	7.30	3.22	YES	NO	
Cluster-V		12690 (11025+1665)	MADA	11063 (5710+5353)	1897	5.78	3.61	YES	YES	
Cluster-VI	Dhanbad (SOD: Critical)	4150	MADA	4150 (1664+2486)	0.0	4.92	2.79	YES	NO	--
Cluster-VII		21565	MADA	20826 (17596+3230)	739	3.56	2.57	YES	YES	Excess mine water needed to be utilized
Cluster-VIII		9320	MADA	5294 (3730+1564)	4026	6.05	3.80	YES	NO	
Cluster-IX		12980	MADA	9358 (4549+4809)	3622	6.62	4.01	NO	NO	
Cluster-X		11825	Damodar river	6201 (4255+1946)	5624	4.27	2.84	NO	NO	
Cluster-XI	Dhanbad (SOD: Critical)	24960	MADA & DVC	19425 (14015+5410)	5535	4.86	2.76	YES	NO	
Cluster-XIII	Baghmara (SOD: Critical)	750	Damodar river	692	58.0	7.66	4.86	NO	NO	--
Cluster-XIV		943	NA	668	275	6.34	4.28	NO	NO	--
Cluster-XV		6200	NA	5941 (4600+1341)	259	5.67	3.58	NO	NO	--
Cluster-XVI	Chirkunda (SOD: Safe)	1910	DVC (Barakar river)	1730 (1380+350)	180	5.49	4.02	NO	NO	--
Cluster-XVII	Salanpur (SOD: Safe)	5091 *	DVC (Barakar river)	5091 (1470+1405)	2216	5.85	3.84	NO	NO	-

*EAC awaited

MADA – Mineral Area Development Authority, Jharkhand, Dhanbad (payment basis).

DVC – Damodar Valley Corporation, Maithon/Panchet, Jharkhand (payment basis).

8.0 IMPACT OF MINING ON GROUND WATER REGIME

8.1 GENERAL CONSEQUENCES OF COAL MINES ON AMBIENT HYDROGEOLOGICAL REGIME

Mining of coal either by opencast or underground method is bound to incise one or more water bearing strata (aquifers) which, in turn, may result in depletion or draw down in water levels and a corresponding inflow of water into the mine workings. The potential effects of coal mining operations on the hydrogeological regime are as under:

- Creates disruption in formation/aquifer
- Dewatering of aquifers
- Change in hydraulic gradient
- Modification in recharge of aquifers
- Change in groundwater flow pattern

The general need in mine planning from the hydrogeological point of view is the estimation of ground water seepage into the mine, its rate, the mine pumping capacity to meet the storm rainwater accumulation, extent of depression of water surface and management of mine effluent (mine water). It is also desirable that the consequences of mining operation on groundwater regime be determined in advance. However, the mine pumping in most of the cases are passive dewatering for the safety of the mine pit, active mine dewatering is done in few cases for very high potential aquifers.

8.2 POTENTIAL CONSEQUENCES OF OPENCAST AND UNDERGROUND COAL MINES ON HYDROGEOLOGICAL REGIME IN JHARIA COALFIELD

Generally, in the opencast and underground mines of Jharia Coalfield, alluvium and overlying weathered mantle are the first to be excavated, followed by upper Barakar Formation / Aquifer. Since these formations vary in thickness, compaction and their constituents over the area, their aquifer properties also vary.

The porosity and the compactness in the sandstone controls the discharge from these aquifers. The alluvium and weathered Formation wherever loose and fragile possess more porosity and this has high groundwater potential. Due to the mine cut, a depression in the water table is created. The initial discharges due to this depression is large in amount because of concentration of flow to that region. In the top zones, water table condition prevails and semi-confined conditions exist in the stratified section (Gondwana Sedimentary basin). With progress of mine operations, there is an increase in the depth of incision, as a result which, the semi-confined aquifers are also gets punctured.

During mining, the hydraulic gradients generally steep down near mine i.e. within the mine influence area. In the up-dip region, only un-confined aquifer is punctured through the mining process and thus only

unconfined aquifer is affected whereas in the down-dip region both un-confined and semi-confined aquifers may be affected. The confined aquifers of lower Barakar Formation in the mining area are not punctured as it lies below the working coal seams and hence normally there is no noticeable effect in the aquifer related to this formation.

8.3 ESTIMATION OF RADIUS OF MINE INFLUENCE ZONE

Radius of Influence can be defined as the radial distance from the center of the borehole to the point where there is no lowering of groundwater table/potentiometric surface.

The radius of influence (R) for Opencast and UG Mines within Jharia CF is calculated by using Sichardt's formula based on present mining scenario.

$$R_0 = C*(H-h) * \sqrt{(K)}$$

Where, R_0- Radius of influence (m), C - Constant =3000,

(H-h)- Drawdown (m), K – Hydraulic conductivity (m/s).

Here, K for Barakar Formations is 0.05 m/d or 5.7×10^{-7} m/sec.

Here, it may be appropriate to mention that the presence of prominent boundaries/water bodies, faults or inter-fringing of sandstone and shale beds may restrict the propagation of drawdown cone. With the presence of low permeable beds such as clay/shale and younger coal seams in the formation, laying above the working seams the water level in the phreatic aquifer is not directly affected. Both, the phreatic and semi-confined aquifers, get affected during the working by board and pillar method as subsidence takes place while extracting total coal (depillaring). Surface vigilance and filling up subsided zone, if any, has to be constantly under observation. The effect on groundwater level for most of the coalmine in Jharia coalfield has been observed in the down-dip side, generally within a distance up to 500 m from active mine zone and becomes milder/ negligible thereafter.

9.0 CONSERVATION MEASURES & FUTURE STRATEGY

- BCCL has installed 25 Pressure Filter Plant of total capacity of 4.16 MGD to meet drinking water requirement in nearby area. At present 63 Water Treatment Plants are operational having capacity of 16.16 MGD within Jharia Coalfield area. Further, installation of 28 more Pressure Filter Plants having capacity of 5.84 MGD are in progress.

- BCCL has participated in development of low cost technology for drinking water in a CSIR project along with CIMFR, Dhanbad and a pilot plant of 4000 Liters/hour is functional at PB Project site of BCCL. Similar plants have been proposed at other sites of BCCL.
- A scheme titled 'Scheme for multi-purpose utilization of surplus mine water of Barora Area, Block II and Govindpur Area of BCCL' was prepared with a view to harness the excess water discharge to take care of the persistence problem of water scarcity in the nearby villages. In the scheme, two water reservoirs of capacity 27 MG and 17 MG have been proposed in the non-coal bearing area for storage of 3250 GPM and 2000 GPM surplus mine water which will be fed by mine discharge at mines of Barora, Block-II and Govindpur Area through pipe line.
- Rooftop rainwater harvesting (RWH) has been taken up in the project areas using the administrative buildings. 138 no. of quarters having roof-top area of about 14950 sq. m. is ready to harvest rainwater and around 13150 cum/annum of water is going to recharge the nearby groundwater system through RWH structures. Proposal has already been made to facilitate this kind of RWH structure at suitable locations i.e., Lodna Area, Kusunda Area (Jawahar Nagar, Matkuria, Coal Board Colony), Sijua Area (Nichitpur and Tetulmari Colony) within Jharia Coalfield to augment groundwater recharge.
- After cessation of mining, with plenty of rainfall and abundant ground water recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may be considered as a temporary phenomenon. The abandoned mine workings (UG) behave as water pool and improves the resources availability in the coalfield area.
- Utilization of treated mine water discharge by both, industry and local people, in the mine influence area. The excess mine water can be used to recharge groundwater system by connecting pipelines to abandoned dug wells. Utilization of mine water for irrigation will also enhance the ground water recharge potential through artificial recharge in the area.
- Increase vegetative cover by plantation in the mine area under land amelioration measures. This will contain the surface run-off and increase the groundwater recharge.
- Imparting awareness among workers and local peoples about Rainwater harvesting and artificial recharge will have priority. This aspect is usually covered during the Environmental Week celebrated every year (5 to 12 June).
- Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will continue under routine monitoring (May, August, November & Jan).

10.0 EXISTING/PROPOSED RAINWATER HARVESTING STRUCTURES IN BCCL COAL MINES

Fig-3 to 4.



Proposed Rain Water Harvesting Site GVTC, Cluster-I, Barora Area



Proposed Rain Water Harvesting Site Nehru Balika Vidhalaya, Cluster-I, Barora Area
Fig-5 to 6.



Proposed Rain Water Harvesting Site Barora Area Guest House, Cluster-I, Barora Area



Proposed Rain Water Harvesting Site Regional Hospital Baghmara, Cluster-I, Barora Area

Fig-7 to 8.



Proposed Rain Water Harvesting Site – Barora Area Office, Cluster-I, Barora Area



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA

Fig-9 to 10.



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



FILTER PLANT IN THE MINE AREA

Fig-11 to 12.

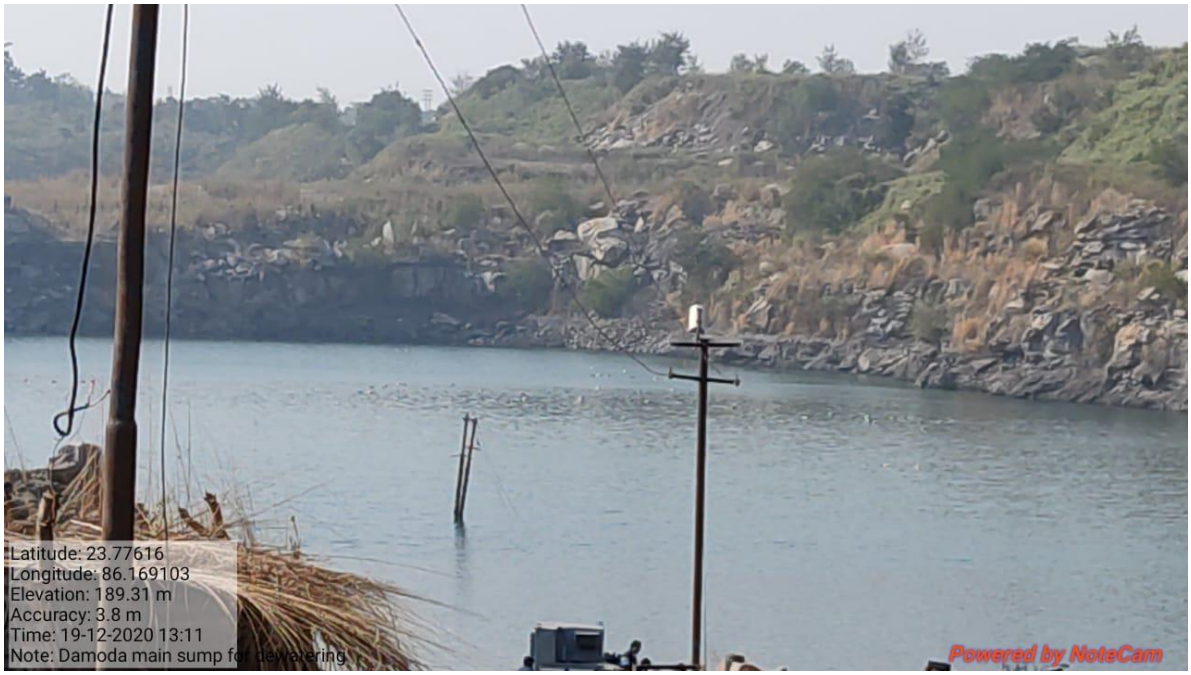


RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA

Fig-13 to 14.



RECHARGE POND / ABANDONDED IN THE JCF MINE AREA



Annexure – IV

25 Year Normal Rainfall Data (in mm) for Dhanbad District (Source: WRIS Grided Data)

Yearly Rainfall (25 Years Normal: 1998-2022)	
Year	**Rainfall (in mm)**
1998	1578
1999	1903
2000	1481
2001	1648
2002	1584
2003	1546
2004	1401
2005	1149
2006	1390
2007	1773
2008	1173
2009	1303
2010	1027
2011	1296
2012	1152
2013	1203
2014	1002
2015	996
2016	1398
2017	1385
2018	1144
2019	1357
2020	1116
2021	1745
2022	982

Monthly Rainfall (25 Years Normal: 1998-2022)	
Month	**Rainfall (in mm)**
January	8.2
February	15.1
March	19.8
April	32.1
May	77.6
June	204.6
July	329.6
August	285.8
September	259.9
October	105.5
November	6.4
December	4.5
Total	1349.1

Monthly Rainfall (16 Years Normal: 2008-2023) Bardhaman District, RCF	
Month	**Rainfall (in mm)**
January	7.55
February	16.06
March	17.69
April	37.68
May	131.88
June	198.95
July	254.46
August	240.09
September	180.82
October	92.15
November	9.44
December	14.95
Total	1201.72

Annexure – IV

Block wise Rainfall Data as per GWRE 2023-24 (Source: INGRES Portal)

State	District	Block	Category (GWRE 2023-24)	Rainfall in mm
Jharkhand	DHANBAD	BAGHMARA	SEMI-CRITICAL	1393.60
Jharkhand	DHANBAD	BALIAPUR	OVER EXPLOITED	1393.60
Jharkhand	DHANBAD	DHANBAD	SEMI-CRITICAL	1393.60
Jharkhand	DHANBAD	DHANBAD URBAN	CRITICAL	1393.60
Jharkhand	DHANBAD	JHARIA	HILLY AREA	0.00
Jharkhand	BOKARO	CHANDRAPURA	SAFE	1211.50
West Bengal	PASCHIM BARDHAMAN	SALANPUR	SAFE	1348.20

Annexure – IV

Rainfall Data (in mm) At Dhansar (Rescue station) Observatory Station
State Sec Deptt of Coord, BCCL

Year	January	February	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Annual
2005	34.20	22.80	41.80	32.20	33.00	193.00	542.00	107.80	185.60	39.20	0.00	2.00	1233.60
2006	0.00	0.00	34.40	33.80	87.60	214.20	477.70	246.30	172.00	0.00	1.00	0.00	1267.00
2007	0.00	22.00	37.80	0.00	78.70	167.20	545.00	426.40	351.40	52.00	0.00	0.00	1680.50
2008	5.80	4.80	17.80	18.40	18.00	216.10	433.48	183.80	297.80	85.80	0.00	0.00	1281.78
2009	0.00	0.00	1.60	2.20	112.00	72.80	269.20	192.80	333.00	98.20	10.20	0.00	1092.00
2010	0.00	12.20	7.60	9.20	64.30	206.20	199.40	212.60	230.10	45.30	3.4	----	991.90
2011	7.60	0.00	18.0	11.40	121.60	344.20	163.40	452.0	374.0	41.80	0.00	0.00	1534.20
2012	17.6	13.4	1.0	9.0	6.60	52.0	328.20	315.10	367.70	11.60	61.60	18.0	1201.80
2013	0.0	32.0	3.0	33.90	190.40	244.20	192.80	364.40	304.70	233.60	0.0	0.0	1599.0
2014	12.40	36.80	21.80	2.60	79.80	217.60	305.30	315.60	178.0	6.40	0.0	0.0	1176.0
2015	23.80	0.0	6.20	76.20	35.80	122.10	407.60	244.40	145.20	25.60	0.0	6.20	1093.10
2016	3.0	20.60	5.50	0.0	99.40	181.60	248.80	456.70	443.60	50.40	0.0	0.0	1509.60
2017	8.80	0.0	3.80	17.90	33.20	120.0	533.40	284.70	247.40	207.70	3.40	0.0	1460.30
2018	0.0	0.0	0.0	102.90	76.30	270.60	382.30	338.80	159.50	38.90	2.40	37.90	1346.60
2019	0.0	49.60	10.20	54.20	132.0	188.0	319.10	343.60	403.10	156.40	3.20	10.80	1667.00
2020	22.0	7.60	77.80	76.80	86.20	214.10	296.80	351.40	214.0	92.0	0.0	0.0	1438.70
2021	0.00	0.00	21.8	12	157.4	295	382.2	130.2	451.8	285	54.4	43	1832.8
2022	12.8	85.8	0	0	61.8	130.2	104.6	350.1	172.2	64.4	0	3	984.9
2023	0.00	0.00	19.40	47.20	128.00	61.20	128.50	424.20	289.80	211.20	0.00	49.20	1358.7
2024	6.60	11.00	90.00	0.00	80.20	80.60	284.00	678.20	404.60	105.60	0.00	0.00	1740.8

Annexure – V

Location of Hydrograph Stations (Dug Wells)

Well No	Latitude	Longitude	Well No	Latitude	Longitude
A002	86.2586	23.8181	D029	86.3742	23.8208
A004	86.3417	23.8492	D030	86.3640	23.8096
A006	86.3149	23.8498	D034	86.3837	23.7733
A007	86.2982	23.8287	D035	86.4321	23.6705
A008	86.2635	23.8527	D036	86.4360	23.6564
A009	86.2462	23.8758	D039	86.4371	23.7195
A010	86.2805	23.8290	D046	86.5211	23.7377
A013	86.3226	23.7735	D047	86.4076	23.7539
A015	86.3425	23.8249	D052	86.4473	23.7538
A016	86.3598	23.7807	D054	86.3751	23.7222
A017	86.3672	23.7520	D056	86.4600	23.6590
A019	86.4004	23.6847	D057	86.4999	23.6467
A020	86.3272	23.7481	D059	86.5253	23.6806
A023	86.2581	23.7502	D062	86.4805	23.7029
A024	86.2275	23.7535	D063	86.4636	23.6760
A025	86.2540	23.7830	D065	86.4929	23.7442
A026	86.3005	23.7787	D068	86.4623	23.7054
A027	86.3402	23.8090	D070	86.5443	23.7112
A028	86.2979	23.7900	D071	86.5248	23.7922
A029	86.2713	23.7865	D072	86.5238	23.8293
A032	86.3521	23.7360	D074	86.4255	23.7015
A034	86.2537	23.7136	D075	86.3985	23.6509
B001	86.2402	23.8164	D077	86.3707	23.6802
B002	86.2091	23.7950	D080	86.4067	23.7650
B009	86.1797	23.8387	D088	86.3950	23.6230
B010	86.1718	23.8153	D089	86.3872	23.5968
B011	86.2063	23.8256	D090	86.4209	23.6058
B012	86.2049	23.8094	D091	86.4378	23.5621
B014	86.2704	23.8008	D096	86.4663	23.6135
B015	86.1484	23.7685	D105	86.3295	23.6436
B017	86.1194	23.7514	D109	86.1983	23.6554
B018	86.0918	23.7459	D112	```86.2586	23.6670
B024	86.2161	23.7410	D113	86.2785	23.6948
B027	86.3418	23.7562	D115	86.1250	23.6843
B029	86.2076	23.6992	D117	86.1787	23.7136
B032	86.2135	23.7676	DB001	86.7902	23.7303
B033	86.2053	23.8552	DB002	86.7794	23.75
B038	86.2135	23.8834	DB003	86.7638	23.6555
B040	86.1731	23.8799	DB004	86.8062	23.6541
B041	86.1611	23.9121	DB005	86.8216	23.6785
B043	86.2420	23.8949	DB008	86.81519	23.73067
B044	86.1276	23.8735	DB009	86.8135	23.7354
B046	86.1195	23.8163	DB010	86.8561	23.7085
B047	86.1233	23.7702	DB012	86.8713	23.7638
B048	86.2783	23.7259	DB013	86.8687	23.7814

B051	86.1521	23.7941	DB018	86.7915	23.7394
B053	86.1636	23.7683	DB019	86.7483	23.7194
B054	86.3639	23.8660	DB022	86.7571	23.7237
B055	86.3427	23.8940	DB023	86.7514	23.7291
B057	86.2860	23.8738	DB024	86.7509	23.7309
B059	86.2293	23.8000	DB025	86.7399	23.7337
B060	86.2541	23.8059	DB026	86.75	23.7194
B062	86.1929	23.7628	DB027	86.7232	23.7298
B065	86.3076	23.8083	DB028	86.6836	23.7472
B067	86.2325	23.7233	DB029	86.6548	23.7462
B068	86.0873	23.7225	DB030	86.6654	23.795
B071	86.0799	23.8088	DB033	86.8126	23.7645
D003	86.4149	23.7804	DB034	86.7877	23.7785
D005	86.4180	23.7098	DB036	86.7546	23.798
D007	86.4574	23.7220	DB038	86.7361	23.8346
D008	86.1915	23.8340	DB039	86.715	23.7996
D010	86.4947	23.7252	DB047	86.7509	23.7557
D012	86.4484	23.7771	K010	86.9157	23.7059
D014	86.4884	23.7808	K012	86.9277	23.7267
D018	86.4317	23.8189	K015	86.9103	23.8177
D019	86.4253	23.8440	K020	86.8824	23.8514
D020	86.4023	23.8527	K021	86.9277	23.7267
D022	86.4021	23.8015	K026	86.8808	23.7414
D025	86.3837	23.7828	K030	86.8472	23.7396
D028	86.4016	23.8223			

Annexure – VA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	Formation	Owner	Utility
A002	Beharekudur	0.63	3.00	12.93	Metamorphic	Nona Das	Domestic
A004	Daldoli	0.52	3.12	6.00	Metamorphic	Govt.	Domestic
A006	Barwadi,Kanko	0.75	3.15	9.10	Metamorphic	Govt.	Domestic
A007	Chaddriderdih	0.45	1.80	9.95	Metamorphic	Hazi	Domestic
A008	Siskari	0.60	1.95	12.50	Metamorphic	Govt.	Domestic
A009	Srirampur	0.43	2.10	9.80	Metamorphic	Mosque	Domestic
A010	Phulwar	0.63	1.90	10.90	Metamorphic	Govt.	Domestic
A013	Sijua	0.40	2.35	6.90	Barakar	Rajen	Domestic
A015	Tetulmari	0.90	1.85	9.00	Metamorphic	Dharmendar	Domestic
A016	Ekra, Kalali	0.45	3.10	6.50	Barakar	Govt.	Domestic
A017	Kachi Balihari	0.56	1.60	5.30	Barakar	Govt.	Domestic
A019	Bhaura	0.54	3.15	11.65	Barakar	Govt.	Domestic
A020	Gorbhudih	0.43	3.30	8.30	BM	Govt.	Domestic
A023	Machhyara	0.43	1.85	12.40	Raniganj	Govt	Domestic
A024	Pipra Tanr	0.22	1.80	19.55	Raniganj	Govt	Domestic
A025	Sinidih	0.22	2.00	11.30	Barakar	Govt	Domestic
A026	Pasitanr	0.32	1.80	9.65	Barakar	Govt	Domestic
A027	Chandor	0.60	2.50	5.50	Barakar	Govt	Domestic
A028	Lakarka 6 no.	0.65	1.30	5.25	Barakar	BCCL	Domestic
A029	Aambagan	0.10	2.60	9.15	Barakar	Govt	Domestic
A032	Baludih	0.55	2.30	6.85	BM	Govt	Domestic
A034	Bhatdih	0.55	3.50	24.50	Raniganj	BCCL	Domestic
B001	Muraidih	0.47	1.80	5.35	Talchir	Govt	Domestic
B002	Baghmara Tola	0.32	1.85	11.25	Metamorphic	Govt	Domestic
B009	Jari Tanr	0.60	2.57	9.00	Metamorphic	Hariram Majhi	Domestic
B010	Narayanpur	0.23	4.57	8.60	Metamorphic	Mukteswar	Domestic
B011	Nischitpur	0.60	2.08	11.30	Metamorphic	Babulal Das	Domestic
B012	Harina	0.37	2.20	10.87	Metamorphic	Ramayan	Domestic
B014	Mathadih	0.76	2.15	3.75	Barakar	Govt	Domestic
B015	Bera Basti	0.55	1.60	2.50	Talchir	Dhanu Roy	Domestic
B017	Chandrapura	0.40	1.85	11.40	Barakar	Govt	Domestic
B018	Khanoodih	0.66	2.30	13.25	Metamorphic	Govt	Domestic
B024	Telmuchu	0.67	4.35	10.83	Raniganj	Govt	Domestic
B027	Chirudih Basti	0.08	1.40	11.00	BM	Govt	Domestic
B029	Popanki	0.50	1.70	6.50	Metamorphic	Govt	Domestic
B032	Madhuband	0.80	4.30	8.60	Barakar	BCCL	Domestic
B033	Ramakunda	0.75	3.20	9.65	Metamorphic	Liluram Mahato	Domestic

B038	Tantri	0.4	1.80	11.3	Metamorphic	Panchayat	Domestic
B040	BhuiwarChita	0.4	1.80	9.15	Metamorphic	Govt	Domestic
B041	Pawapur	0.45	3.00	6.7	Metamorphic	Govt	Domestic
B043	Chatatanr	0.5	1.50	9.2	Metamorphic	Govt	Domestic
B044	Lachmipur	0.35	3.35	10.1	Metamorphic	Govt	Irrigation
B046	Telo	0.2	1.50	8.1	Metamorphic	Govt	Domestic
B047	Madanpur	0.7	1.80	10.8	Metamorphic	DVC	Domestic
B048	Mahuda	0.65	2.10	11.50	Raniganj	Mosque	Domestic
B051	Taranga	0.00	2.50	5.75	Metamorphic	Bisun	Irrigation
B053	Karmatanr	0.58	2.70	13.25	Barakar	Govt	Domestic
B054	Domanpur	0.45	3.30	9.55	Metamorphic	Govt	Domestic
B055	Rantanr	0.50	3.40	5.25	Metamorphic	Govt	Domestic
B057	Kotaldih	0.60	3.20	7.5	Metamorphic	Govt	Domestic
B059	Khodovaly	0.60	2.40	9.30	Barakar	BCCL	Domestic
B060	Bahiyardih	0.77	3.00	15.60	Barakar	BCCL	Domestic
B062	Sadariyadih	0.15	3.10	9.50	Barakar	Govt	Domestic
B065	Jhinjipahari	0.95	2.20	12.4	Metamorphic	Private	Domestic
B067	Simatanr	0.55	2.20	11.8	Raniganj	Govt	Domestic
B068	Sibutanr	0.4	2.20	6	Metamorphic	DVC	Domestic
B071	Bandiyo	0.55	3.50	7.1	Metamorphic	Govt	Irrigation
D003	Dhansar	0.6	1.70	8.7	Barakar	Govt	Domestic
D005	Jiyalgora PO	0.7	2.80	10.55	Metamorphic	Govt	Domestic
D007	Golden Pahari	0.67	2.85	10.05	Barakar	BCCL	Domestic
D008	Alokdiha	0.35	1.75	8.15	Metamorphic	Govt	Domestic
D010	Rakhisitpur	0.55	1.65	4.6	Metamorphic	Govt	Domestic
D012	Dhowatanr	0.75	1.85	13.2	Metamorphic	Govt	Domestic
D014	Karmatanr	0.48	1.90	11.55	Metamorphic	Nepal	Domestic
D018	Dhaiya	0.44	2.00	8.1	Metamorphic	Govt	Domestic
D019	Memko More	0.42	3.80	7.57	Metamorphic	Govt	Domestic
D020	Dhanbad	0.22	3.10	11.45	Metamorphic		Domestic
D022	Shyamnagar	0.35	1.70	6.3	Metamorphic	Govt	Domestic
D025	Godhar More	0.6	2.75	5.8	Barakar	Govt	Domestic
D028	Nawadih	0.46	2.00	10.6	Metamorphic	Gitarani Paul	Domestic
D029	Karamara	0.5	3.10	10.5	Metamorphic	Govt	Domestic
D030	Borkiboa	0.7	2.00	5.6	Metamorphic	Haru	Domestic
D034	Kusunda	0.6	1.50	3.45	Barakar	BCCL	Domestic
D035	Patherdih	0.4	2.00	11.2	Metamorphic	Govt	Domestic
D036	Sudamdih	0.9	2.00	6.2	Metamorphic	BCCL	Domestic
D039	Tilabani	0.85	2.00	20	Barakar	BCCL	Domestic
D046	Sindupur	0.74	3.00	8.75	Metamorphic	Govt	Domestic
D047	Ena colliery	0.45	3.20	23.8	Barakar	BCCL	Domestic
D052	Goluckdih	0.47	3.10	5	Metamorphic	Govt	Domestic
D054	Amtal	0.65	6.40	10.8	Barakar	Govt	Domestic
D056	Bhutgoria	0.5	1.80	12.75	Metamorphic	Govt	Domestic
D057	Kandra	0.37	2.10	6.55	Metamorphic	Govt	Domestic

D059	Belghutu Tola	0.5	3.60	9.3	Metamorphic	Govt	Domestic
D062	Bendachuna	0.65	2.80	12.1	Metamorphic	Saheb Ram	Domestic
D063	Chatabad	0.2	1.90	10.7	Metamorphic	Govt	Domestic
D065	Nischitpur	0.15	3.15	10.6	Metamorphic	Govt	Domestic
D068	Surunga	0.53	3.00	10.25	Metamorphic	Govt	Domestic
D070	Jaladih	0.7	1.80	9.5	Metamorphic	Govt	Domestic
D071	Domandih	0.65	2.00	13.5	Metamorphic	Govt	Domestic
D072	Gobindpur	0.4	1.70	6.7	Metamorphic	Govt	Domestic
D074	Bhulan-Barari	0.1	1.60	12.8	Barakar	Govt	Domestic
D075	Manpur	0.6	2.90	10.2	BM	Govt	Domestic
D077	Rohoniatanr	0.4	3.15	6.9	BM	Govt	Domestic
D080	Bastacolla	0.7	2.50	24.95	Barakar	Govt	Domestic
D088	Laghla more	0.35	2.00	7.75	Metamorphic	Govt	Domestic
D089	Machatanr	0.6	1.60	9.15	Metamorphic	Govt	Domestic
D090	Marradih	0.42	3.10	8.8	Metamorphic	Govt	Domestic
D091	Asurbandh	0.65	1.80	8.1	Metamorphic	Govt	Domestic
D096	Paradih	0.85	1.30	9.2	BM	Private	Domestic
D105	Bandhwatanr	0.55	3.00	9.15	Metamorphic	Dasarath Mahato	Domestic
D109	Domatanr	0.65	9.15	9	Metamorphic	Shiv Charan Mahato	Domestic
D112	Bansra	0.45	1.38	7.75	Metamorphic		Domestic
D113	Dumarda	0.7	3.00	11	Metamorphic	Govt	Domestic
D115	Mahuar	0.15	2.00	6.45	Metamorphic	Private	Domestic
D117	Bhatua	0.23	2.70	10	Metamorphic	Govt	Domestic
DB001	Laikadih	1	2.55	14.96	Barakar	BCCL	Domestic
DB010	Kulti College	0.6	1.8	13.88	BM	Govt	Domestic
DB012	Sabanpur	0.85	1.8	9.6	Barakar	Govt	Domestic
DB013	Dendua More	0.5	2	7.85	-	Govt	Domestic
DB018	Sarsapahari	0.75	1.6	7	Barakar	Govt	Domestic
DB019	Luchibad	0.73	1.8	6.45	Talchir	Govt	Domestic
DB002	Sulibari	0.42	1.8	9.63	Barakar	Govt	Domestic
DB022	Dahibari Majhi Basti	0.9	1.85	16.25	Barakar	Govt	Domestic
DB023	BCCL Substation,Dahibari	0.67	1.42	5.75	Barakar	Govt	Domestic
DB-24	Dahibari,LHS	0.58	2	12.8	Barakar	Govt	Domestic
DB026	Patlabari	0.7	4	9.8	Metamorphic	DVC	Domestic
DB027	Ledaharia Village	0.67	2.4	10.65	Metamorphic	Govt	Domestic
DB028	Patharkua	0.7	2.3	8	Barakar	BCCL	Domestic
DB029	Kelyasol	0.6	3.6	13.7	Barakar	BCCL	Domestic
DB003	Puapur	0.37	1.55	5.25	Raniganj	Govt	Domestic

DB030	Ramkanali Village	0.6	3.1	10.55	Metamorphic	Govt	Domestic
DB033	Barajor/Amkura	0.7	2	9.2	Talchir	Kajal Chatterjee	Domestic
DB034	Tetuldanga	0.6	3.6	11.6	Talchir	Govt	Domestic
DB036	Madanpur	0.55	2.4	8	Talchir	Chhotka Marandi	Domestic
DB038	Lukuidih	0.55	3.8	7.8	Metamorphic	Govt	Domestic
DB039	Pandra	0.65	3	6.9	Talchir	Forest Dept.	Domestic
DB004	Sarbari	0.62	2.22	8.98	Raniganj	DVC	Domestic
DB047	Mugma	0.65	3.2	8.3	Barakar	Govt	Irrigation
DB005	Parbelia	0.48	3.2	7.8	Raniganj	Govt	Domestic
DB008	Chungei	0.8	2.2	5.75	BM	Govt	Domestic
DB009	Begunia Temple	0.68	3	19.25	Barakar	Govt	Domestic
K010	Phatepur	0.8	2.02	28.3	Raniganj	Govt	Domestic
K012	Ethora	0.81	2	15.9	Raniganj	Govt	Domestic
K015	Kankurkunda	0.55	2.1	12.5	-	Govt	Domestic
K020	Majhladih	0.79	1.22	11.77	-	Govt	Domestic
K021	Pratappur	0.6	1.4	10.94	-	Govt	Domestic
K026	Bodra	0.9	2.1	10	BM	Govt	Domestic
K030	Kulti Station	0.31	0.75	4.25	BM	Govt	Domestic

MP: Measuring Point **R.L.: Reduced Level** **W.L.: Water Level m: Meter**
Abn.: Abandoned **b.g.l.: Below Ground Level** **a.g.l.: Above Ground Level**
G.L.: Ground Level **bmp: Below Measuring Point** **BM: Barren Measure**

Annexure – VB

Historical Water Level data of Hydrograph Stations

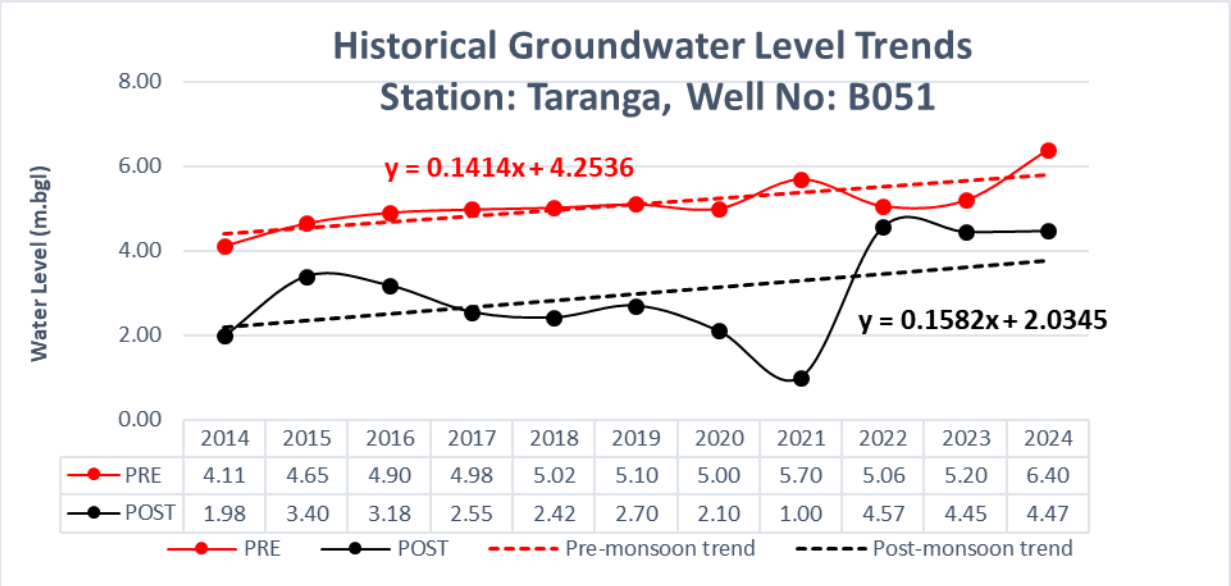
Well No	Water level below ground level (bgl) in meters																	
	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20	May 21	Nov 21	May 22	Nov 22	May 23	Nov 23
JCF																		
A002	9.10	5.21	9.30	4.95	8.15	4.35	8.27	4.78	7.55	3.25	6.95	3.00	6.87	4.50	6.45	4.91	4.80	3.10
A004	4.56	1.78	5.20	1.48	3.48	0.91	4.48	1.73	3.38	1.78	4.63	2.28	3.51	1.83	4.40	1.80	3.51	1.90
A006	8.25	6.25	8.25	3.95	6.95	3.35	8.40	5.35	4.90	4.25	7.75	5.30	7.00	4.07	8.40	5.30	7.35	4.72
A007	7.79	4.57	9.45	5.27	7.55	2.55	7.40	3.75	9.45	4.10	7.35	3.70	6.63	3.66	7.40	3.75	8.15	5.65
A008		9.73	11.85	3.20	9.90	1.38			11.30				8.99	4.30	8.80	4.20	10.70	5.03
A009	6.70	5.47	7.23	4.44	7.77	2.42	6.42	5.22	8.87	5.07	6.12	4.62	7.42	4.55	6.30	5.05	7.42	4.76
A010	9.61	8.37		2.42	7.47	2.27	7.72	5.47	8.17	5.57	7.57	5.29	8.92	5.60	7.70	5.40	8.92	5.05
A013	3.60	5.30	5.20	3.85	4.40				5.10				4.63	2.60	4.60	2.50	4.63	2.31
A015	7.15	7.00	7.95	5.20	6.50	3.95			7.00				6.93	3.76	6.70	3.50	6.93	3.62
A016	5.55	4.17	5.85	3.15	3.65	2.20	4.30	3.65	5.45	1.95	7.15	1.75	3.45	2.00	5.80	3.08	5.55	3.52
A017	3.79	2.64	2.44	2.69	2.44	2.24	3.34	2.84	2.94	2.24	2.14	1.69	3.36	2.37	2.62	2.59	2.41	2.19
A019			7.81	4.11	6.38	2.46	5.55	2.45	4.86	3.44	6.06	3.26	3.31	1.91	4.10	2.54	2.90	2.60
A020	4.59	2.93	7.49	3.50	4.27	1.77	4.57	2.57	4.57	1.82	8.47	3.87	5.47	2.02	5.59	3.54	8.02	4.20
A023	11.37	9.37	11.87	8.13	11.87	6.97	11.15	7.17	11.97	3.77	8.92	5.62	9.52	2.82	7.97	4.79	9.00	5.71
A024	17.20	14.58	16.62	12.43	16.28	4.18	14.58	6.88	15.88	2.48	4.88	4.28	10.13	2.78	7.28	4.33	5.38	3.90
A025	7.78	5.85	7.43	4.58	6.38	2.88	6.63	3.13	6.08	1.93	2.98	1.83	5.78	2.43	3.31	2.08	2.93	2.60
A026	7.33	3.18	8.93	4.48	5.28	2.53	6.23	3.88	6.58	3.33	6.98	3.18	5.66	2.73	6.42	4.31	8.40	3.83
A027	4.40	3.99	4.85	1.80	2.90	1.25	2.90	1.00	2.40	0.92	2.40	1.10	1.67	0.90	1.90	1.33	1.70	1.60
A028	4.35	3.60	3.35	1.47	4.30	1.55	4.15	2.51	2.45	3.15	4.00	3.03	6.23	3.75	4.23	3.30	3.45	3.35
A029	4.55	4.60	5.92	6.96	4.40	1.30	6.45	2.10	4.85	3.40	6.20	3.20	6.49	5.90	4.60	1.15	5.60	3.20
A032	4.41	2.13	4.75	2.10	3.15	1.55	2.80	0.70	2.75	0.95	1.90	1.75	2.35	0.96	2.25	1.75	3.83	1.60
A034	8.40	4.81	4.75	4.45	12.45	4.45	5.90	3.70	6.35	3.95	8.35	3.45	5.20	3.55	8.20	6.35	6.54	4.01
B001	3.28	2.75	3.58	1.93	2.33	1.63	2.88	2.08	3.18	1.73	3.28	1.63	2.58	1.91	2.10	1.81	3.22	2.45
B002	-	-	10.93	6.99	10.9	6.8	-	-	10.88	6.58	-	-	10.13	6.5	9.8	6.4	10.55	4.47
B009	8.82	3.50	8.90	3.90	7.80	2.30	8.40	3.40	6.56	3.25	8.51	3.27	7.61	3.16	7.40	4.60	6.75	3.20
B010	7.12	3.63	6.77	4.69	7.97	4.42	6.97	2.79	8.02	2.77	6.92	2.80	7.12	3.35	6.80	2.70	7.47	4.42
B011	9.49	3.45	9.20	4.55	10.60	2.80	9.90	4.68	9.38	4.65	10.05	4.90	8.24	4.02	9.50	4.60	10.30	3.75
B012	8.78	7.31	7.17	8.63	9.03	5.33	8.37	4.83	8.98	8.63	8.63	5.66	8.68	6.99	6.4	4.7	8.88	5.63
B014	2.94	2.29	2.44	0.47	2.94	1.84	3.64	2.84	2.24	2.74	2.44	1.04	2.84	2.04	3.24	2.6	2.84	2.34
B015	1.5	0.45	1.85	0.55	1.85		1.85	0.85	1.9	0.95	3.7	1.47	1.46	0.35	3.67	1.02	3.2	1
B017	6.65	2.9	4.8	3.15	3	2.65	6.61	4.4	7.4	4.6	6.69	4.15	6.5	4.25	6.5	4.2	7.95	4.33
B018	9.01	6.16	6.39	5.19	6.24	1.99	8.56	3.39	8.34	3.34	8.54	3.52	7.84	3.62	8.5	3.2	7.36	3.9
B024	10.05	5.78	10.63	4.28	10.03	4.03	9.28	4.33	4.58	2.33	5.48	3.53	5.68	2.08	5.53	3.46	4.63	3.24
B027	9.87	5.47	6.07	4.22	8.12	3.87	9.97	5.67	7.52	5.42	8.87	5.47	8.89	4.73	10.1	4.8	8.89	4.16
B029	5.58	5.15	5.95	3.05	5.5				4.8	2.65			5.26	2.48	5.5	2.15	3.6	1.9
B032	7.55	3.32	6.95	3.07	6.95	2.8	6.75	3.9	5.55	1.7	3.3	2	5.6	1.7	4.15	2.56	7.3	3.54
B033	6.53	4.13	5.45	4.05	5.3	4.15	6.5	3.45	6.65	3.3	6.29	3.3	6.38	3.43	4.75	3.1	7.3	3.54
B038	10.65	7.95	10.82	4.2	7.6	4.5	10.3	5.1	10.8	4.85	9.17	4.85	9.34	4.18	8.1	5.2	8.17	5.2
B040	5.63	4.45	7.05	3.45	4.7	3.4	6.1	4.6	8.7	4.9	5.68	4.15	5.58	3.24	5.3	3.1	3.5	1.96
B041	5.9	2.85	5.25	3.75	5.35	2.9	5.25	2.05		1.95	5.37	2.25	5.36	2.4	5.05	3.6	6.45	4.02
B043	7.65	5.5	7.75	3.82	7.6	2.4	7.5	4.2		4.55	7.35	3.7	7.26	3.78	6.5	4.6	7.26	3.93
B044	9.15	5.54	7.7	4.79	6.6	2.75	9.68	5.05		4.6	8.58	4.73	7.51	3.83	9.1	6.3	9.35	7.63
B046	6.85	4.62	5.05	4.82	5.6	3.8	5.6	3.6			5.55	3.35	5.5	3.65	6.05	3.75	7.25	3.9
B047	9.33	8.6	8.85	6.7	10	4.37	8.2	5.3		5.1	8.02	4.66	7.15	4.73	8.75	5.6	7.8	4.95
B048	7.9	5.42	9.35	4.6	7.7	4.15	7.33	3.97	7.05	4.35	8.2	3.85	7.23	6.05	6.85	6.25	6.13	5.05
B051	4.65	3.4	4.9	3.18	4.98	2.55	5.02	2.42	5.1	2.7	5	2.1	5.7	1	5.06	4.57	5.2	4.45
B053	5.58	2.82		2.07	4.02	1.92	3.92	1.42	3.22	1.42	3.12	1.4	4.85	1.87	4.42	3.54	2.62	1.13

B054	7.62	4.56	9.25	5.55	7.2	4.1	7.55	3.65	9.05	3.55	7.7	3.87	7.4	3.43	7.3	4.75	7.65	5.8
B055	3.46	2.25	4.45	2.2	4.6	5.52	3.6	2.48		2.5	4.15	2.58	3.73	2.52	3.3	2	3.73	2.2
B057	6.18	3.35	6.9	3.45	5.9	3.6	6.2	3.1		2.95	6.4	3.05	5.36	2.92	6.1	3.5	5.36	3.26
B059	4.12	1.6	4.4	0.5	5.4	0.6	3.9	0.9	6.2	0.9	5.25	1.4	5.49	0.9	4.5	1.14	1.88	0.7
B060	9.21	5.28	10.33	5.03	13.23	3.18	13.68	4.23	8.13	3.23	10.33	3.21	11.26	2.23	10.53	5.8	10.73	5.73
B062	9.1	5.21	9.3	4.95	8.15	4.35	8.27	4.78	7.55	3.25	6.95	3	6.87	4.5	6.45	4.91	4.8	3.1
B065	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.4	11.05	0.95	9.25	2.3	9.03	1.42	7.45	2.27	8.45	2.35
B067	9.23	5.53	9.53	4.3	10	2.15	9.55	4	8.57	4.35	7.55	3.95	8.95	2.95	8.5	6.3	8.05	5.32
B068	5.05	3.42	5.25	2.8	4.35		5.2	3.85		3.65	5.1	3.44	4.18	3.76	5.5	4.6	7.92	4.6
B071	5.48	3.2	6.15				5.5	3.47		3.45			5.43	3.25	5.3	2.5	10.28	5.64
D003	4.25	2.25	2.35	1.9	2.15	2.3	3.43	2.45	1.75	1.3	5.4	1.38	3.41	0.85	5.96	1.32	3.15	1.85
D005	9.37	8.33	9.4	6.4	7.9	5.2	7.8	5.3	8.25	4.85	8.6	7.7	7.28	4	8.4	7.01	8.4	7.01
D007	8.25	5.61	7.53	4.03	7.33	2.88	7.53	2.83	8.23	3.28	7.33	5.13	6.08	2.63	9.03	5.67	9.03	3.64
D008	6.24	4.38	8	3.43	5.15	1.85	5.65	1.85	4.8	2.85	5.83	2.75	4.55	2.27	5.8	3.5	7.7	4.82
D010	3.77	2.9	3.77	1.6	3.65	1.6	3.95	2.6	3.5	2.73	3.78	2.45	3.55	1.47	3.5	1.9	5.4	2
D012	12.25	7.9	12.25	8.8	12.45	8.55	11.25	7.7	12.25	7.2	10.82	8.07	11.38	7.28	12	9.9	11.38	7.76
D014	11.02	9.47	10.77	8.12	10.22	7.47	10.52	7.42	10.32	7.07	9.47	5.65	9.57	7.02	10.3	7.1	9.57	6.18
D018	7.01	4.45	3.36	1.56	3.56	3.76	7.06	3.06		3.06			3.66	3.11	4.5	2.3	3.66	2.35
D019	8.43	5.12	8.33	5.5	7.76	4.65	7.53	4.83	7.45	4.85	7.21	4.25	7.47	4.4	7.05	4.4	7.68	5.48
D020	7.42	6.58	8.02	5.88	7.88	4.43	7.38	3.88	8.18	4.33	7.29	3.81	7.66	3.88	6.4	5.5	6.48	4.28
D022	5.78	2.67	5.45	4.75	4.15	1.15	5.8	1.75		2.5	5.75	1.7	3.8	0.5	4.6	1.7	3.8	1.36
D025	4.48	2.45	2.4	1.9	2.4	1.2	2.6	2.4	3.9	5.38	6.5	3.38	8.68	3.8	10.5	4.7	4.4	3.4
D028	9.38	7.22	9.27	3.57	8.64	2.79	9.04	5.74	8.52	5.59	7.44	4.62	8.75	5.51	7.9	5.6	8.75	4.87
D029	9.62	4.35	8.35	4.2	6.3	3.45	9.6	5.2	9.35	5	8.69	5	9.55	5.1	9.75	7.1	9.55	5.87
D030	4.55	3.15	4.45	3.2	4.4	1.25	4.58	1.1	4.6	0.75	4.5	1.35	4.23	0.84	4.37	2.29	4.08	2.2
D034	2.55	1.45	2.3	0.3	0.8	0.55	2.8	0.45	2.4	2	2.9	2.4	3.38	2.5	5	3.15	3.8	2.5
D035	9.8	7.9	9.52	6.45	8.8	3.6	8.4	4.45	8	3.8	8.2	5.4	6.6	2.9	6.1	4.68	5.23	3.9
D036	1.66	1.13	0.78	0.95	1.3	0.7	1.2	0.6	1.2	0.55	2.1	1	2.02	0.55	3.25	0.6	1.85	0.6
D039	5	2.61	2.18	2.65	5.05	4.75	4.95	4.35	4.95	5.6	9.05	5.7	10.35	4.75	7.5	3.05	8.52	3.28
D046	6.14	3.31	7.46	3.26	7.16	3.01	6.06	3.24	7.61	3.36	6.01	3.21			7.05	4.6	7.66	4.18
D047	9.6	3.6	3.18	2.95	3.15	2.85	5.33	2.55	4.55	4.35	9.45	5.45	4.05	2.45	2.2	1.5	4.45	3.27
D052			4.23	1.63	3.53	1.56	4.63	3.33	2.08	3.54	4.58	3.28			3.6	2	3.2	1.95
D054	8.78	6.7	9.5	3.55	8.65	5.35	8.85	3.45	9.35	3.15	7.33	2.88			9.5	6.9	8.03	6.3
D056	10.6	6.9	8.46	5.25	7.1	5	10.48	5.8	6.2	5.55	10	5.75	6.85	4.86	9.4	5.9	5.6	3.73
D057	5.94	5.33	6.1	5.41	5.23	3.43	6.03	4.63	5.23	4.43	6.13	3.98	5.42	3.5	5.2	4.05	5.18	3.65
D059	6.98	3.32	7.7	4.88	7.35	3.55			7.3				7.3	3.6	7.38	3.95	7.3	4.02
D062	7.43	4.12	6.33	3.5	7.76	3.65	7.35	4	7.45	3.85	7.21	3.85	7.47	3.4	7.75	4.4	7.47	3.74
D063	8.41	4.9	9.8	3.74	7.85	3.15	8.3	5.3	7.58	5.3	8.43	5.17	7.75	3.14	9.8	5.7	7.75	4.55
D065	7.48	4.36	8.85	2.35	6.95	4.95	7.45	3.9	8.35	3.85	7.68	3.85	7.41	4.83	7.9	5.7	6.4	4.65
D068	8.49	4.9	6.45	3.54	8.42	4.27	7.27	3.27		2.97	6.97	3.03	7.92	4.22	8.2	5.2	7.92	4.6
D070	7.1	4.25	7.55	3.08	6.5	4.28	7.2	5.1	5.1	4.8	7.12	4.8	6.13	3.78	7.5	5.05	8.6	4.63
D071	10.85	6.55	11.35	5.45	10.35	4.05	10.55	6.89	10.93	6.85	10.6	7	10.28	3.35	10.15	7.5	10.28	5.64
D072	4.62	2.6	3.41	2.3	2.5		5.65	3.6		3.75	6.92	3.86	4.36	2.69	3.3	2.2	5	2.9
D074	10.05	7.2	7.73	5	9.25	3.85	8.6	4.8	5.8	3.57	4.3	3.93	6.93	2.9	6.17	5.77	4.57	3.54
D075	7.42	4.5	5.75	1.4	3.2	1.3	7.4	3.4	5.25	4	7.45	3.27			5.8	2.3	5.75	2.8
D077	6.44	5.6	4.6	2.9	6.5	4.9	6.3	5.2	6.5	3.2	6.4	3.5	5.98	4.69	6.5	4.7	5.98	3.93
D080	10.97	3.35	6.55	4.15	8.65	3.7	9.35	4.2	5	3.05	4.3	4.9	7.1	2.55	6	3.3	4.75	2.6
D088	5.93	3.65		4.2	6.55	2.75	6.15	3.66		3.45	6.12	4.03	6.55	2.52	5.6	2.8	6.55	3.1
D089	5.2	3.22		4.7	6	2.7	5.3	3.7		3.6	5.45	3.63	4.41	2.55	5.7	4.2	4.41	3.55
D090	6.66	3.88		3.68	4.03	2.58	6.63	3.83		3.68	5.82	3.46	5.63	2.66	7	4.5	5.63	3.68
D091	6.85	4.95		4.15	5.65	2.65	6.85	3.15		3.4	6.4	3.4	5.18	3.02	5.2	3.1	5.18	3.2
D096	6.9	3.13		3.15	6		6.85	3.05					5.97	2.71	7.75	4.05	6.1	3.2
D105	7.57	3.1	8.15		7.95	4.3	4.1	4.2	7.7	4.48	6.7		8.2	6	7.05	4.92		
D109	8.15	6.55	5.8	4.15	7.51		7.78	3.5	6.35	3.85	7.9	3.22	7.33	3.1	5.2	3	7.33	2.88
D112	6.4	3.75	5.95	3.4	7.05	2.5	6.63	4.11	7.25	4.57	6.74	4.63	6.9	4.05	7.15	3.35	6.9	3.35

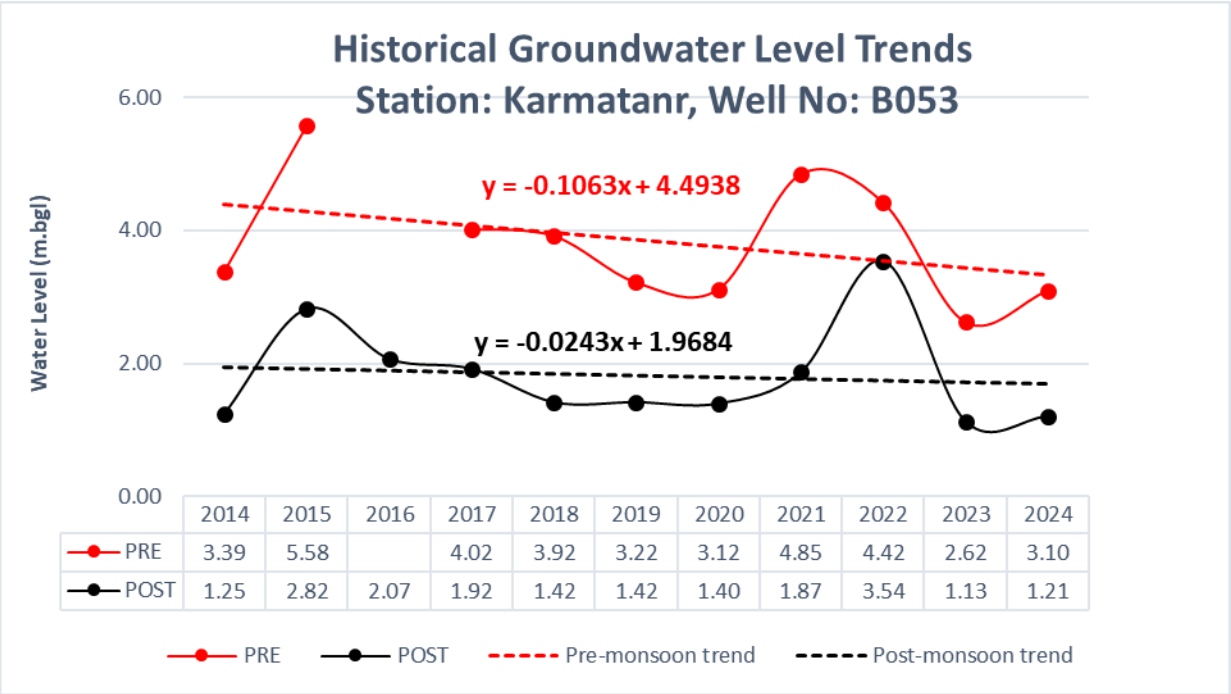
D113	6.6	3.85		3.95	7.28	2.35	6.85	3.3		3.5	6.1	3.45	6.8	2.99	7.3	4.3	5.75	3.48
D115		4.85		5.22	6.05	2.7	7.1	3.05		2.95	7.45	2.4	7.65	3.43	5.5	4.6	6.38	3.83
D117	7.86	5.34		5.67	8.8	4.37	7.92	5.02		5.02	7.52	4.79	7.87	5.11	8.7	5.5	7.27	5.25
RCF (Part)																		
DB001	5.4	4.08	4.17	3.7	4.5	3.8	4.35	4.2	4.85	4.3	5.08	4.08	4.88	3.88	4.73	3.76	3.94	2.77
DB002	3	1.8	3.2	1.98	3.42	2	3.19	2.02	3.6	2.62	3.97	2.43	3.30	2.31	3.20	2.24	2.9	2.25
DB003	4.8	3	5.3	3.22	5.32	2.42	5.6	3.1	5.67	3.12	4.72	3.37	4.53	3.20	4.40	3.11	4.55	2.98
DB004	7.5	4	7.32	3.12	6.59	3.42	6.8	4.1	5.8	3.55	5.17	3.01	4.96	2.98	4.81	2.89	6.1	4.80
DB005	6.88	3.26	6.48	3.8	5.48	3.8	4.98	3.13	5.08	2.78	5.1	3.26	4.90	3.10	4.75	3.00	5.52	3.50
DB008	4.6	2.8	4.57	3.02	4.17	2.13	4.17	2.89	4.27	3.07	5.01	3.1	4.81	2.95	4.67	2.86	4.5	3.42
DB009	9.45	4.5	10.5	5.26	11.5	6.26	9.26	5.22	11.01	6.26	10.4	6.44	9.98	5.00	9.68	4.85	9.5	5.18
DB010	5.68	4.07	4.75	3.75	4.4	2.5	4.8	2.9	4.55	2.95	5.28	3.07	5.07	2.92	4.92	2.83	4.6	3.12
DB012	6.5	2.05	6.76	2.78	6.3	2.73	5.18	2.55	5.08	2.73	4.9	2.05	4.70	1.95	4.56	1.89	5.44	2.30
DB013	3.55	6.5	3.25	5.8	3.72	5.5	3.1	5.3	2.92	5.4	3	4.5	4.88	2.98	4.73	2.89	4.5	2.70
DB018	5.48	3.65	4.6	3.2	4.2	3.3	4.2	2.99	4.6	2.55	3.8	2.9	3.65	2.76	3.54	2.67	4.25	2.61
DB019	5.26	3.02	5.5	3.93	5.53	3.18	4.98	3.03	5.33	3.98	4.9	3.02	4.70	2.87	4.56	2.78	4.8	2.96
DB022	4.87	3.1	4.63	2.23	4.83	2.53	3.16	1.83	3.8	2	3.99	2.16	3.83	2.05	3.72	1.99	4.25	2.43
DB023	4.05	2.82	4.17	2.97	3.9	2.57	4.4	2.17	4.67	2.27	3.82	2.82	3.67	2.68	3.56	2.60	4.8	2.94
DB024	9.47	6.3	9.48	4.08	7.38	4.3	8.88	4.98	8.93	4.46	7.6	3	7.30	2.85	7.08	3.91	8.25	4.18
DB025	8.1	3.5	7.73	3.63	6.88	3.23	6.68	2.65	6.4	2.78	5.25	3.05	5.04	2.90	4.89	2.81	5.15	2.90
DB026	5.9	3.77	6.14	3.53	6.6	3.52	7.3	4.86	7.6	4.6	6.93	3.77	6.65	3.58	6.45	3.47	6.9	3.66
DB027	6.26	3.2	5.77	2.92	6.02	3.35	5.97	3.69	5.57	3.37	6	3.59	5.76	3.41	5.59	3.31	6.85	3.63
DB028	3.08	3.74	1.9	4.1	2.1	3.9	1.88	4.3	2.6	3.8	1.9	3.35	3.80	2.03	3.69	1.97	4.2	2.39
DB029	9.1	4.8	8.6	4.6	8.1	3.98	7.6	4.1	7.1	4.25	6.9	4.3	6.62	4.09	6.43	3.96	8.5	4.67
DB030	7.02	3.6	7.6	3.8	6.8	3.98	7.1	3.8	6.85	3.5	6.01	4.25	5.77	4.04	5.60	3.92	7.5	3.89
DB031	7.84	3.78	7.44	3.6	6.8	3.8	5.45	3.8	5.55	3.55	4.91	3.78	4.71	3.59	4.57	3.48	5.7	2.98
DB033	6.05	4	6.85	3.95	5.07	3.65	5.55	2.9	5.6	3.15	4.69	3	4.50	2.85	4.37	2.76	5.6	3.10
DB034	9.2	4.02	7.93	3.3	6.95	3.88	6.4	3.3	5.9	3.18	5.33	3.8	6.12	3.61	5.94	3.50	5.5	3.08
DB036	6.48	4.15	8.1	4.8	6.75	3.98	7.85	3.9	8.4	4.25	6.46	3.8	6.20	3.61	6.02	3.50	5.04	3.24
DB038	4	2.95	4.2	2.05	3.8	2.8	3.95	2.43	3.55	2.31	3.68	2.95	3.53	2.80	3.43	2.72	3.73	2.66
DB039	5.45	3.31	6	3.6	5.8	3.8	5.62	3.47	5.1	3.5	5.74	3.31	5.51	3.14	5.35	3.05	6.67	3.90
DB047	7.62	4.8	8.77	3.27	6.77	3.62	8.97	3.63	9.07	3.77	6.56	3.8	6.30	3.61	6.11	3.50	7.02	4.30
K010	3.1	1.9	3.05	1.85	3	1.8	2.95	1.86	3.01	2.01	3.11	1.98	2.99	1.88	2.90	1.82	3.5	1.98
K012	4.16	1.98	4.8	2.5	3.9	1.75	4.05	1.9	3.75	1.8	3.65	1.95	3.50	1.85	3.40	1.80	3.7	2.00
K015	4.75	2.46	4.32	2.3	4	2.1	4.5	2.35	4.3	2.22	4.1	2.2	3.94	2.09	3.82	2.03	4.8	2.10
K020	7.25	2.85	7.1	2.7	6.5	2.8	6.75	2.98	6.3	2.5	6.2	2.4	5.95	2.28	5.77	2.21	5.44	2.50
K021	5.45	2.98	5.3	2.8	5.4	3.09	5.1	3	4.88	2.8	4.9	2.7	4.70	2.57	4.56	2.49	4.6	3.00
K026	2.2	1.46	2.7	1.8	2.1	1.6	2.08	1.65	2.1	1.55	2.07	1.4	1.99	1.33	1.93	1.29	2.1	1.50
K030	2.5	1.4	2.4	1.4	2.22	1.53	2.4	1.63	2.6	1.1	2.22	1.3	2.13	1.24	2.07	1.20	2.4	1.50

Annexure – VI

HYDROGRAPHS OF CLUSTER-I



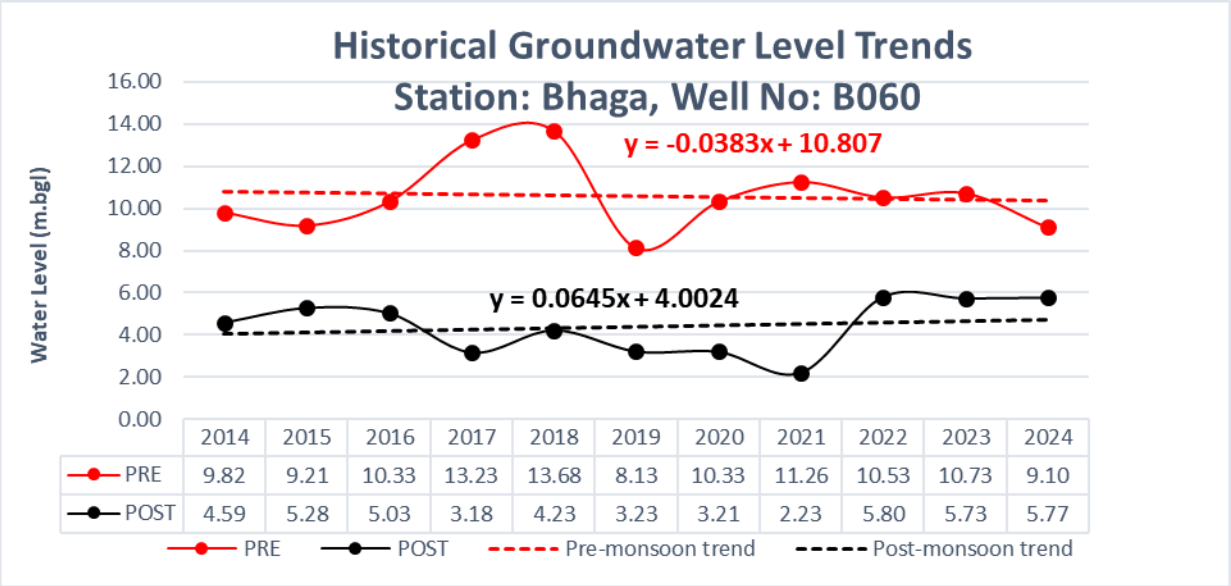
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	4.11	4.65	4.90	4.98	5.02	5.10	5.00	5.70	5.06	5.20	6.40
POST	1.98	3.40	3.18	2.55	2.42	2.70	2.10	1.00	4.57	4.45	4.47

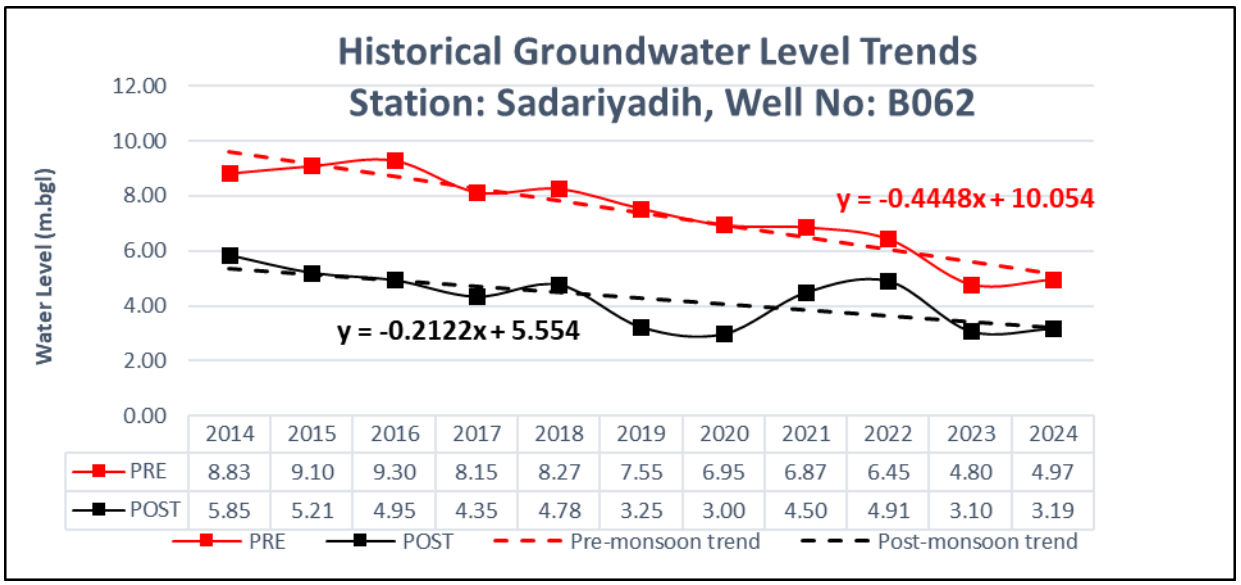


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	3.39	5.58		4.02	3.92	3.22	3.12	4.85	4.42	2.62	3.10
POST	1.25	2.82	2.07	1.92	1.42	1.42	1.40	1.87	3.54	1.13	1.21

Annexure – VI

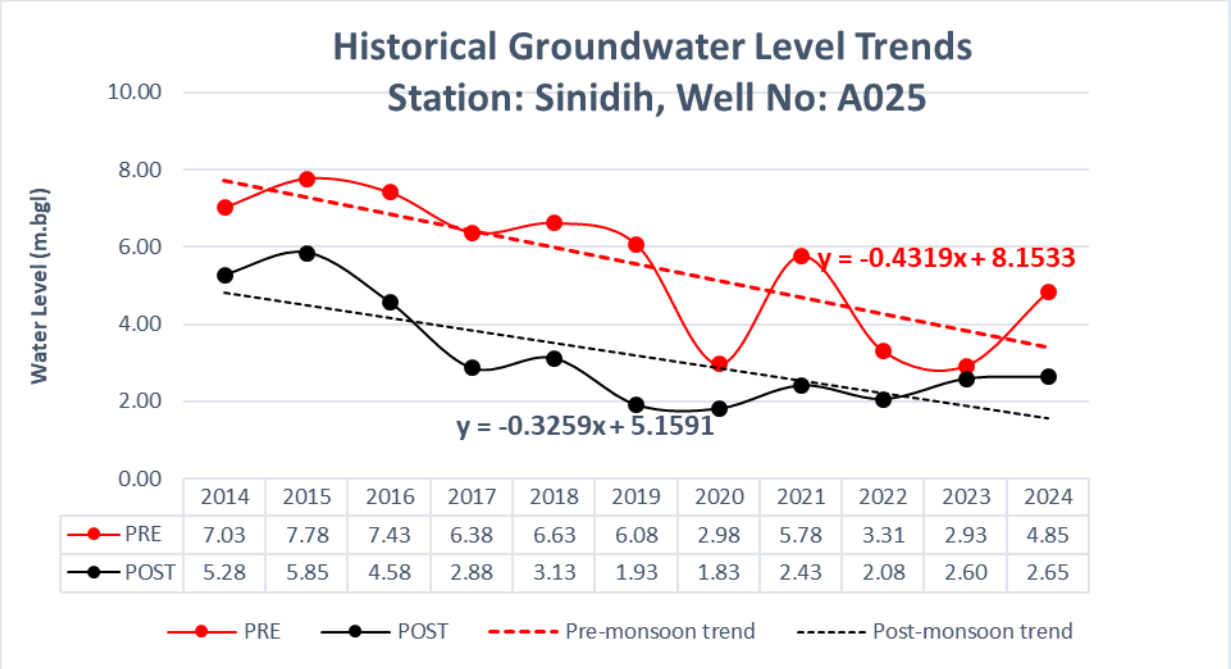
HYDROGRAPHS OF CLUSTER-II



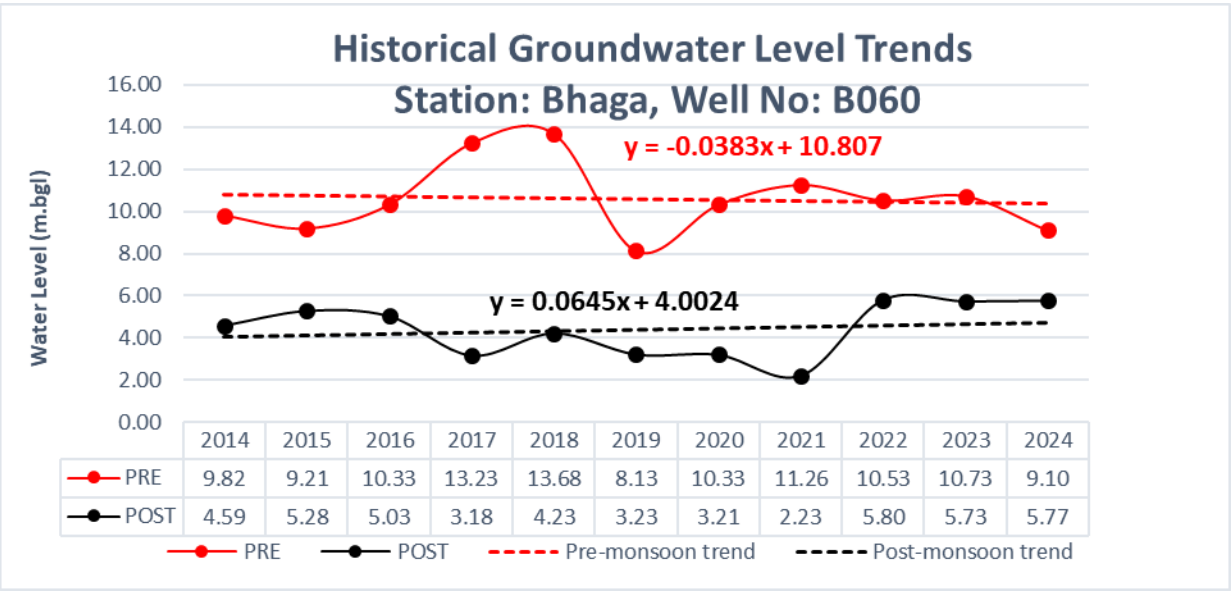


Annexure – VI

HYDROGRAPHS OF CLUSTER-III



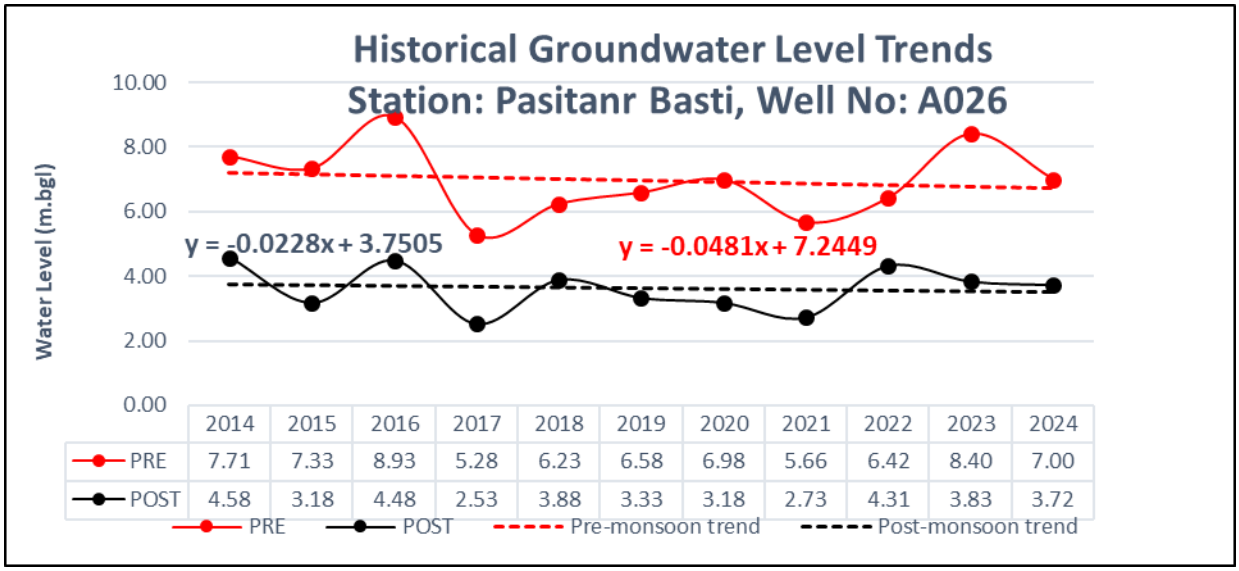
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	7.03	7.78	7.43	6.38	6.63	6.08	2.98	5.78	3.31	2.93	4.85
POST	5.28	5.85	4.58	2.88	3.13	1.93	1.83	2.43	2.08	2.60	2.65

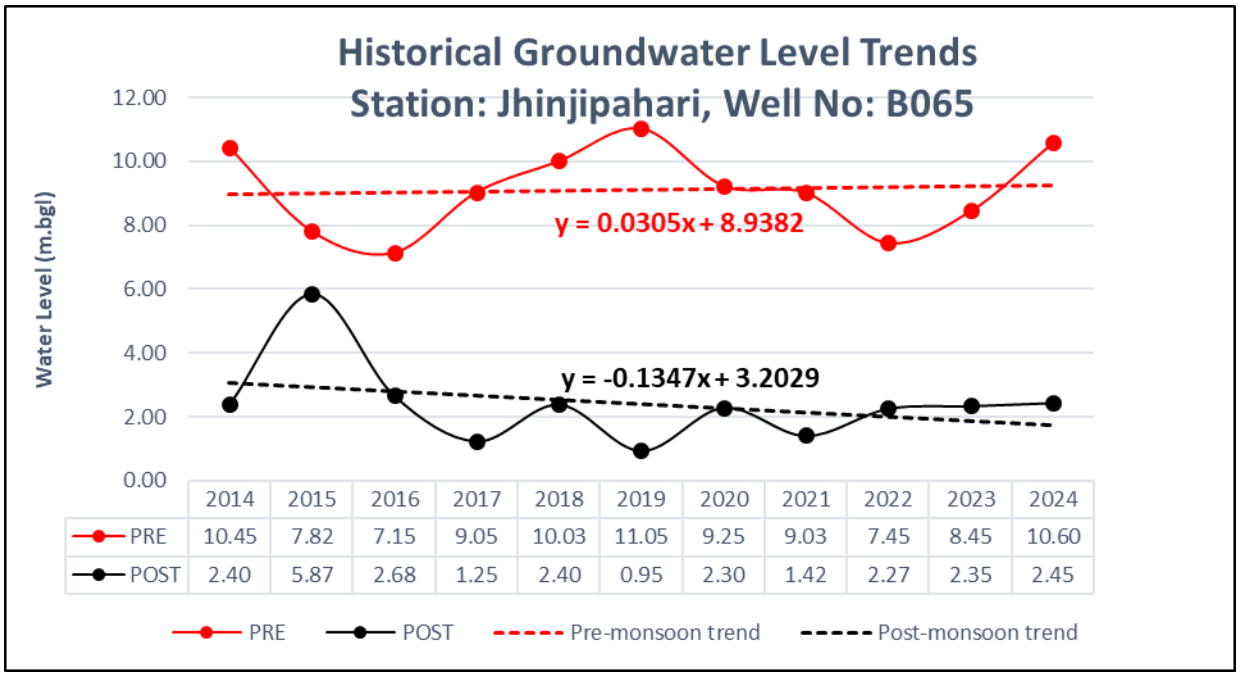


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	9.82	9.21	10.33	13.23	13.68	8.13	10.33	11.26	10.53	10.73	9.10
POST	4.59	5.28	5.03	3.18	4.23	3.23	3.21	2.23	5.80	5.73	5.77

Annexure – VI

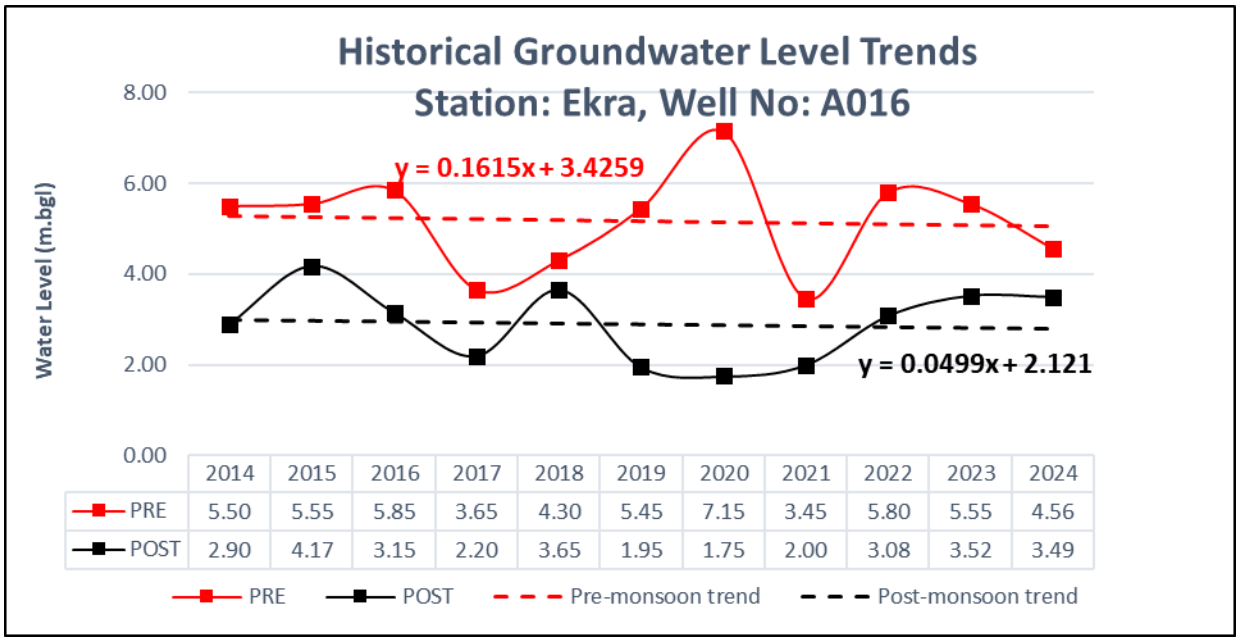
HYDROGRAPHS OF CLUSTER-IV

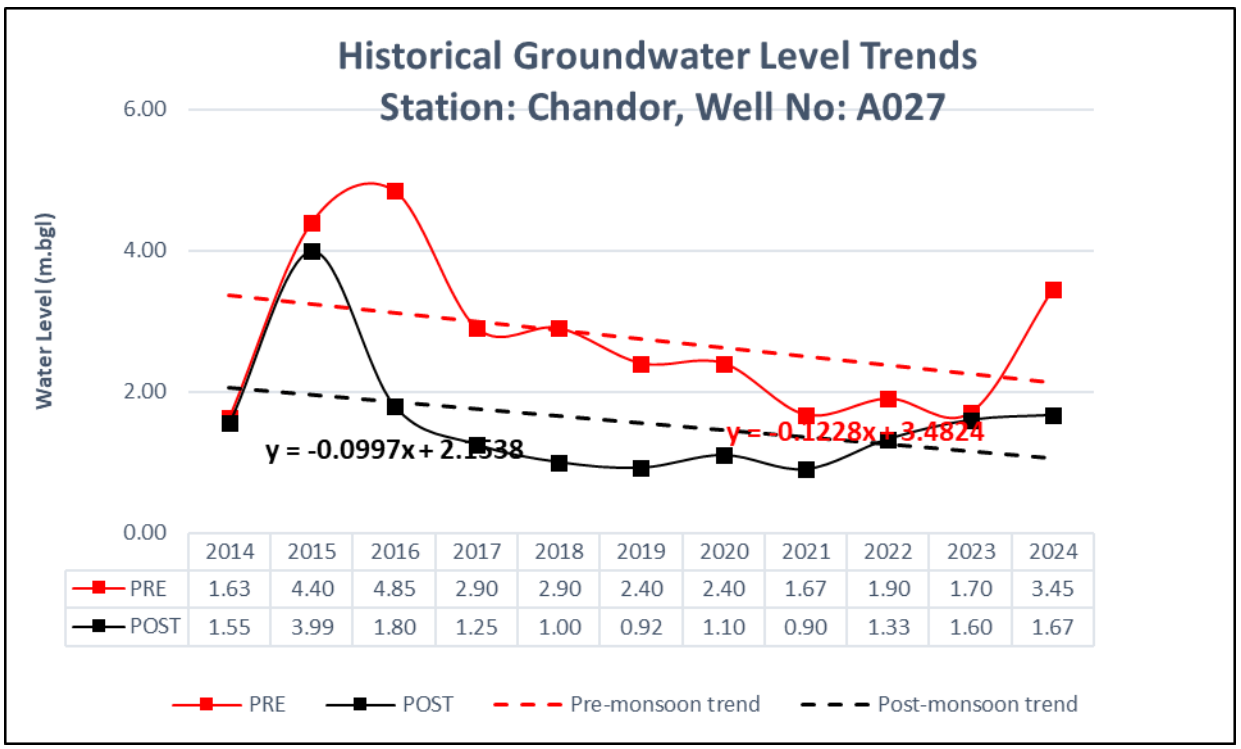




Annexure – VI

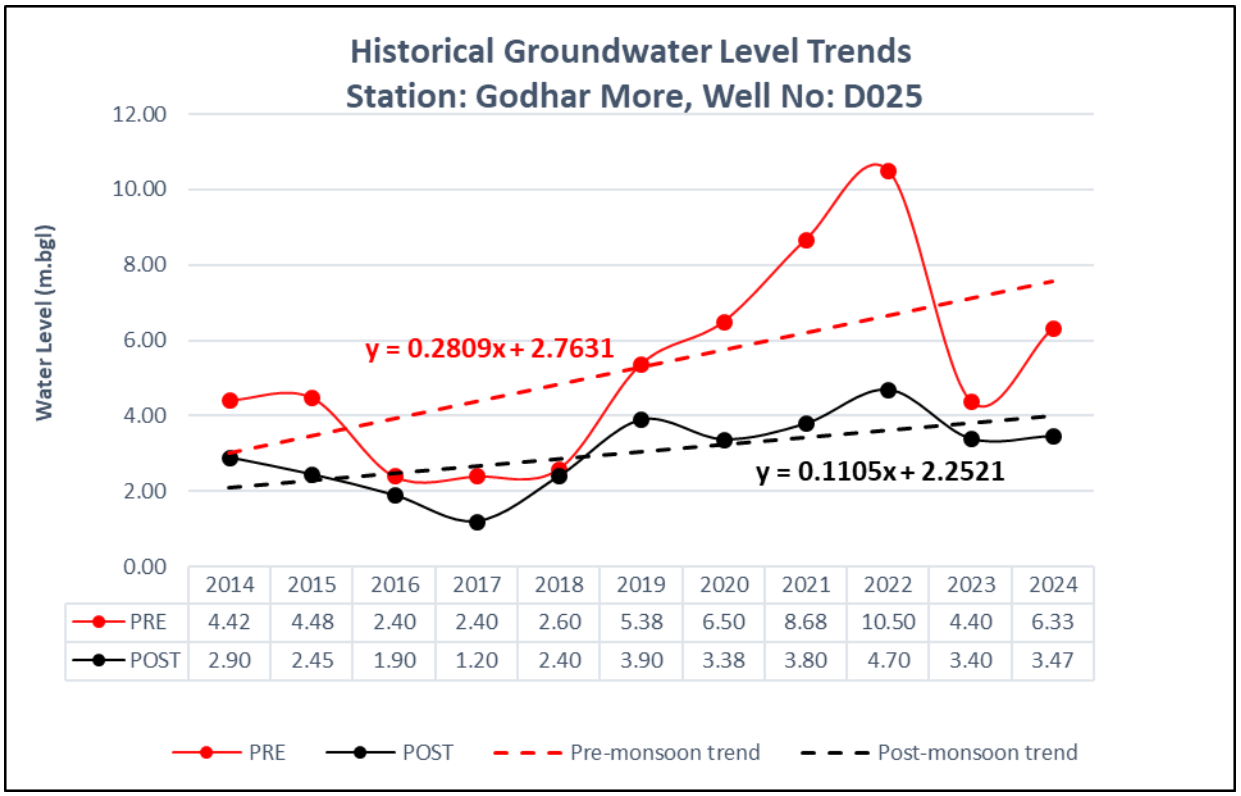
HYDROGRAPHS OF CLUSTER-V



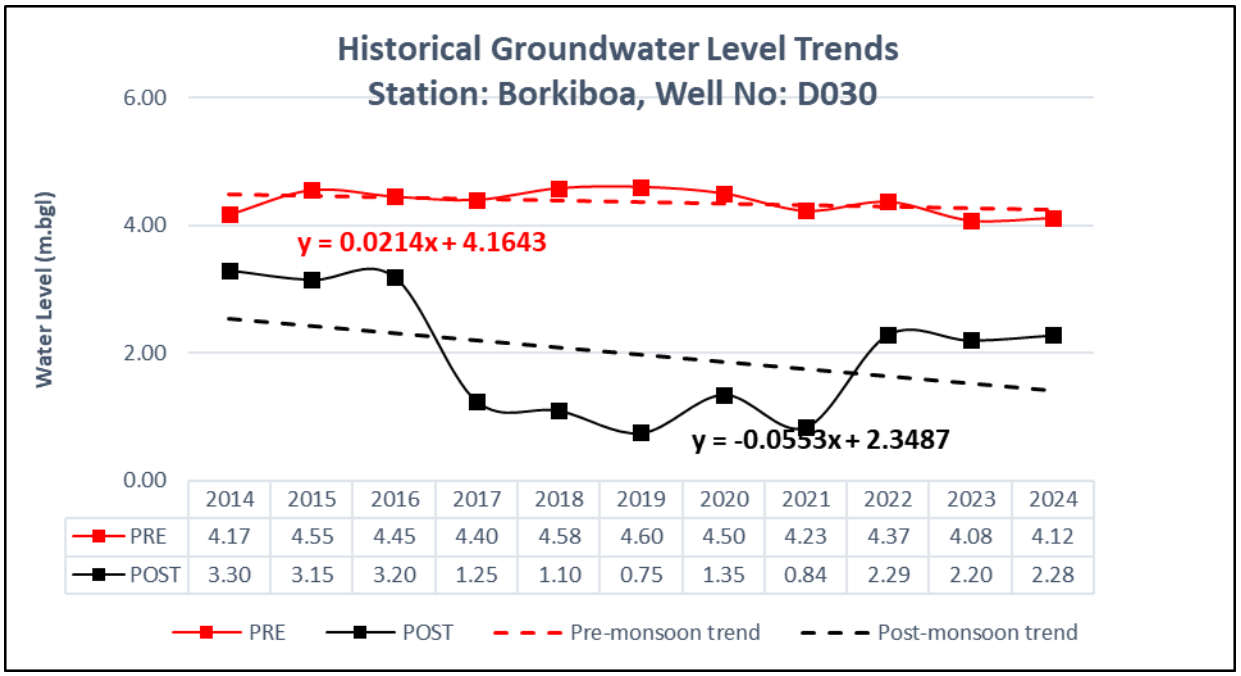


Annexure – VI

HYDROGRAPHS OF CLUSTER-VI



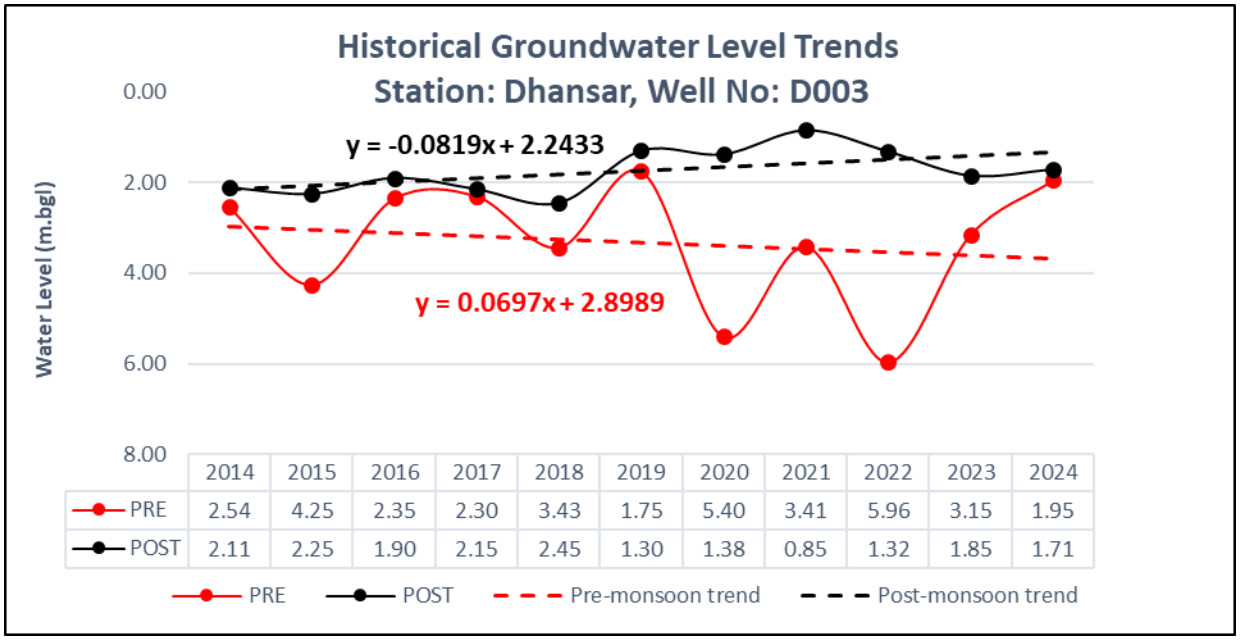
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	4.42	4.48	2.40	2.40	2.60	5.38	6.50	8.68	10.50	4.40	6.33
POST	2.90	2.45	1.90	1.20	2.40	3.90	3.38	3.80	4.70	3.40	3.47

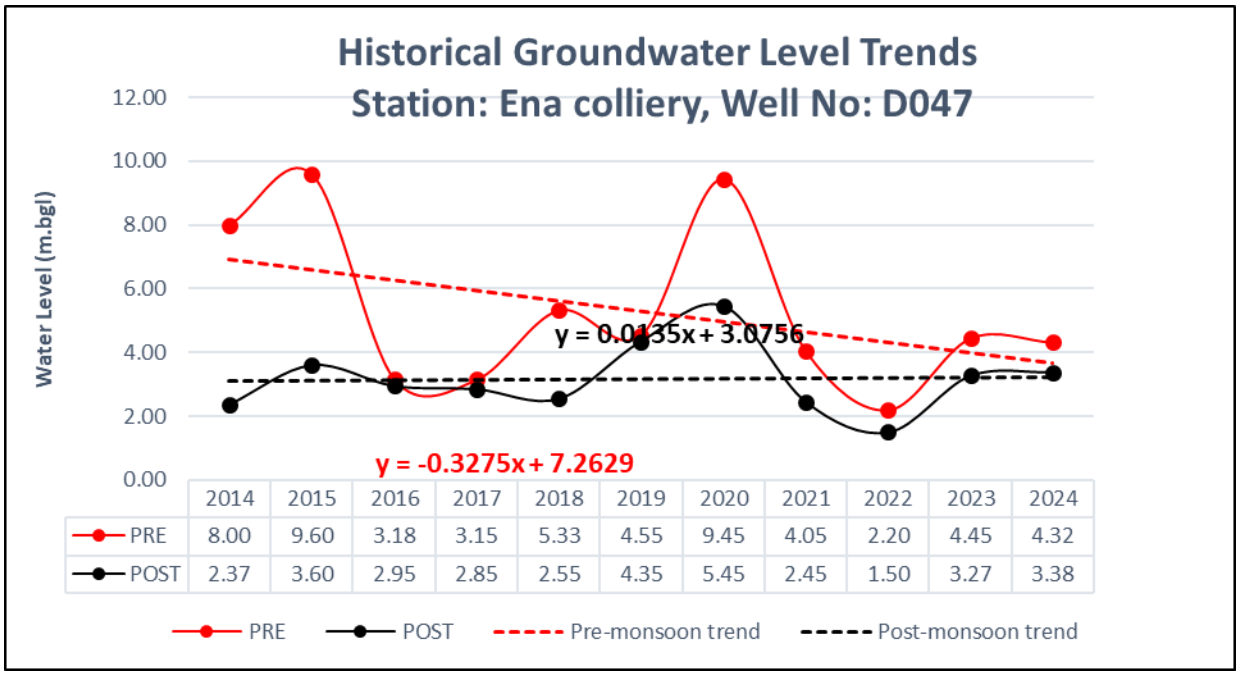


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	4.17	4.55	4.45	4.40	4.58	4.60	4.50	4.23	4.37	4.08	4.12
POST	3.30	3.15	3.20	1.25	1.10	0.75	1.35	0.84	2.29	2.20	2.28

Annexure – VI

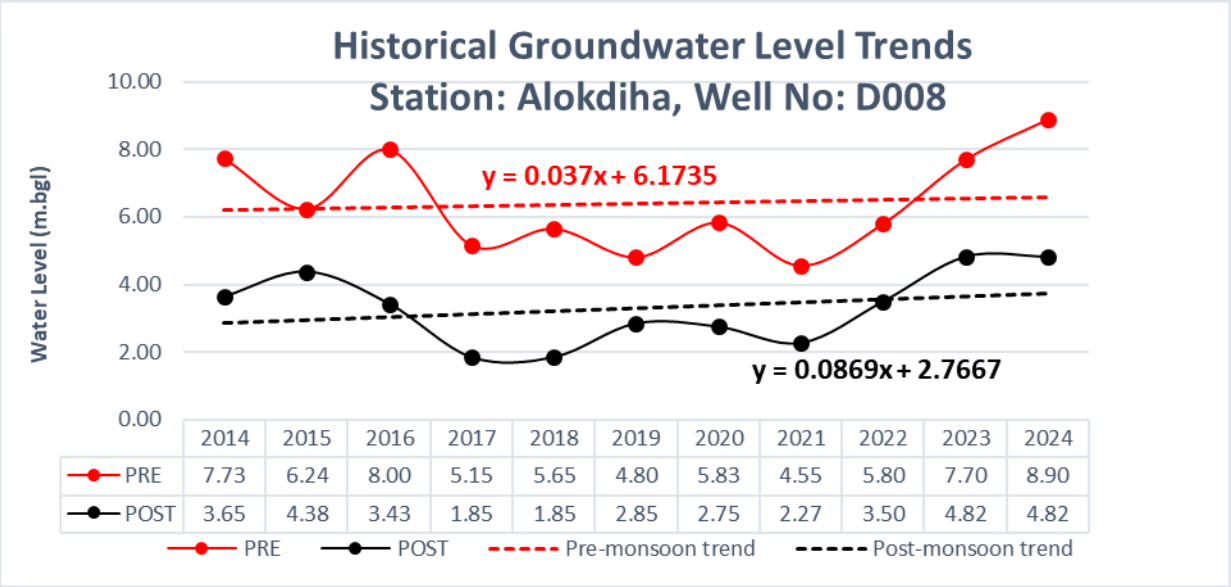
HYDROGRAPHS OF CLUSTER-VII



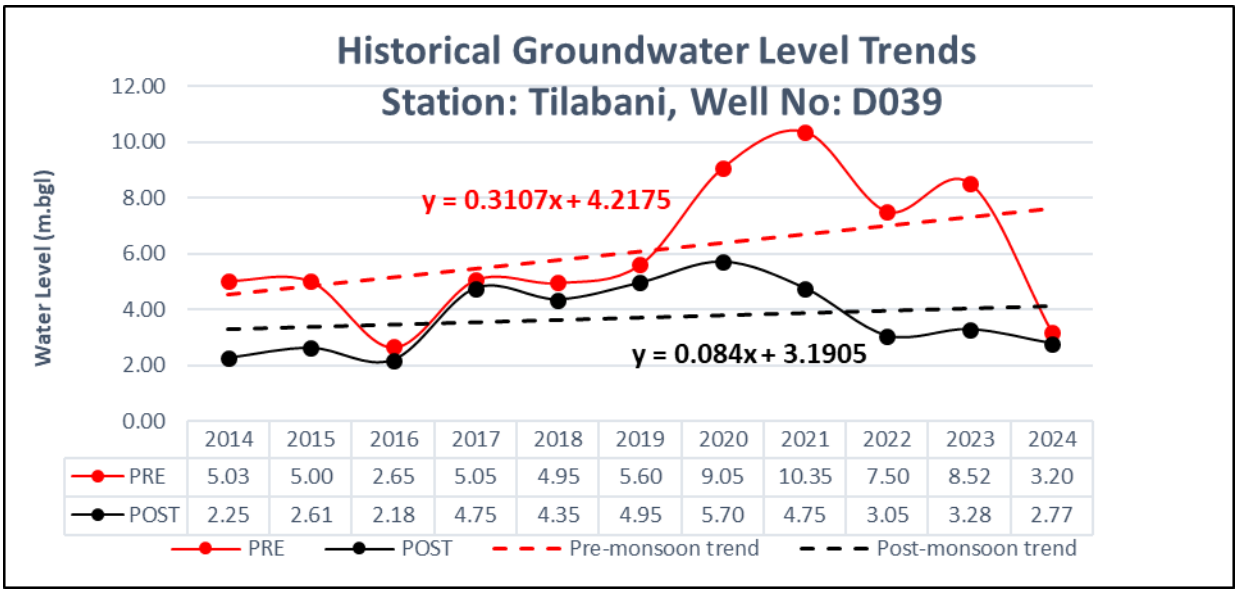


Annexure – VI

HYDROGRAPHS OF CLUSTER-VIII



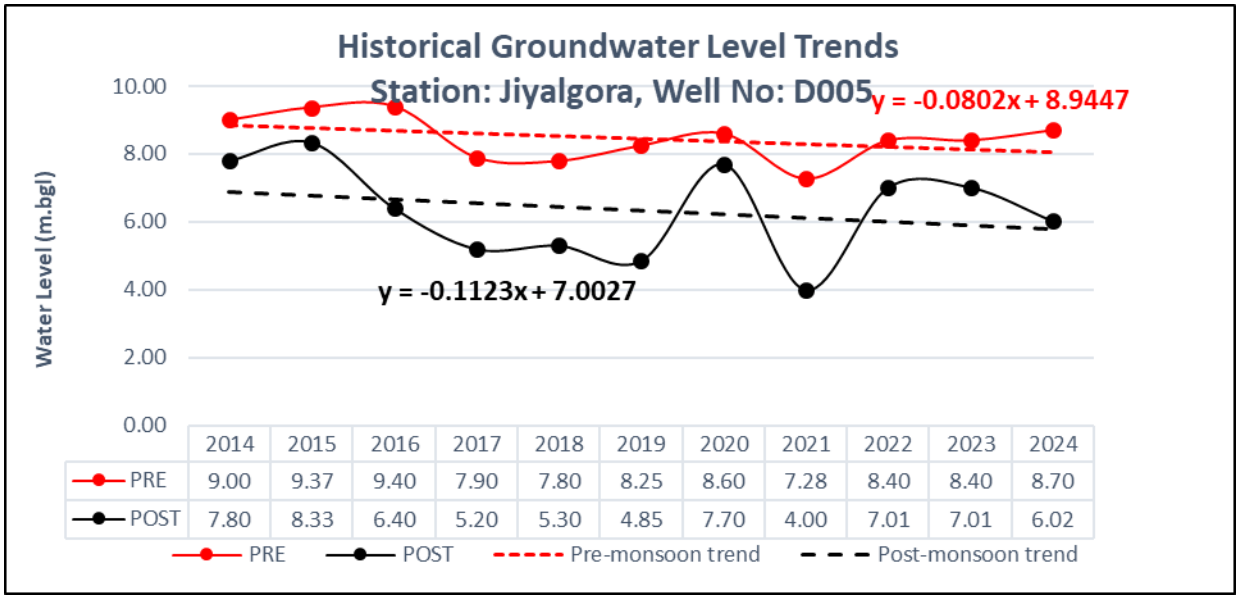
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	7.73	6.24	8.00	5.15	5.65	4.80	5.83	4.55	5.80	7.70	8.90
POST	3.65	4.38	3.43	1.85	1.85	2.85	2.75	2.27	3.50	4.82	4.82

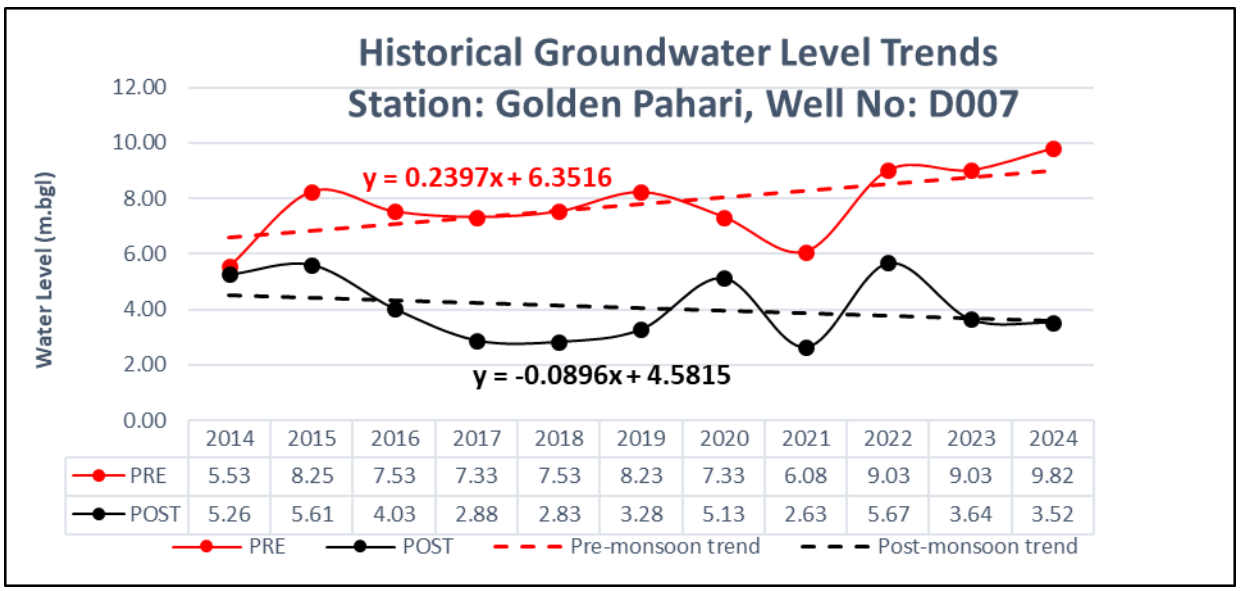


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	5.03	5.00	2.65	5.05	4.95	5.60	9.05	10.35	7.50	8.52	3.20
POST	2.25	2.61	2.18	4.75	4.35	4.95	5.70	4.75	3.05	3.28	2.77

Annexure – VI

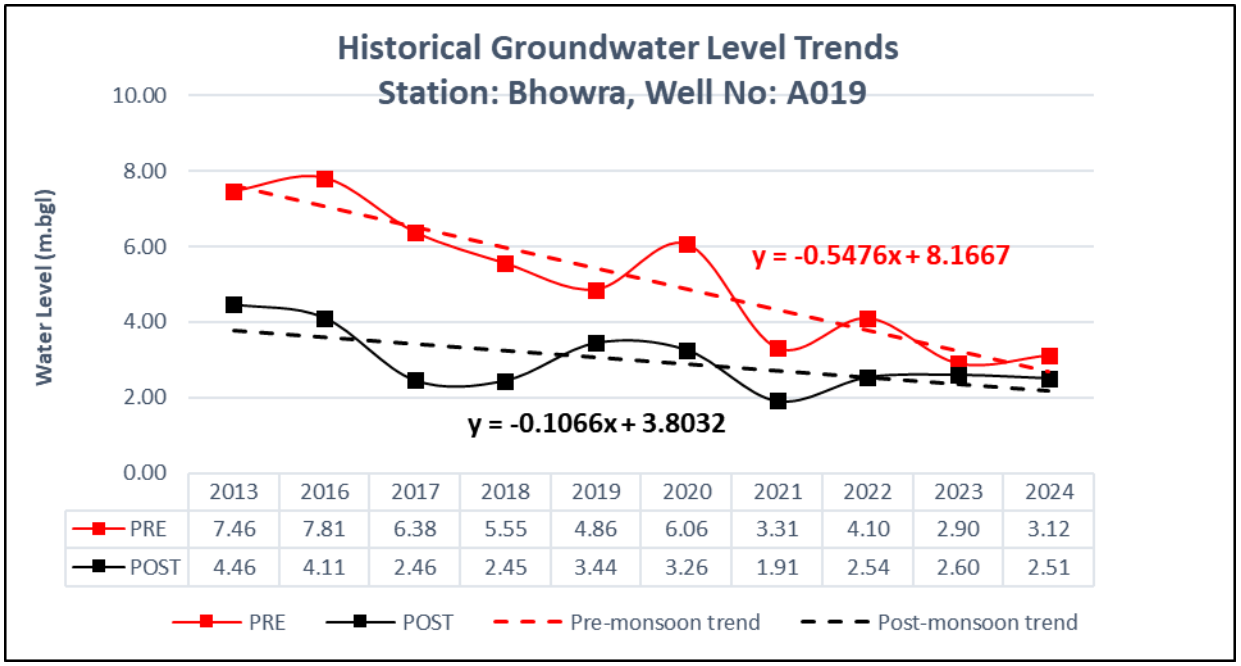
HYDROGRAPHS OF CLUSTER-IX



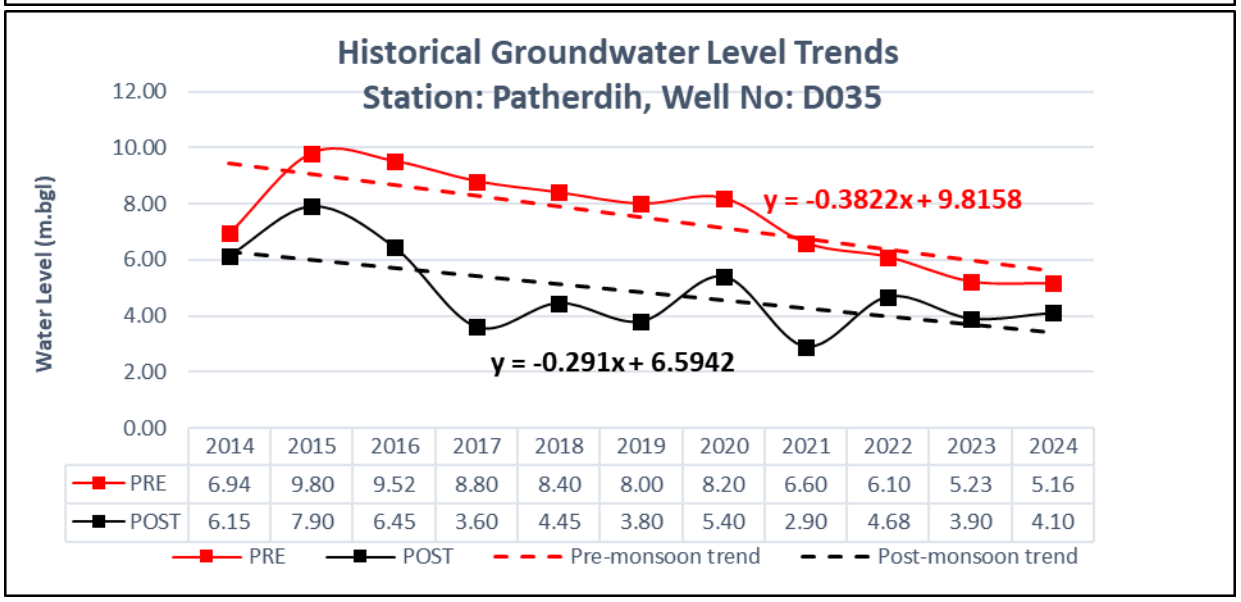


Annexure – VI

HYDROGRAPHS OF CLUSTER-X



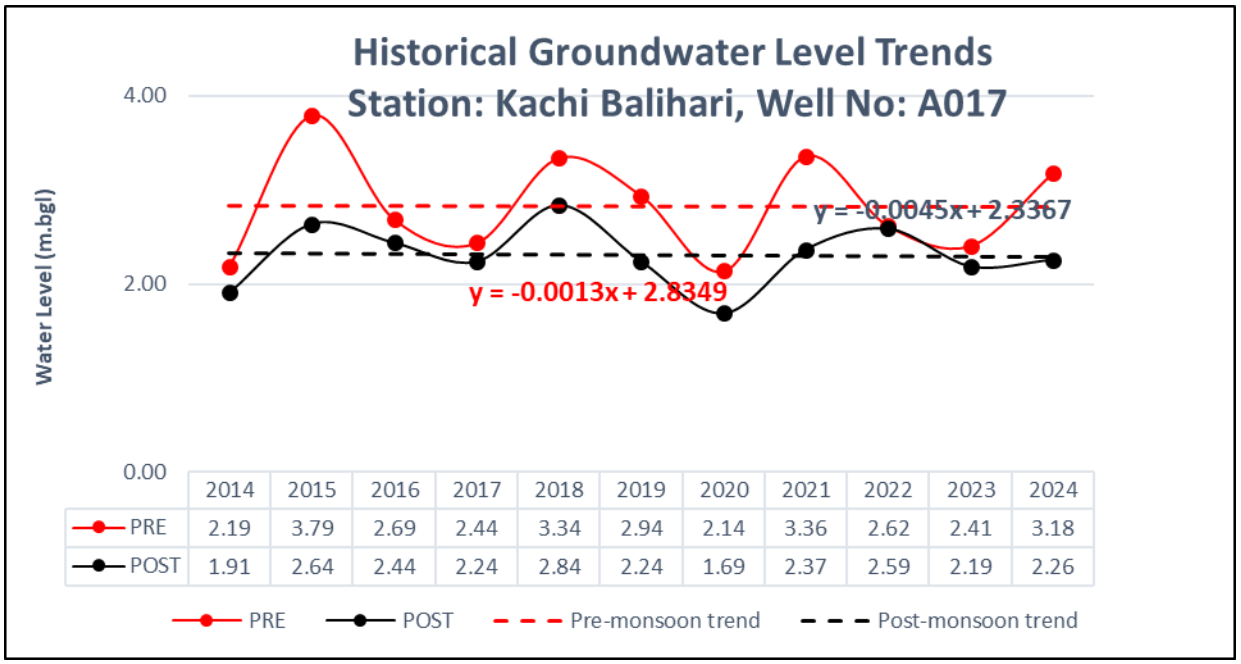
	2013	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	7.46	7.81	6.38	5.55	4.86	6.06	3.31	4.10	2.90	3.12
POST	4.46	4.11	2.46	2.45	3.44	3.26	1.91	2.54	2.60	2.51



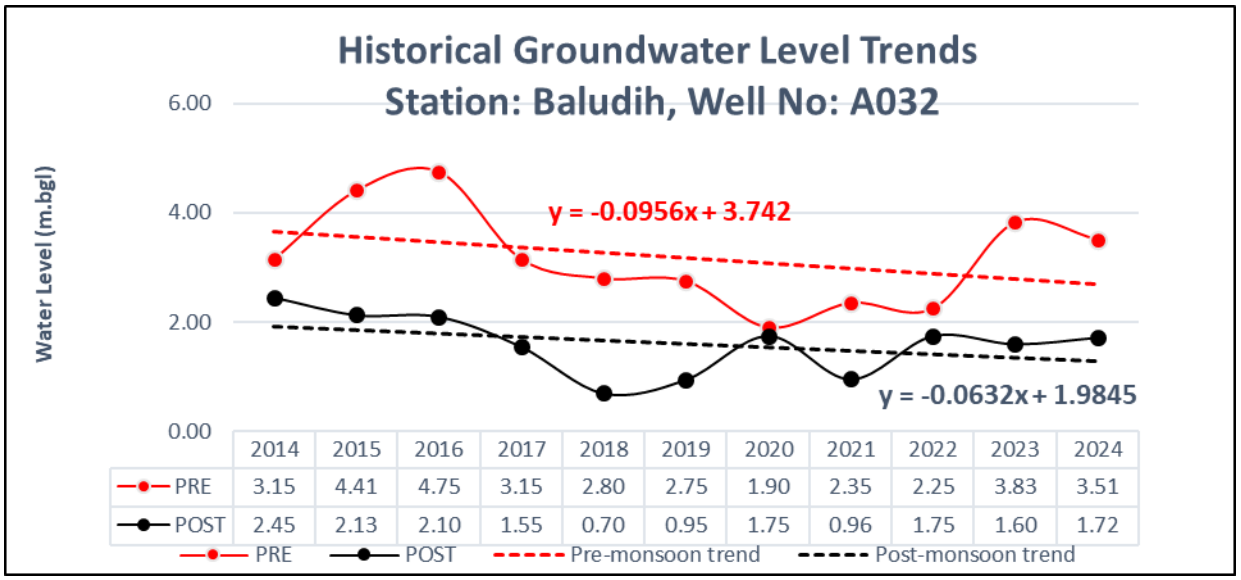
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	6.94	9.80	9.52	8.80	8.40	8.00	8.20	6.60	6.10	5.23	5.16
POST	6.15	7.90	6.45	3.60	4.45	3.80	5.40	2.90	4.68	3.90	4.10

Annexure – VI

HYDROGRAPHS OF CLUSTER-XI



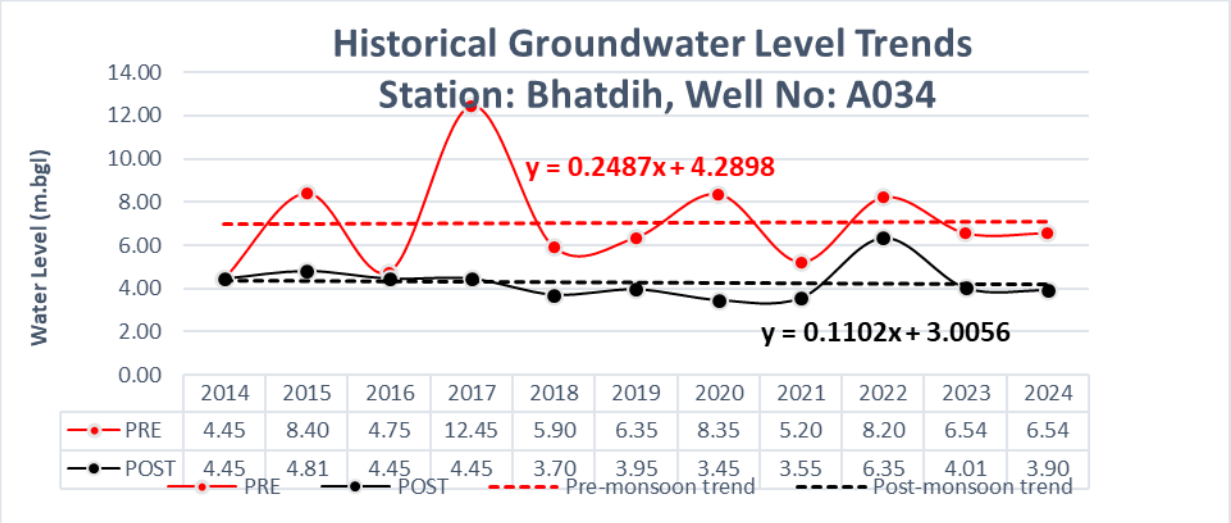
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	2.19	3.79	2.69	2.44	3.34	2.94	2.14	3.36	2.62	2.41	3.18
POST	1.91	2.64	2.44	2.24	2.84	2.24	1.69	2.37	2.59	2.19	2.26

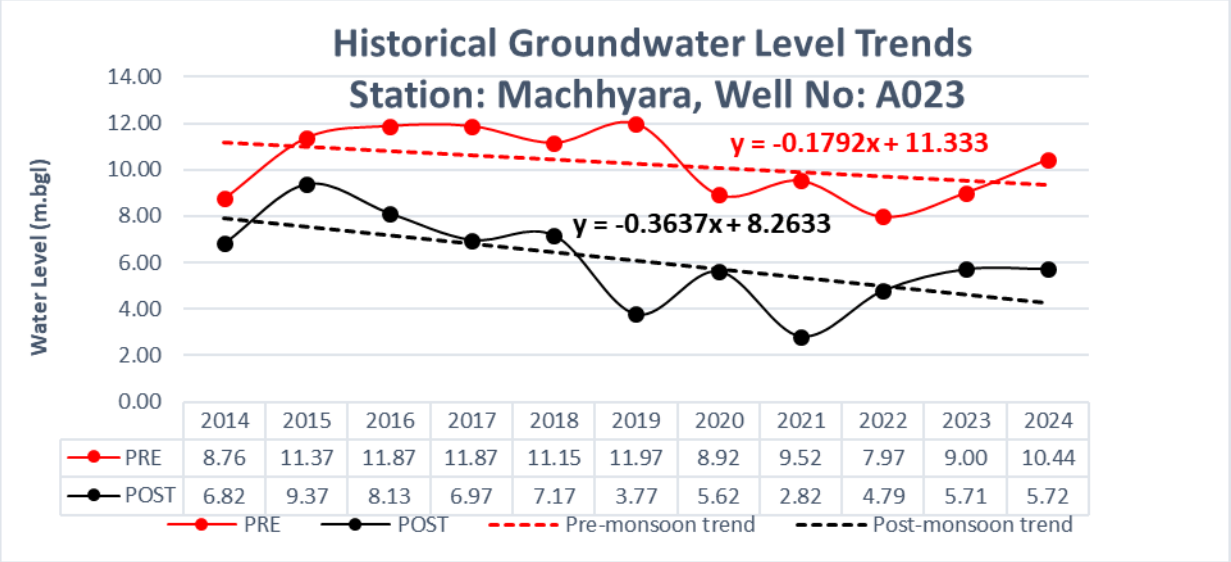


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	3.15	4.41	4.75	3.15	2.80	2.75	1.90	2.35	2.25	3.83	3.51
POST	2.45	2.13	2.10	1.55	0.70	0.95	1.75	0.96	1.75	1.60	1.72

Annexure – VI

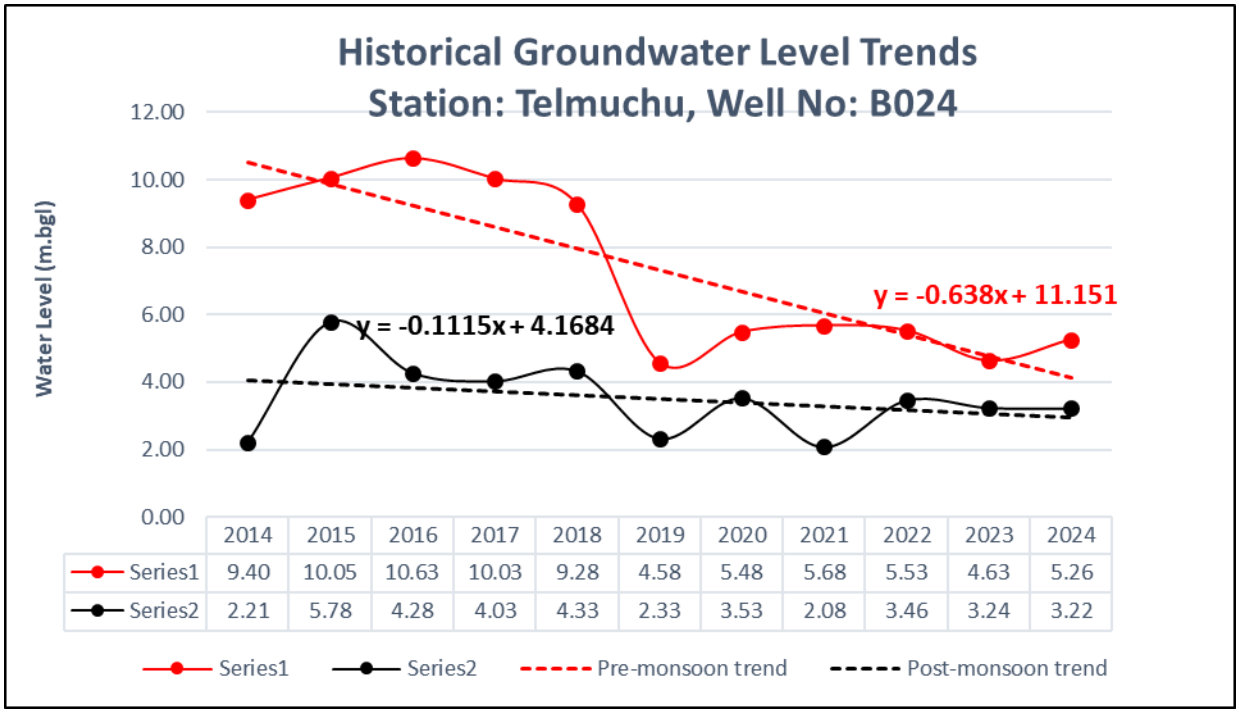
HYDROGRAPHS OF CLUSTER-XIII

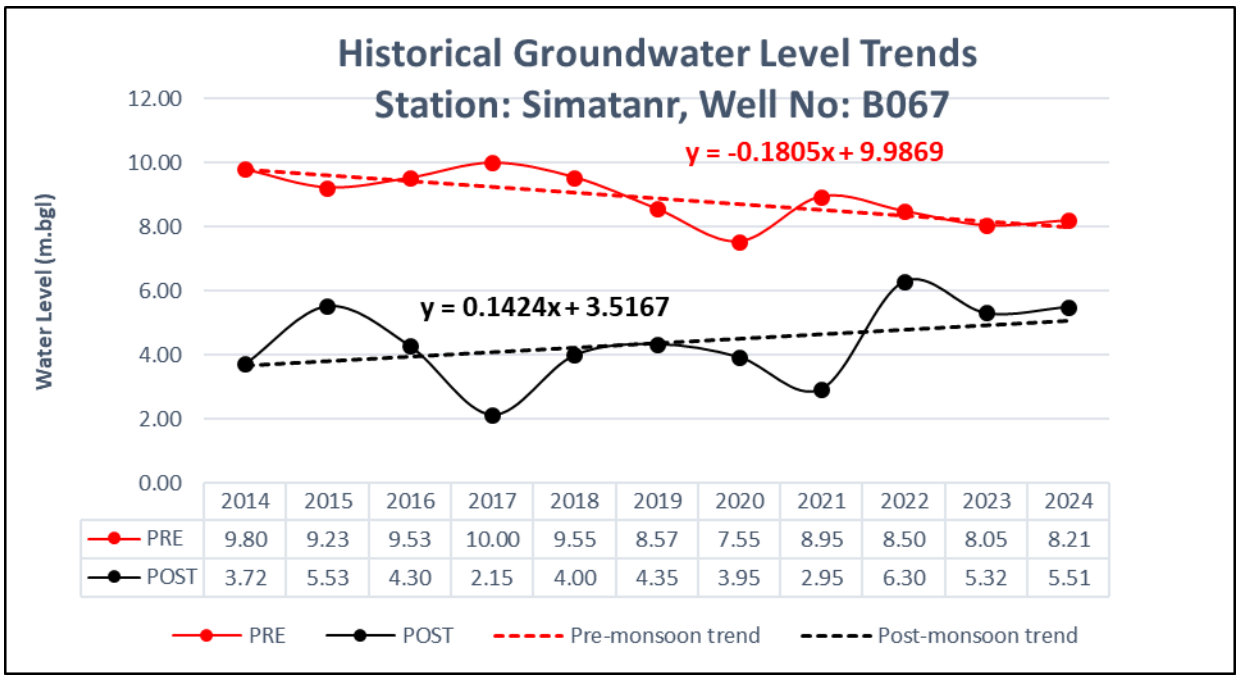




Annexure – VI

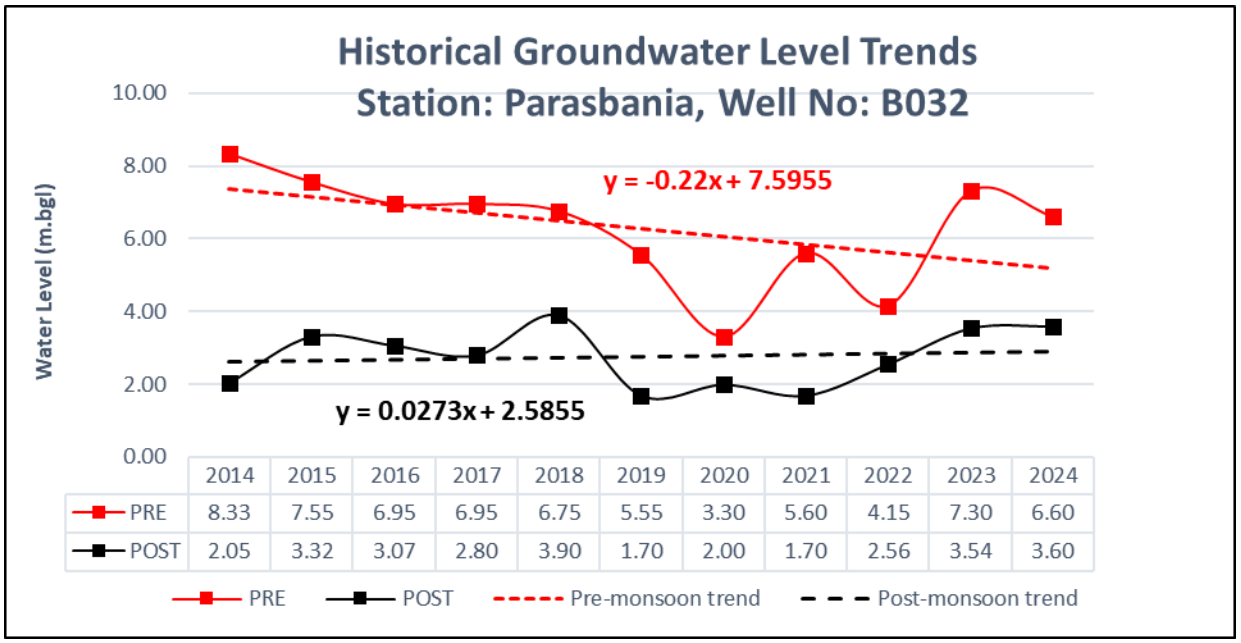
HYDROGRAPHS OF CLUSTER-XIV



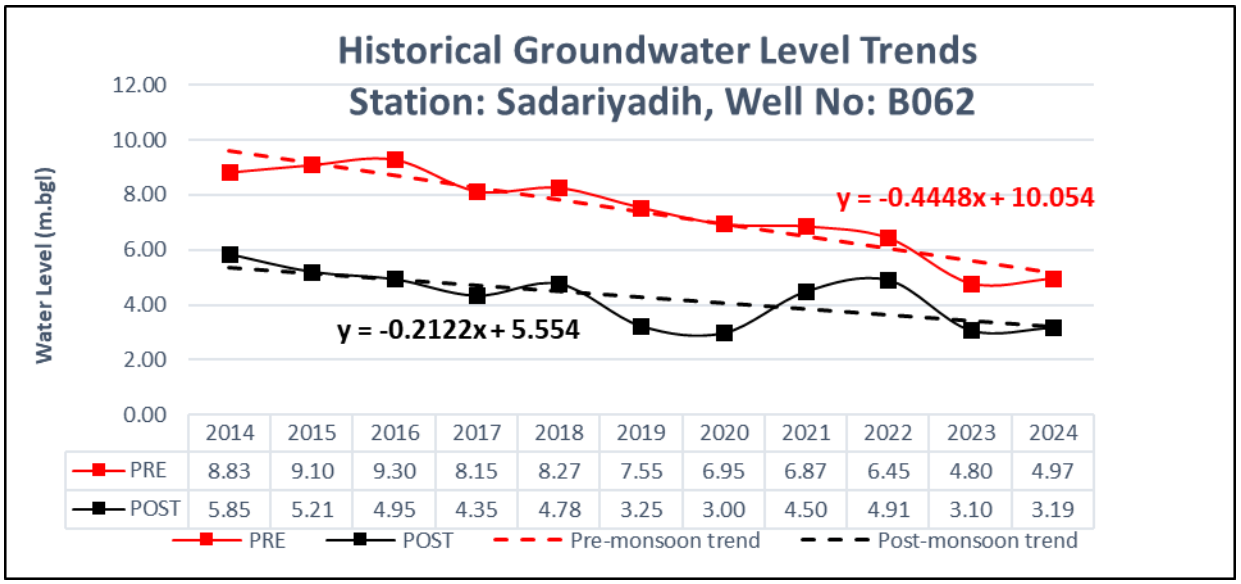


Annexure – VI

HYDROGRAPHS OF CLUSTER-XV



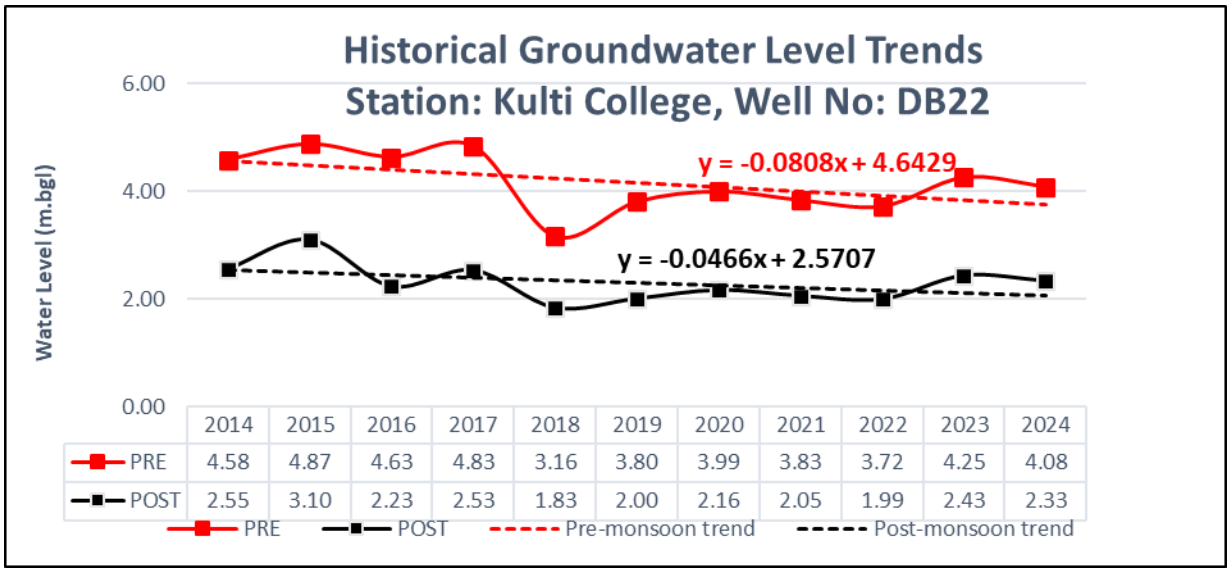
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	8.33	7.55	6.95	6.95	6.75	5.55	3.30	5.60	4.15	7.30	6.60
POST	2.05	3.32	3.07	2.80	3.90	1.70	2.00	1.70	2.56	3.54	3.60



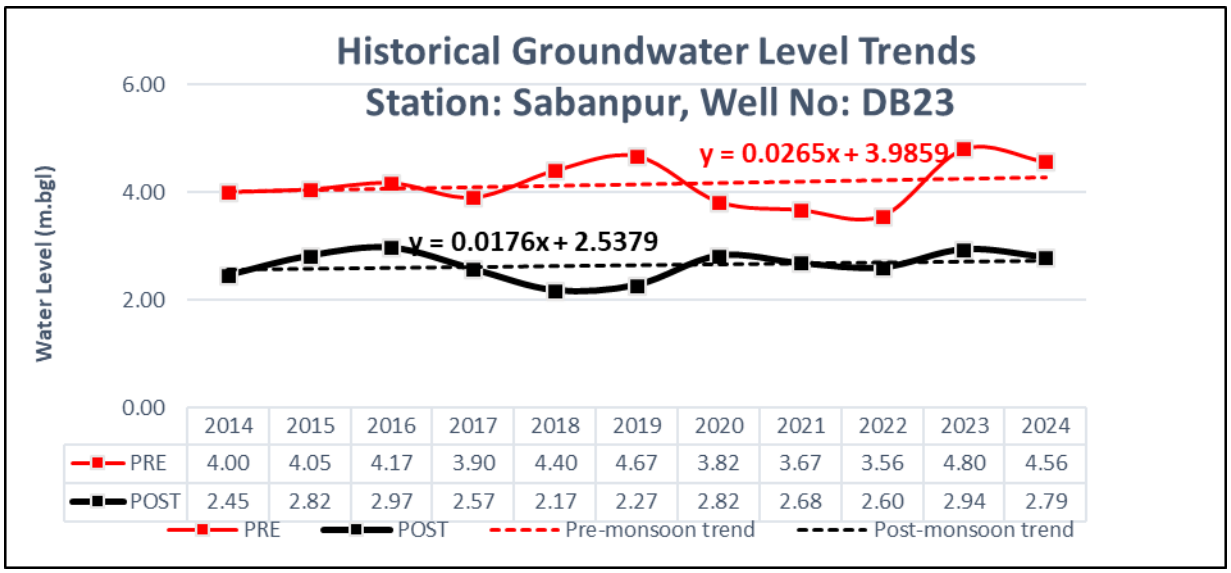
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	8.83	9.10	9.30	8.15	8.27	7.55	6.95	6.87	6.45	4.80	4.97
POST	5.85	5.21	4.95	4.35	4.78	3.25	3.00	4.50	4.91	3.10	3.19

Annexure – VI

HYDROGRAPHS OF CLUSTER-XVI

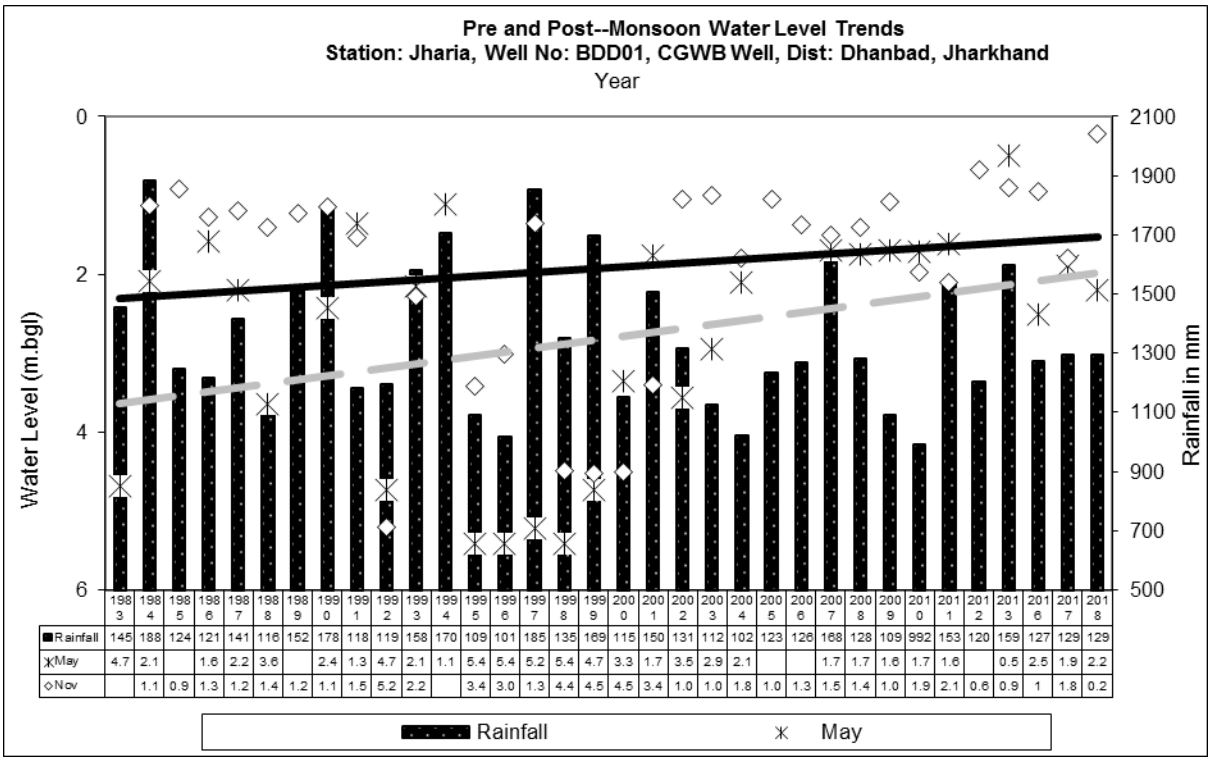


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	4.58	4.87	4.63	4.83	3.16	3.80	3.99	3.83	3.72	4.25	4.08
POST	2.55	3.10	2.23	2.53	1.83	2.00	2.16	2.05	1.99	2.43	2.33

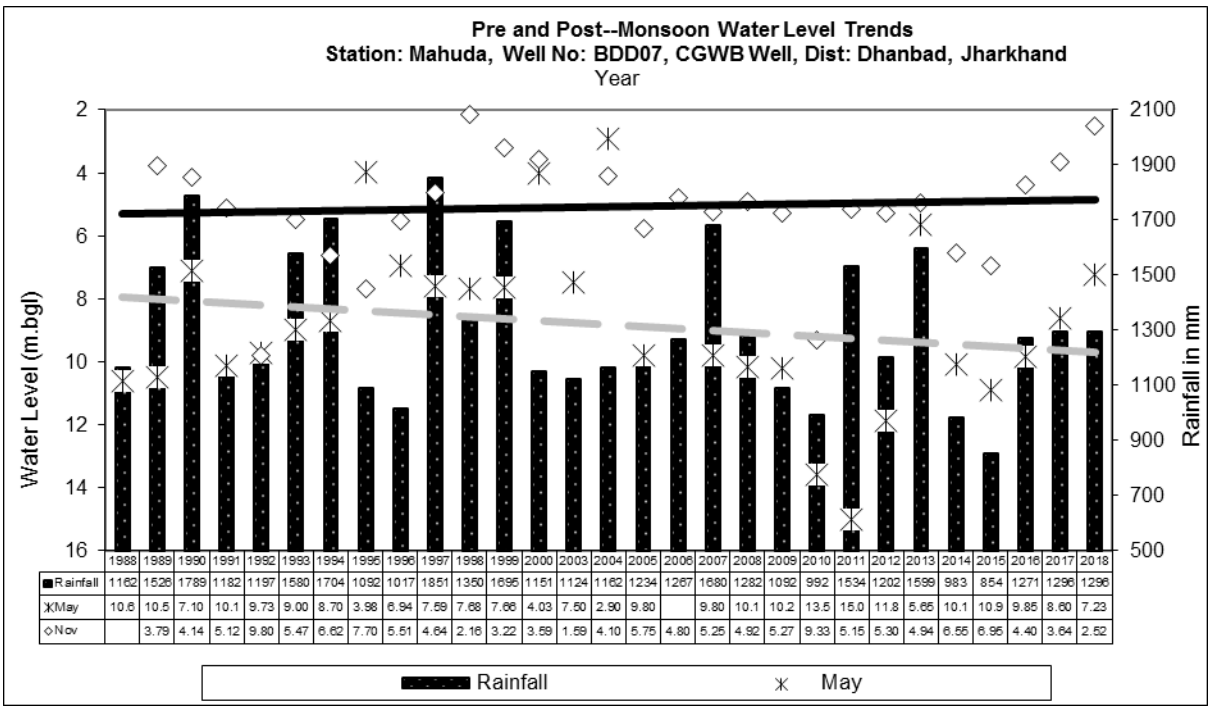


	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
PRE	4.00	4.05	4.17	3.90	4.40	4.67	3.82	3.67	3.56	4.80	4.56
POST	2.45	2.82	2.97	2.57	2.17	2.27	2.82	2.68	2.60	2.94	2.79

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS

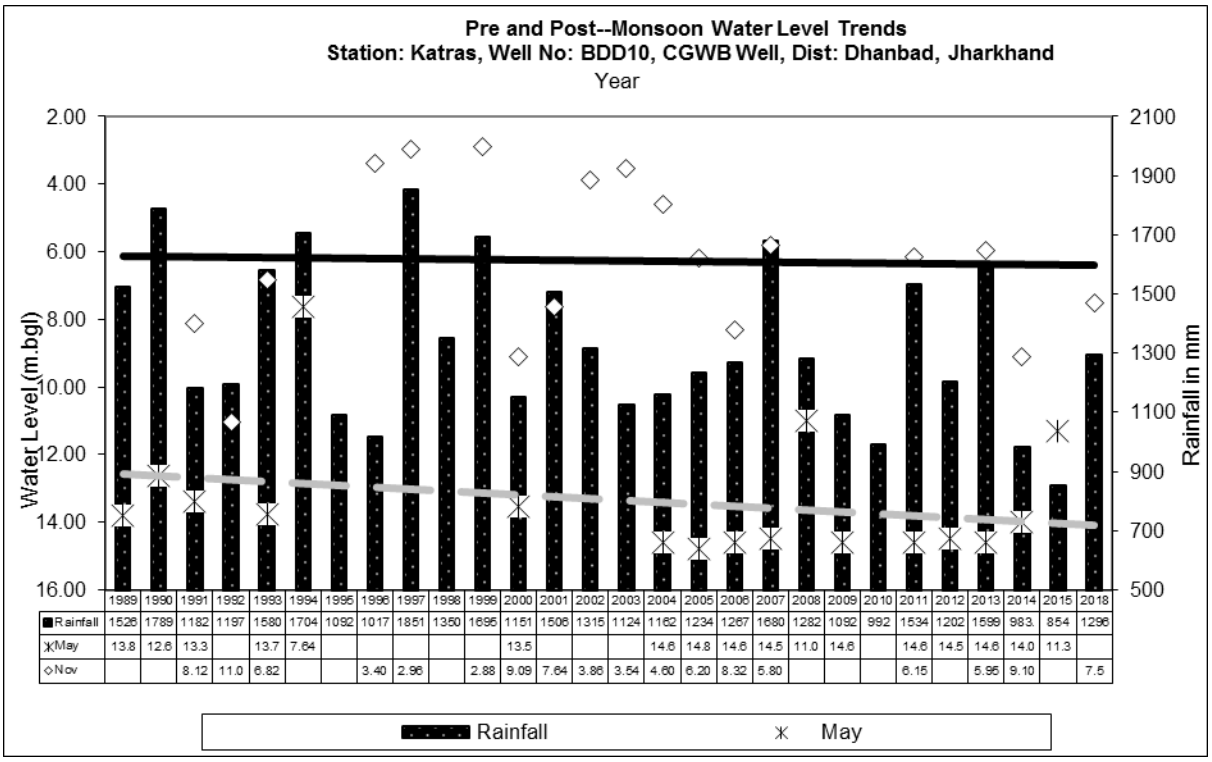


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	153	120	159	127	129	129		
May	4.7	2.1		1.6	2.2	3.6		2.4	1.3	4.7	2.1	1.1	5.4	5.4	5.2	5.4	4.7	3.3	1.7	3.5	2.9	2.1			1.7	1.7	1.6	1.7	1.6		0.5	2.5	1.9	2.2		
Nov		1.1	0.9	1.3	1.2	1.4	1.2	1.1	1.5	5.2	2.2		3.4	3.0	1.3	4.4	4.5	4.5	3.4	1.0	1.0	1.8	1.0	1.3	1.5	1.4	1.0	1.9	2.1	0.6	0.9	1	1.8	0.2		

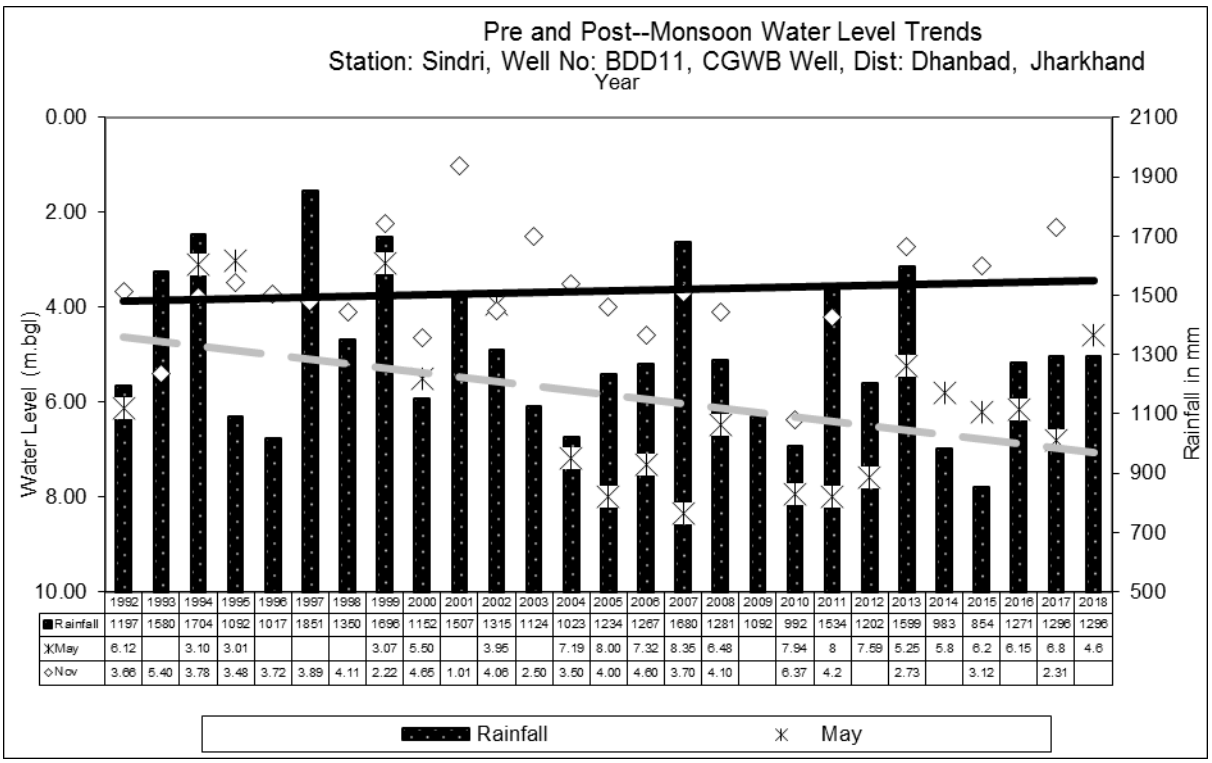


	1988	1989	1990	1991	1992	1993	1994	1996	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	10.5	7.10	10.1	9.73	9.00	8.70	3.98	6.94	7.59	7.68	7.66	4.03	7.50	2.90	9.80		9.80	10.1	10.2	13.5	15.0	11.8	5.65	10.1	10.9	9.85	8.60	7.23
Nov		3.79	4.14	5.12	9.80	5.47	6.62	7.70	5.51	4.64	2.16	3.22	3.59	1.59	4.10	5.75	4.80	5.25	4.92	5.27	9.33	5.15	5.30	4.94	6.55	6.95	4.40	3.64	2.52

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS

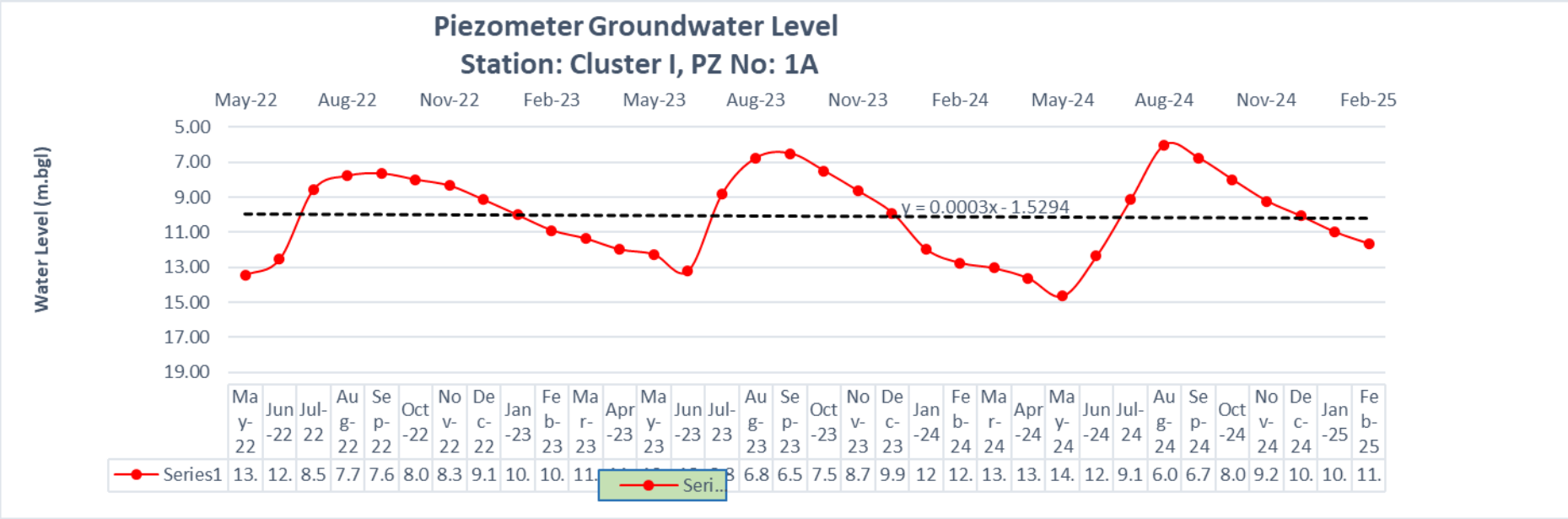


	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2018
Rainfall	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983.	854	1296
May	13.8	12.6	13.3		13.7	7.64						13.5				14.6	14.8	14.6	14.5	11.0	14.6		14.6	14.5	14.6	14.0	11.3	
Nov			8.12	11.0	6.82			3.40	2.96		2.88	9.09	7.64	3.86	3.54	4.60	6.20	8.32	5.80				6.15		5.95	9.10		7.5



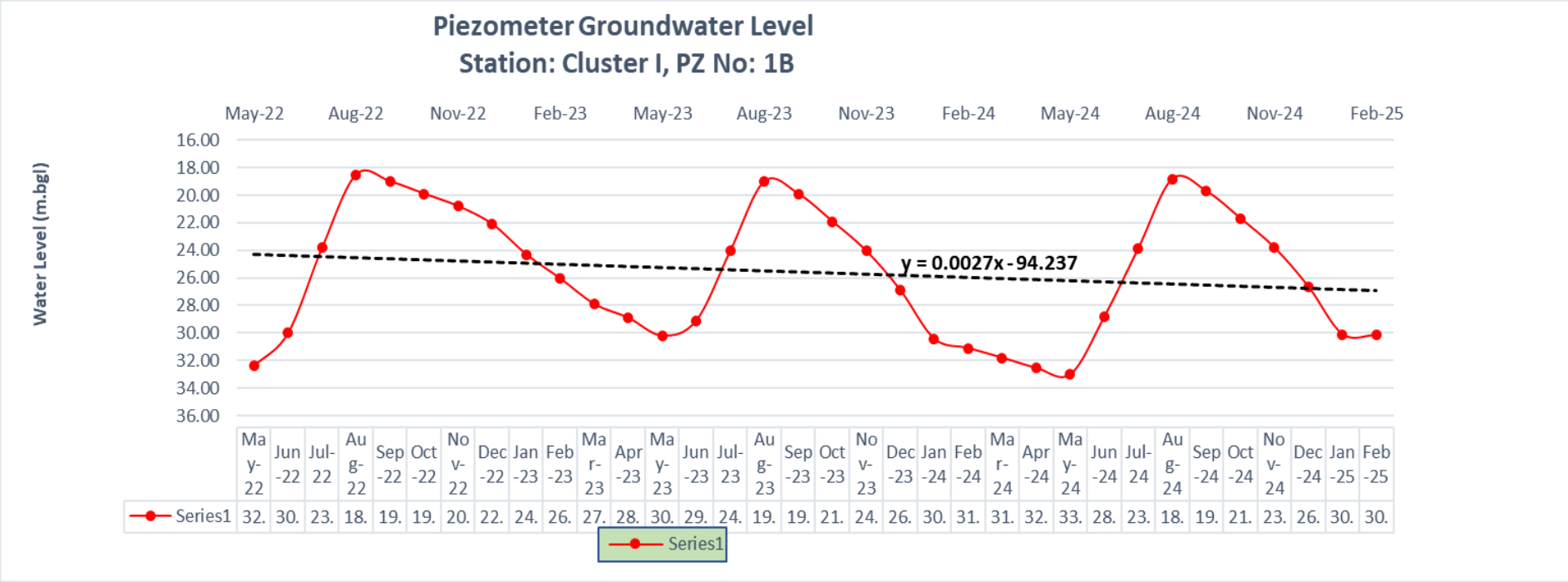
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1197	1580	1704	1092	1017	1851	1350	1696	1152	1507	1315	1124	1023	1234	1267	1680	1281	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	6.12		3.10	3.01				3.07	5.50		3.95		7.19	8.00	7.32	8.35	6.48		7.94	8	7.59	5.25	5.8	6.2	6.15	6.8	4.6
Nov	3.66	5.40	3.78	3.48	3.72	3.89	4.11	2.22	4.65	1.01	4.06	2.50	3.50	4.00	4.60	3.70	4.10		6.37	4.2		2.73		3.12		2.31	

PIEZOMETER HYDROGRAPHS

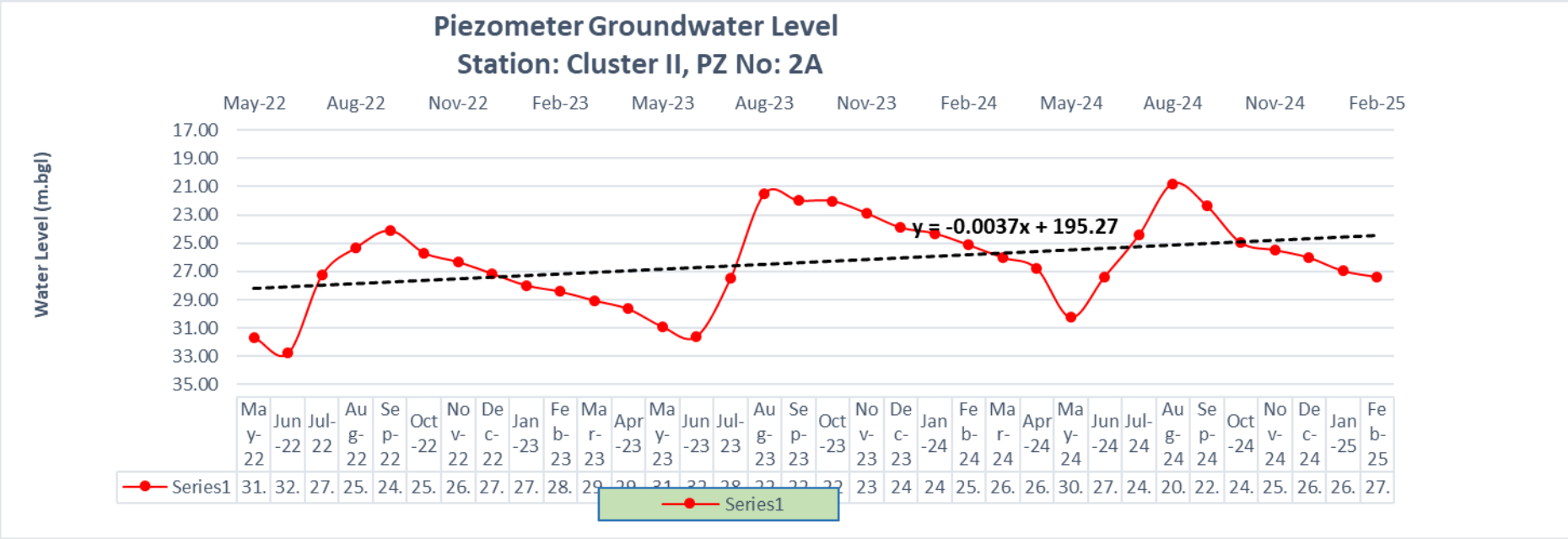


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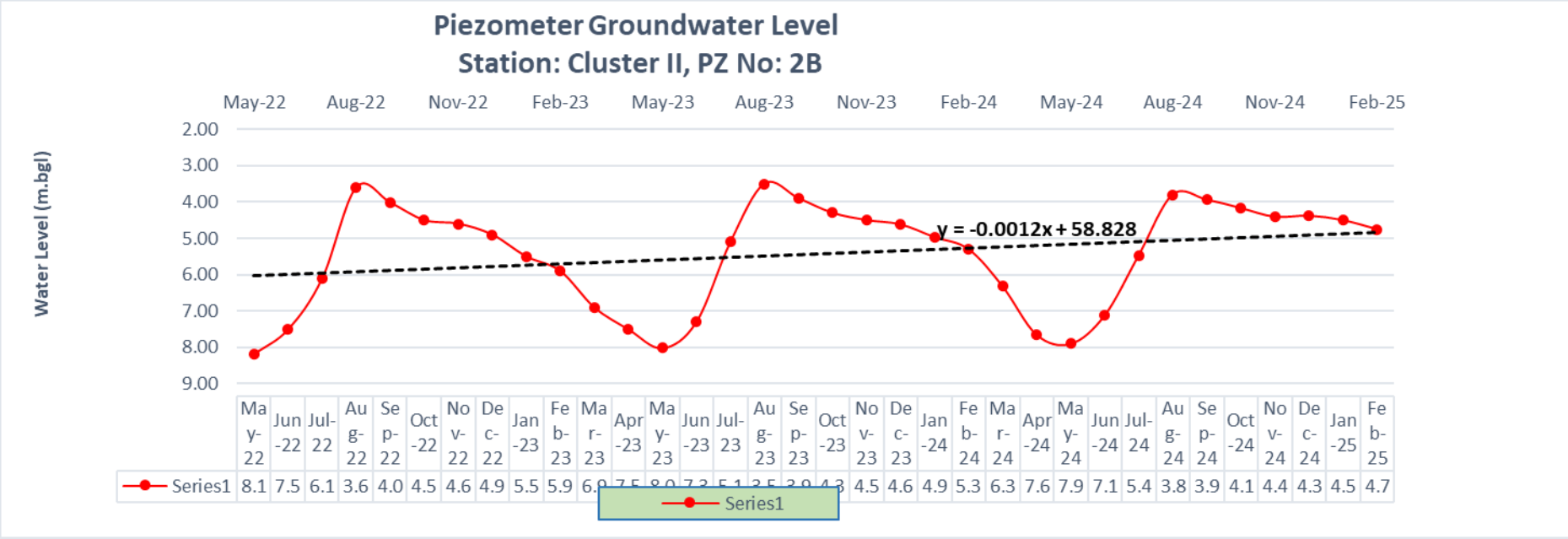
PIEZOMETER HYDROGRAPHS



PIEZOMETER HYDROGRAPHS

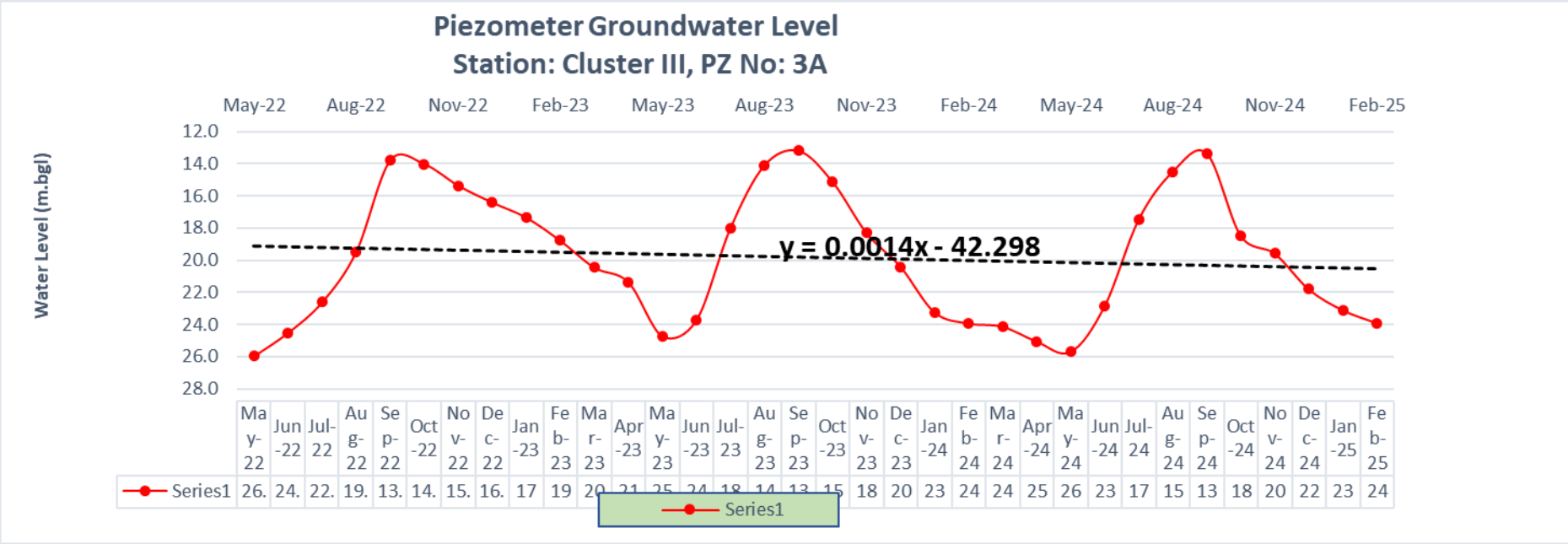


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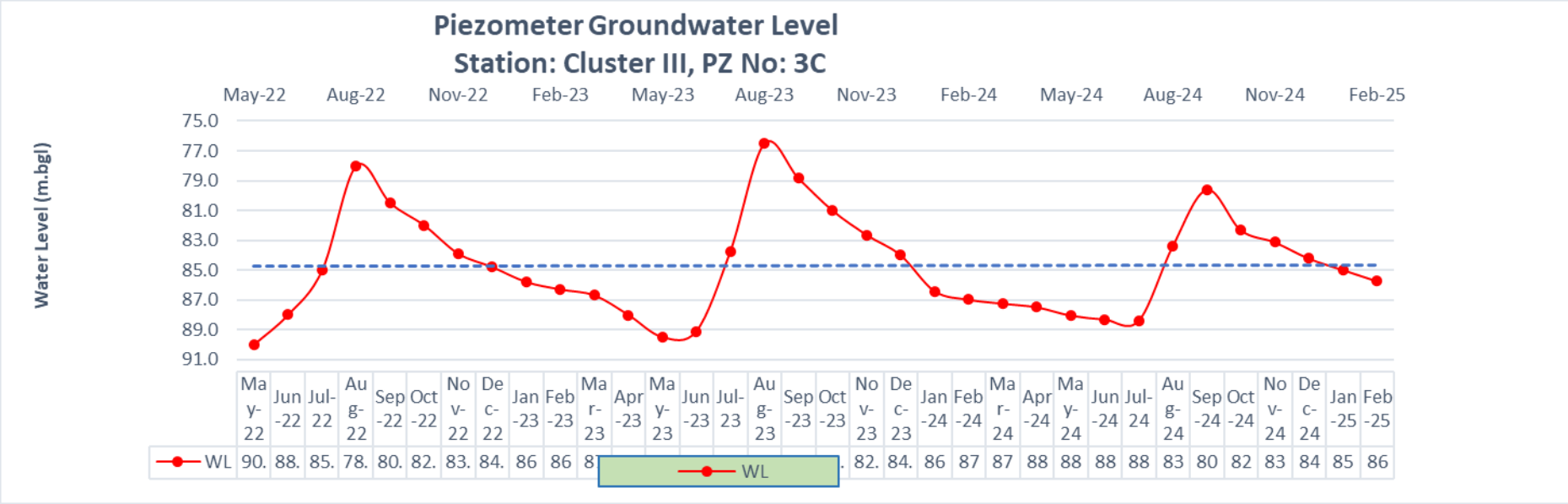
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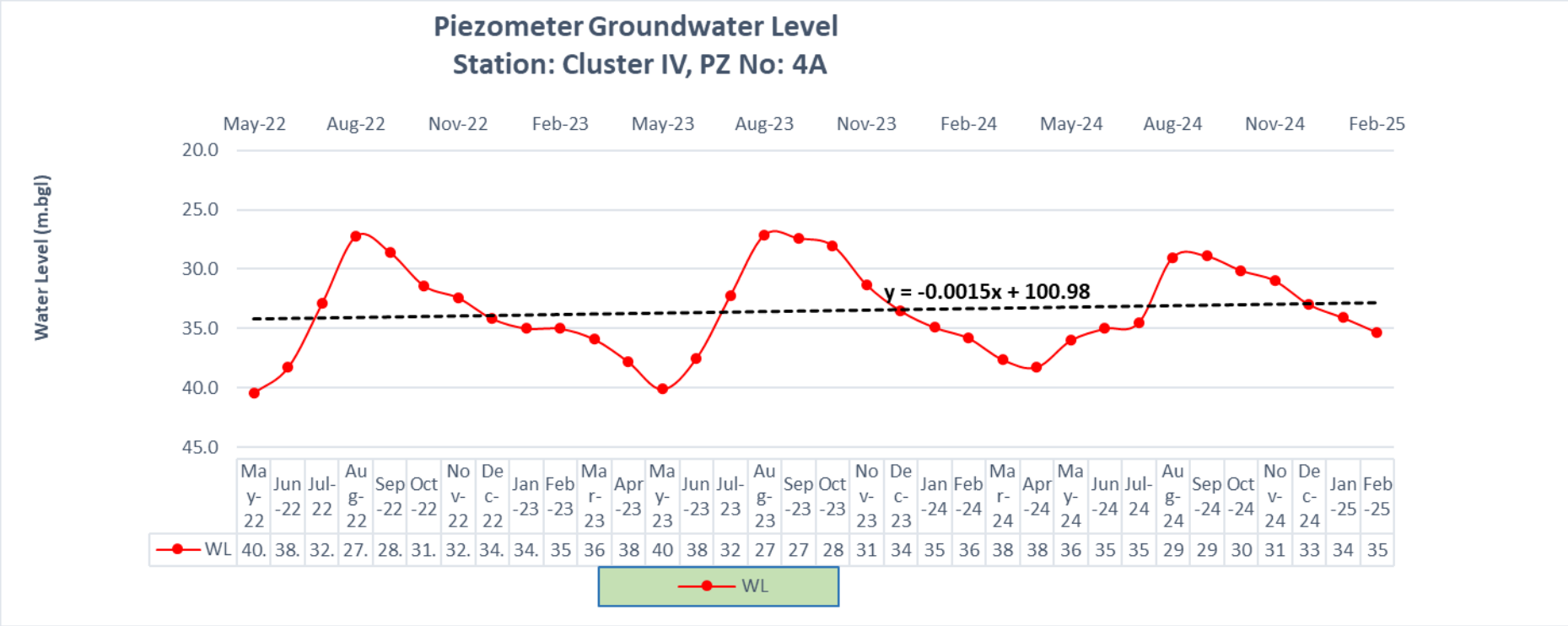


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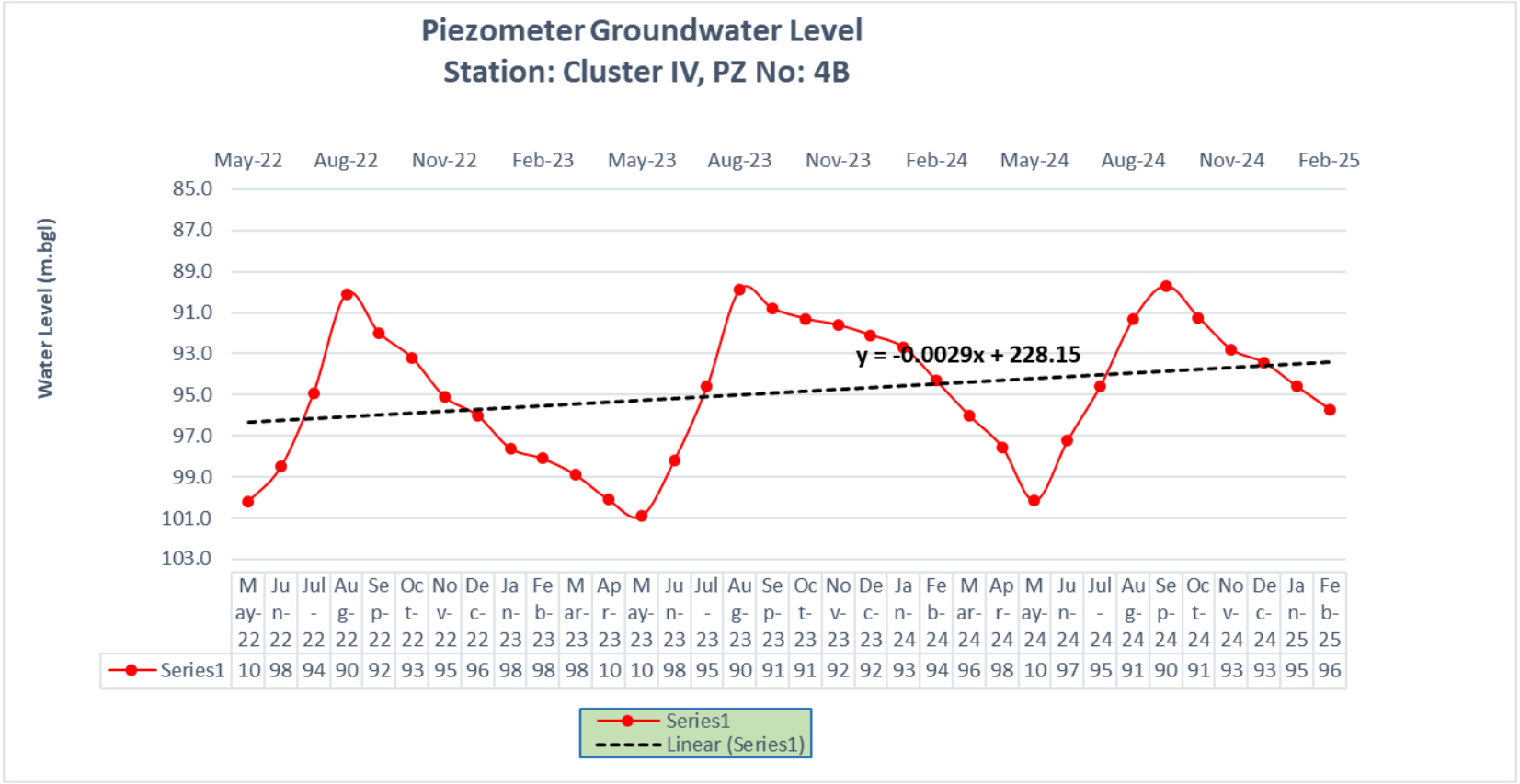
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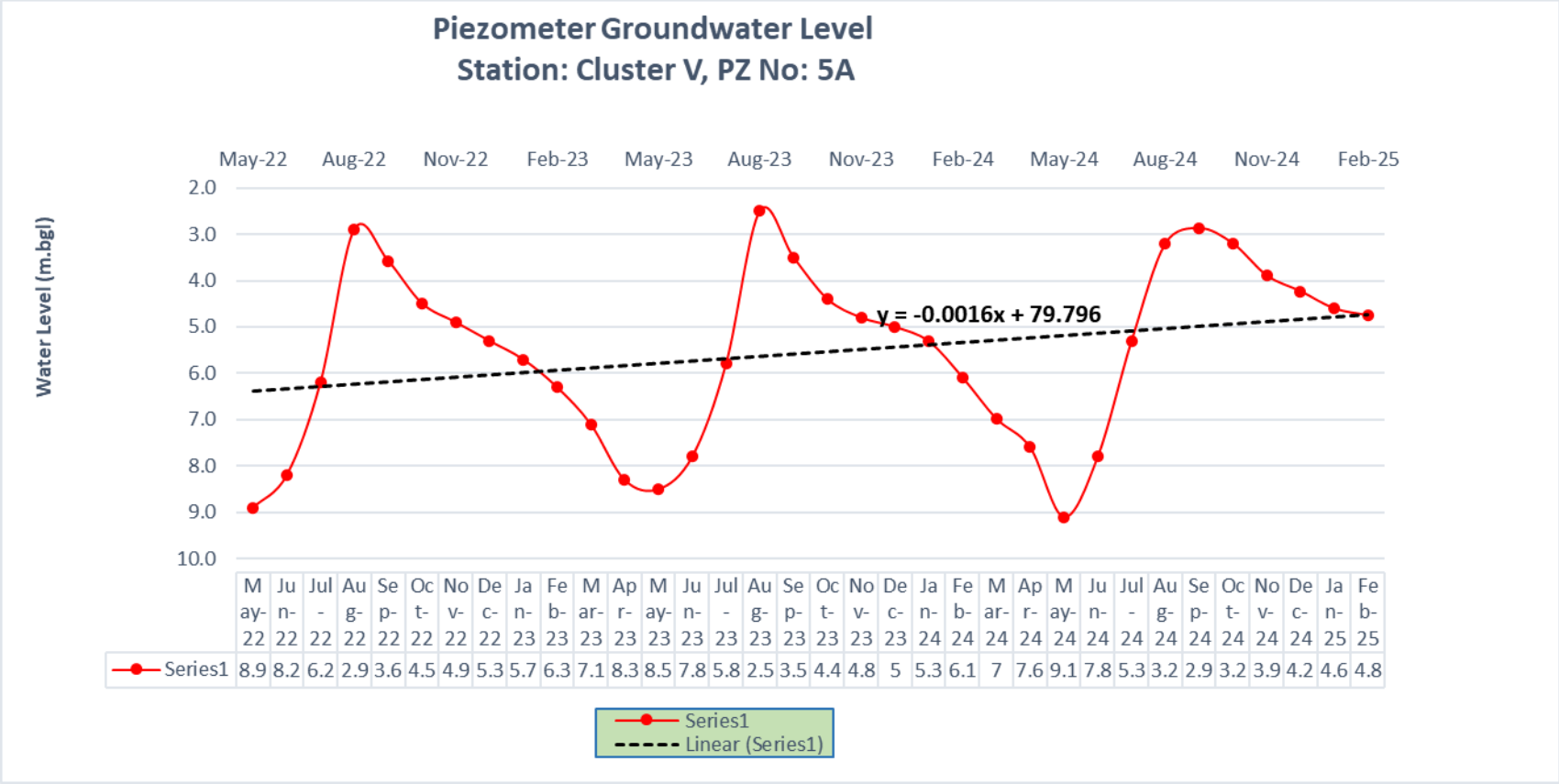
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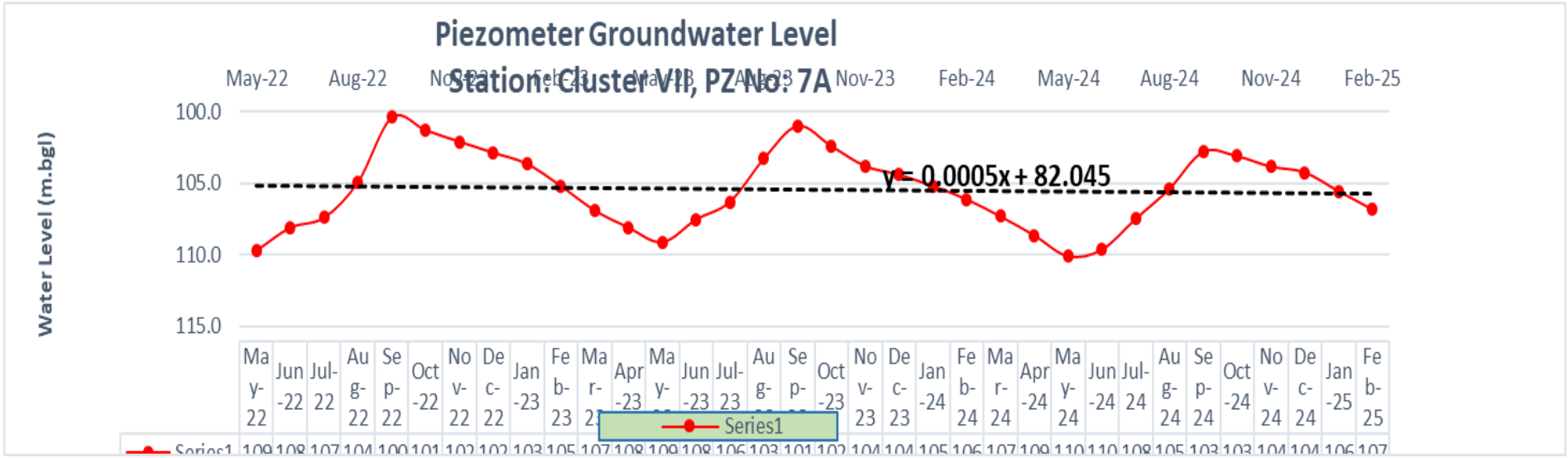
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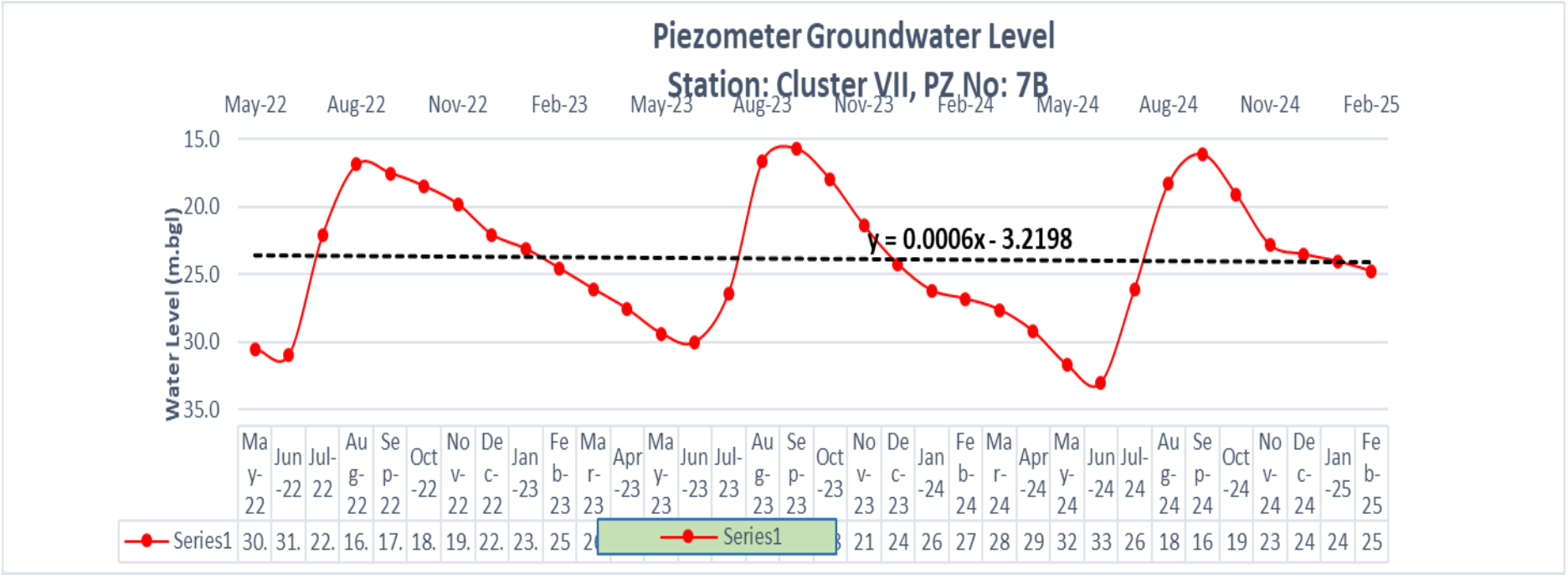
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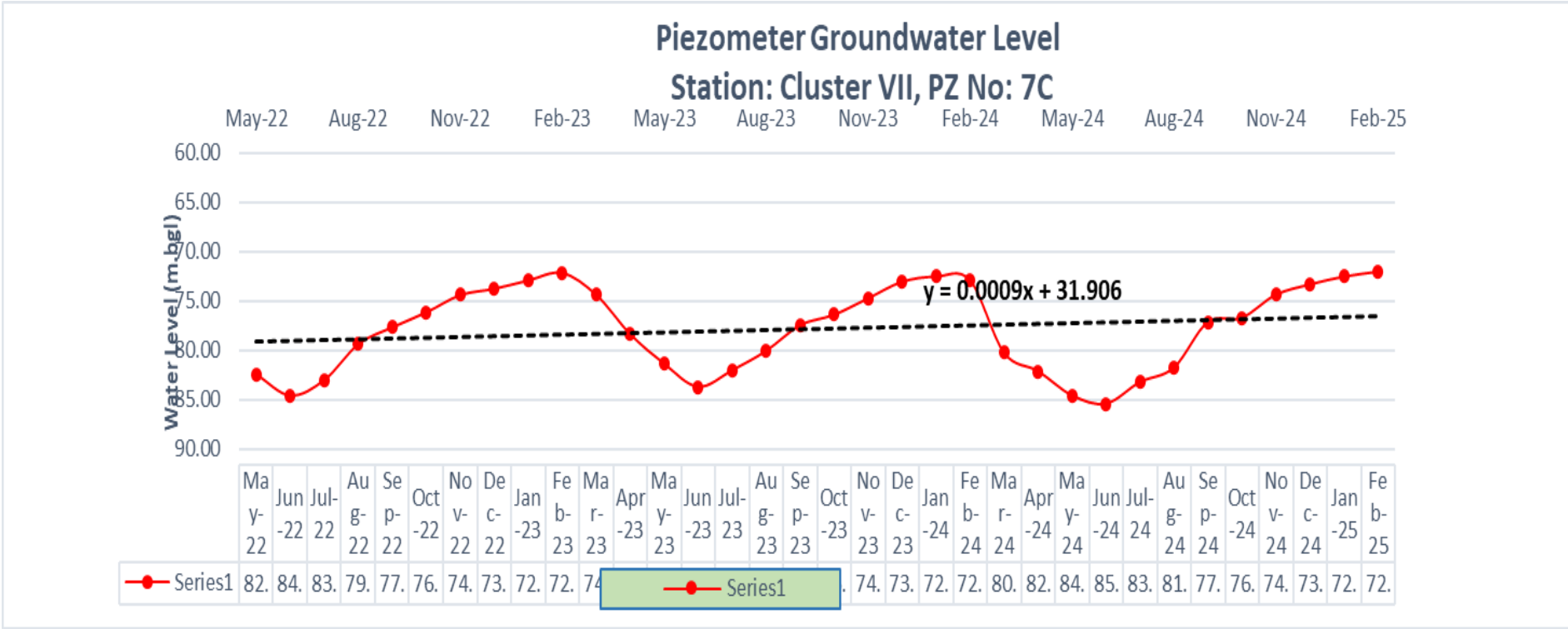
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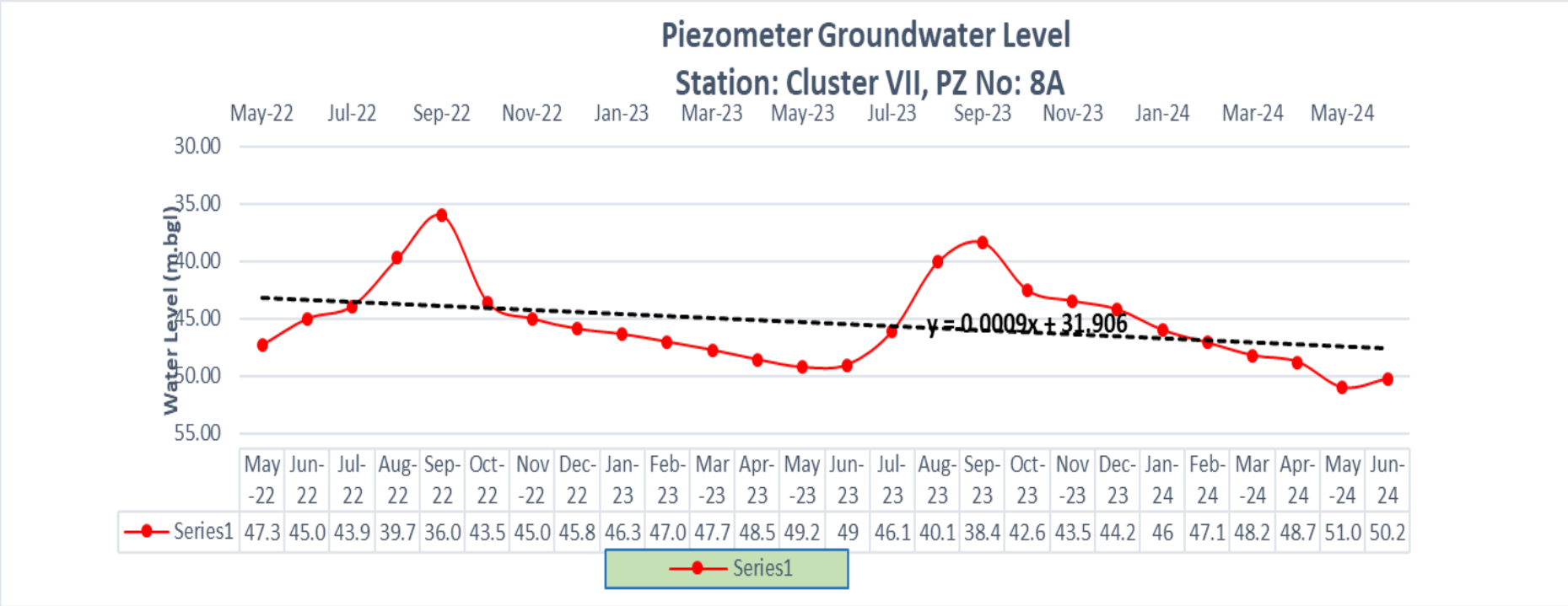
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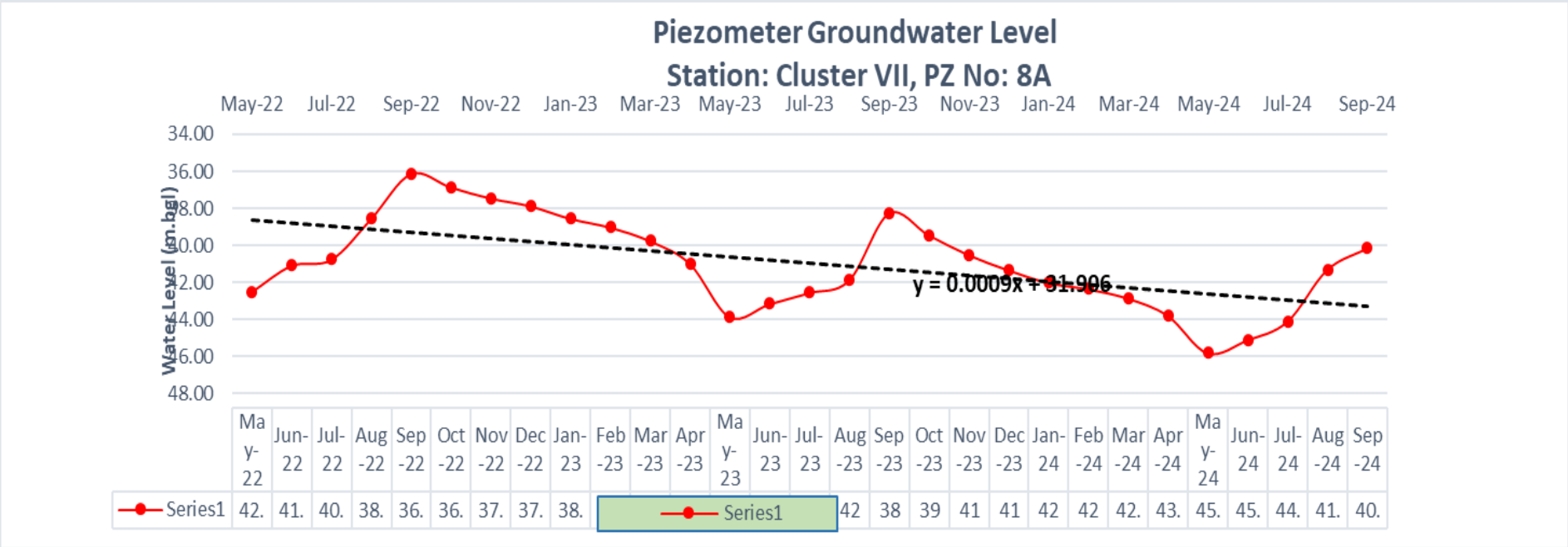


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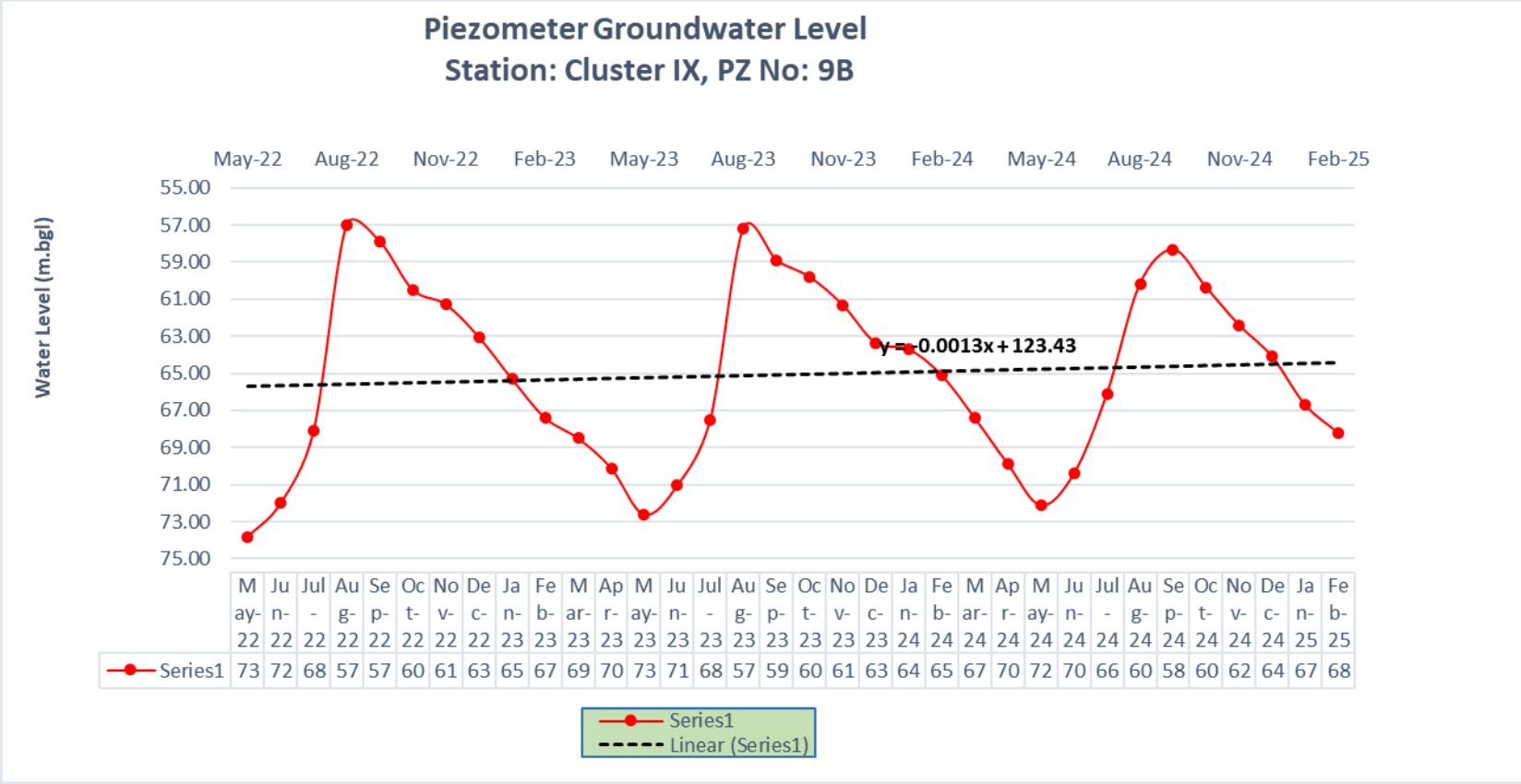


Annexure – VIA

PIEZOMETER HYDROGRAPHS



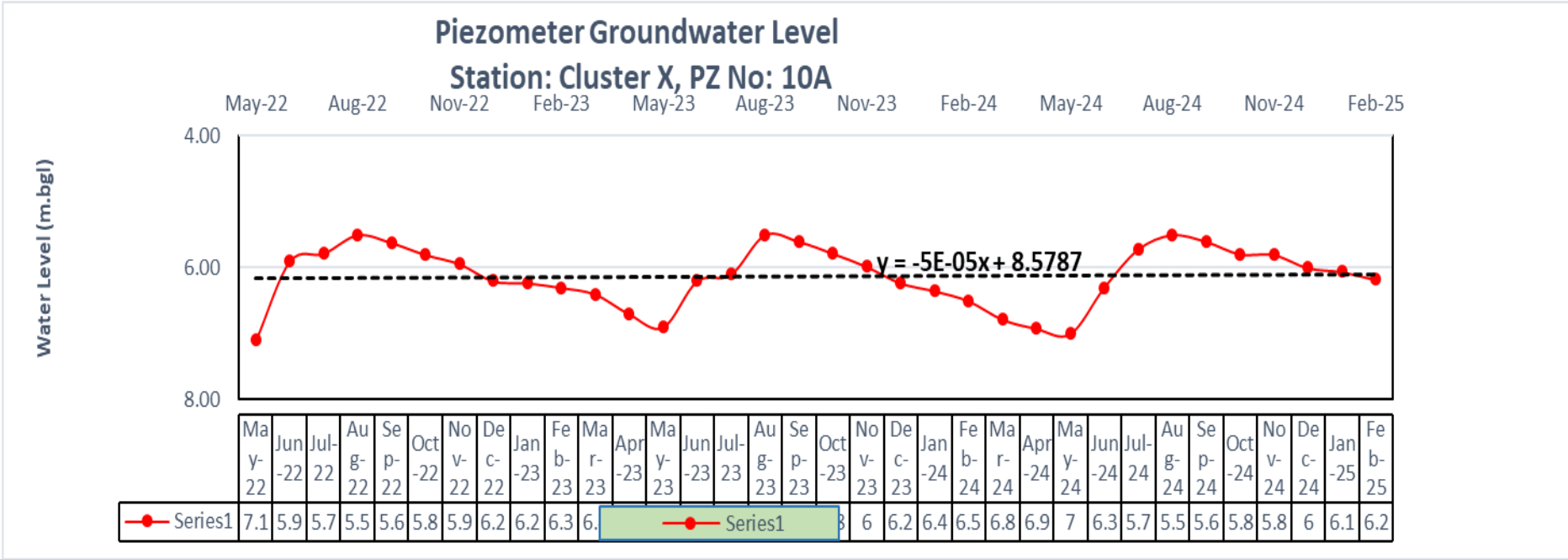
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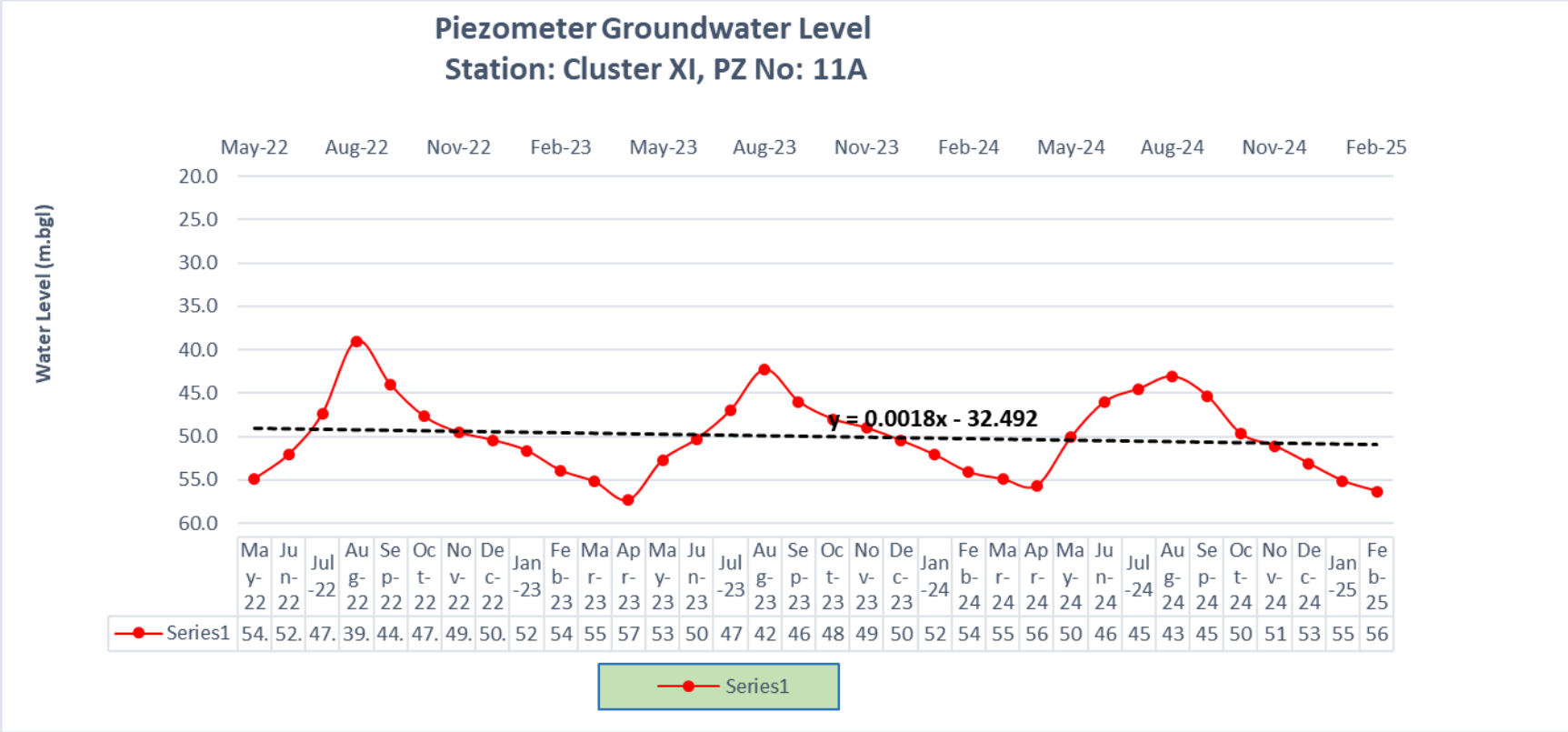
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Series1	73	72	68	57	57	60	61	63	65	67	69	70	73	71	68	57	59	60	61	63	64	65	67	70	72	70	66	60	58	60	62	64	67	68

Annexure – VIA

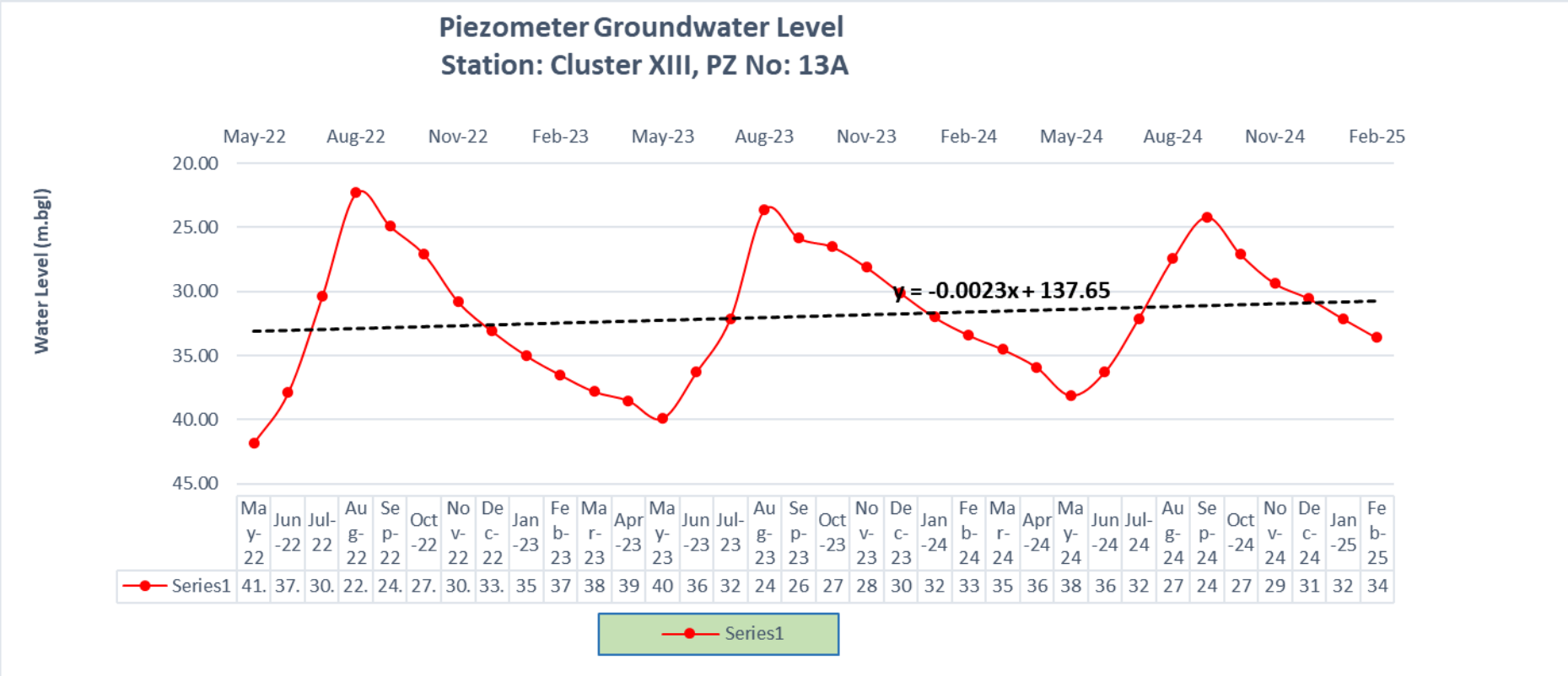
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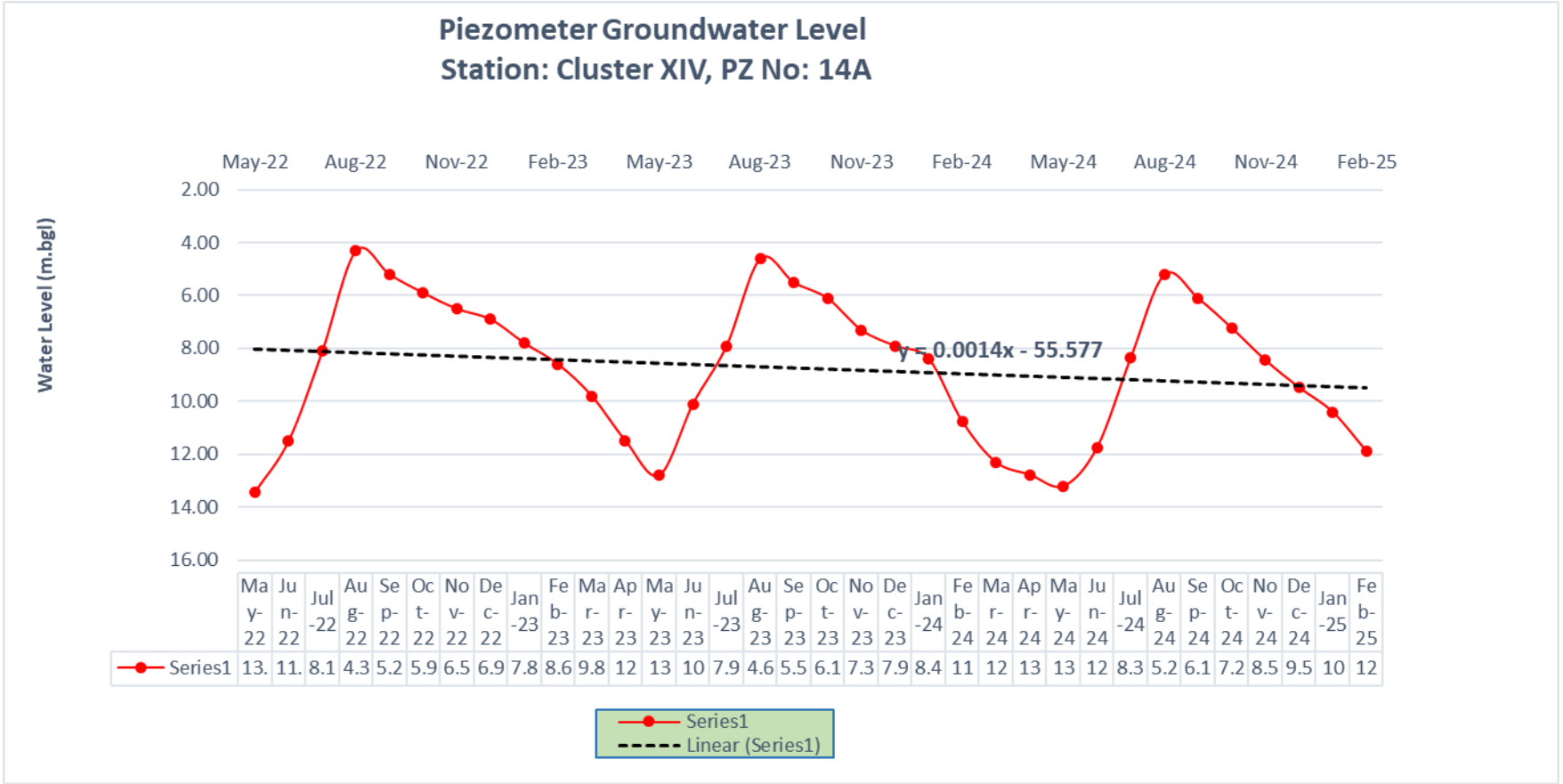
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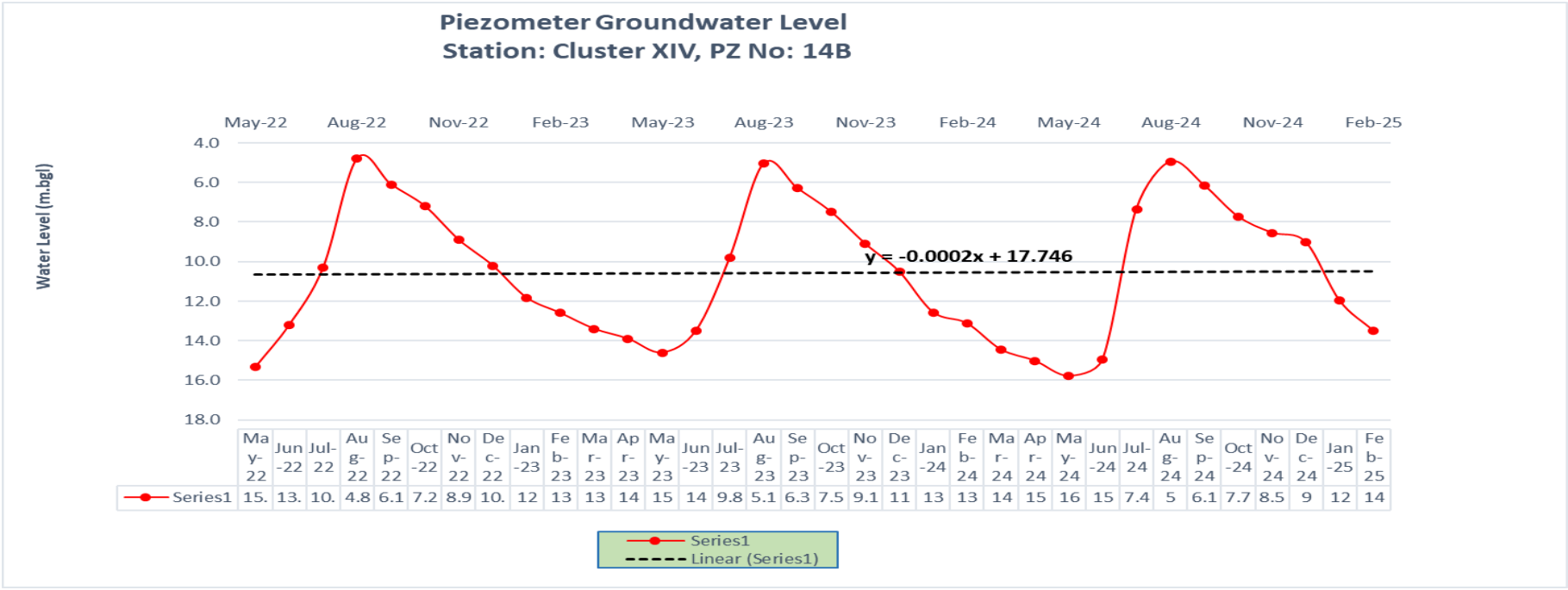
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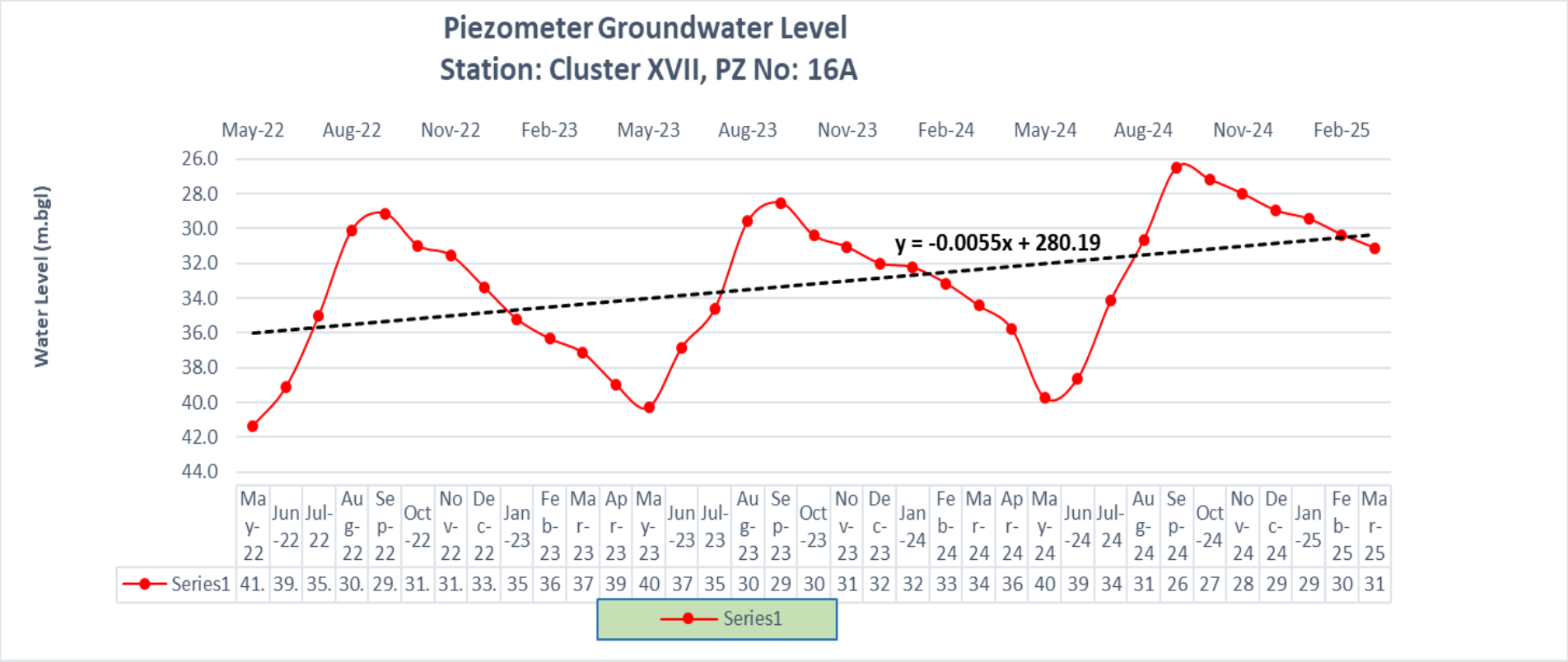


PIEZOMETER HYDROGRAPHS



	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25
Series1	15.	13.	10.	4.8	6.1	7.2	8.9	10.	12	13	13	14	15	14	9.8	5.1	6.3	7.5	9.1	11	13	13	14	15	16	15	7.4	5	6.1	7.7	8.5	9	12	14

PIEZOMETER HYDROGRAPHS



Annexure – VII

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: June month of the assessment year of 2023-24

Sl No	Dug well (CMPDI)	Location	Sampling Date
			June'2024
Jharia Coalfield			
1	**A4**	DALDOLI	12.06.24
2	**A9**	SRIRAMPUR	12.06.24
3	**A10**	PHULWAR	12.06.24
4	**A13**	BHELATANR	11.06.24
5	**A23**	MACHHAYARA	05.06.24
6	**A29**	GOVINDPUR, AMBAGAN VILLAGE	06.06.24
7	**A32**	MOONIDIH BAZAR	05.06.24
8	**B10**	AMDIH NARAYANPUR	06.06.24
9	**B15**	BERA VILLAGE	07.06.24
10	**B19**	BHANDARIDAH	07.06.24
11	**B23**	LOHAPATTI VILLAGE	05.06.24
12	**B32**	MADHUBAND VILLAGE	06.06.24
13	**B40**	BHUIANCHITRO	07.06.24
14	**B46**	TELO	07.06.24
15	**B55**	RANTANR VILLAGE	12.06.24
16	**B59**	KHODOVALY VILLAGE	06.06.24
17	**B64**	KESHALPUR, BATIGHAR	06.06.24
18	**D2**	BIRSA MUNDA CHAWK, BANKMORE	03.06.24
19	**D4**	JHARIA THANA	03.06.24
20	**D5**	JIYALGORA (NEAR P.O.)	03.06.24
21	**D14**	KARMATANR	13.06.24
22	**D19**	MEMKO MORE	06.06.24
23	**D25**	GODHUR MORE	05.06.24
24	**D30**	BORKIBOA VILLAGE	06.06.24
25	**D35**	PATHERDIH RAILWAY COLONY	06.07.24
26	**D41**	JOYRAMPUR	03.06.24
27	**D49**	TISRA THANA	03.06.24
28	**D59**	SITALPUR	04.06.24
29	**D70**	JALADIH	04.06.24
30	**D72**	CHATI GOVINDPUR	07.06.24
31	**D80**	DHANSAR MINE RESCUE STATION	03.06.24
32	**D96**	BANSHRA	04.06.24
33	**D107**	BOGULA	04.06.24
34	**D112**	DEMUDI (DOMATANR)	05.06.24
35	**D115**	TELMUCHU	06.07.24

Sl No	Dug well (CMPDI)	Location	Sampling Date
			June'2024
Raniganj Coalfield			
1	DB-2A	Sulibari	13.06.24
2	DB-4	Sarbari	14.06.24
3	DB-8	Chungei	14.06.24
4	DB-10	Kulti	14.06.24
5	DB-12	Sabanpur	14.06.24
6	DB-13	Dendua More	14.06.24
7	DB-18	Luchibad	13.06.24
8	DB-26	Ledaharia	13.06.24
9	DB-27	Hodla	13.06.24
10	DB-29	Kelyasol	13.06.24
11	DB-30	Ramkanali	14.06.24
12	DB-38	Lukudih	14.06.24
13	DB-39	Pandra	14.06.24
14	K-12	Ethora	14.06.24
15	K-20	Majhladih	14.06.24

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - A10 , PHULWAR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A10**				
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**REM/BCCL/22-23/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**PHULWAR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW3	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code: - A13, BHELATANR*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A13**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**BHELATANR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW4	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code: - A23(MACHHAYARA)

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A23**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**MACHHAYARA**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW5	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	IS 3025(Part 59) : 2006,R:2019, AAS-Flame Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code: - A29, GOVINDPUR,AMBAGAN VILLAGE*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A29**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**GOVINDPUR, AMABAGAN VILLAGE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
		Period of Analysis		**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW6	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - A32 , MOONIDIH BAZAR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A32**			
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**				**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**MOONIDIH BAZAR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**		
			Period of Analysis		**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW7	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code : - A4, DALDOLI*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A4**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**DALDOLI**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW-1	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th d Edition ,Carmine,2023	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 24th Edition, , 4500-Cl-B. (Iodometric Method-I),2023	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th Edition IS-3025,part 56:2003, R-2019/, AAS-VGA,2023	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th Edition, AAS-GTA,2023	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th Edition, AAS-GTA,2023	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code: - A9, SRIRAMPUR*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**A9**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**		**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**SRIRAMPUR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**TO**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW2	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	114	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	88	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.65	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	80	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	22.24	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	128	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	266	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	782	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	614	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B10, AMDIH NARAYANPUR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B10**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**AMDIH NARAYANPUR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW8	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	132	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	108	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.64	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	86	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	28.35	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	93	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{O3}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	248	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	854	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	682	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B15, BERA VILLAGE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B15**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**BERA VILLAGE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW9	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	144	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	106	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.71	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	59	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	18.49	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.52	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	125	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	265	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	728	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	604	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B19 , BHANDARIDIH

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B19**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**BHANDARIDAH**	**Date of Sampling**	**06.05.2024**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW10	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	136	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	112	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.51	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	90	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	17.17	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.31	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	140	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{O_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	242	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	834	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	712	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.3	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code: - B23 , LOHAPATTI VILLAGE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B23**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**LOHAPATTI VILLAGE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW11	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	102	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	116	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.78	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	66	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	32.91	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.85	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	119	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	208	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	642	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	528	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.7	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.17	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B32, MADHUBANDAH

Date of Sampling at Station : June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B32**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**MADHUBNAD VILLAGE**	**Date of Sampling**					
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW12	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	122	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	96	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.67	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	80	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	18.55	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.41	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	151	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	188	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	816	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	636	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.1	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.25	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B40 , BHUIANCHITRO

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B40**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**		**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**BHUIANCHITRO**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW13	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	144	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	104	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.81	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	92	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	28.13	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.38	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	181	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	256	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	946	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	738	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.5	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code : - B46 , TELO*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B46**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**TELO**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW14	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	72	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	135	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.59	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	80	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	11.46	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.56	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	96	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	222	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	652	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	508	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.0	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : -B55 , RANTANR VILLAGE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B55**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**		**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**RANTANR VILLAGE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW15	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	110	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	96	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.69	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	70	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	27.68	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	122	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	258	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	712	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	566	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - B59, KHODOVALY VILLAGE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B59**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**KHODOVALY**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW16	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	116	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	128	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.74	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	95	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	19.28	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.72	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	103	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{O3}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	268	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	906	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	682	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	3.0	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - B64 , KESHALPUR,BATIGHAR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**B64**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**KESHALPUR , BATIGHAR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW17	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	96	2.0-800.0	2	75	200
4	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	118	2.0-1500.0	5	250	1000
5	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.68	0.2-2.00	0.2	1	1.5
6	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
7	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	83	6.0-700	6	30	100
8	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	17.88	0.5-45.0	0.5	45	No relaxation
9	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
10	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.63	1-14	0.1	6.5-8.5	No relaxation
11	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	109	10.0-400.0	10	200	400
12	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
13	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	244	4.0-2000.0	4	200	600
14	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	728	25.0-5000.0	25	500	2000
15	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	582	4.0-2000.0	4	200	600
16	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.8	1-800	0.1	1	5
17	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.19	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D107, BOGULA

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D107**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**BOGULA**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW33	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	4	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	112	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	128	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.61	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	88	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	39.28	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.72	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	178	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	275	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	808	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	642	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	3.0	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D112, DEMUDI(DOMATANR)

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D112**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**		**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**DEMUDI(DOMATANR)**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW34	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	86	2.0-800.0	2	75	200
4	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	136	2.0-1500.0	5	250	1000
5	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.82	0.2-2.00	0.2	1	1.5
6	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
7	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	69	6.0-700	6	30	100
8	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	27.88	0.5-45.0	0.5	45	No relaxation
9	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
10	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.63	1-14	0.1	6.5-8.5	No relaxation
11	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	119	10.0-400.0	10	200	400
12	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
13	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	210	4.0-2000.0	4	200	600
14	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	634	25.0-5000.0	25	500	2000
15	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	498	4.0-2000.0	4	200	600
16	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.8	1-800	0.1	1	5
17	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D115 , TELMUCHU

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D115**		**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**				**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**TELMUCHU**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**		
			Period of Analysis		**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW35	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
	Colour, Hazen unit	APHA, 24th Edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	106	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	124	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method,2023	0.73	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.26	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th Edition, 3500-Mg B: Calculation Method,2023	97	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th Edition, UV-Spectrophotometric Method,2023	29.58	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 24th Edition, , 2150-C,2023	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.56	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th Edition, 4500 S , Turbidity Method,2023	159	10.0-400.0	10	200	400
11	Taste	APHA,24th Edition, 2160-C , 2023	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	236	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	837	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	665	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.1	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

*17***All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D14 , KARMATANR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D14**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**KARMATANR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW21	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	128	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	122	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.59	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	58	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	11.95	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.38	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	114	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{O_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	248	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	664	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	560	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D19, MEMKO MORE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D19**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**		
Sampling Stations	**MEMKO MORE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**TO**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW-22	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	88	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	94	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.67	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.46	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	51	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	17.50	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.52	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	91	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{O_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	242	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	622	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	428	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

***All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. *Ground Water Sampling at Monitoring Station Code : - D2 , BIRSA MUNDA CHAWK,BANKMORE*

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D2**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**BIRSA MUNDA CHAWK , BANKMORE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW-18	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
	Colour, Hazen unit	APHA, 24th Edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	114	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	124	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method,2023	0.82	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th Edition, 3500-Mg B: Calculation Method,2023	92	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th Edition, UV-Spectrophotometric Method,2023	12.38	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 24th Edition, , 2150-C,2023	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.56	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th Edition, 4500 S , Turbidity Method,2023	95	10.0-400.0	10	200	400
11	Taste	APHA,24th Edition, 2160-C , 2023	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	230	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	837	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	665	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

*17***All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D25 , GODHUR MORE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D25**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**GODHUR MORE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**TO**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW23	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	128	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	120	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.62	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	100	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	23.92	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.61	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	138	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	292	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	832	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	732	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.24	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

1. Ground Water Sampling at Monitoring Station Code : - D30 , BORKIBOA VILLAGE

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D30**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**BORKIBOA VILLAGE**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW24	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	104	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	116	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.74	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	68	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	22.26	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.56	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	144	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{O_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	232	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	742	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	540	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D35 , PATHERDIH RAILWAY COLONY

1.

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D35**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**PATHERDIH RAILWAY COLONY**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW25	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	124	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	138	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.78	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	74	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	30.35	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	167	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	264	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	772	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	615	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.5	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D4 , JHARIA THANA

1.

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D4**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**JHARIA THANA**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**TO**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW19	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	110	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	88	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.71	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	125	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	22.24	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	168	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{O_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	296	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	942	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	790	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.5	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D41 , JOYRAMPUR

1.

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D41**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**JOYRAMPUR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW26	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	164	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	132	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.71	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	51	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	8.49	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.52	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	67	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	265	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	838	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	620	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.3	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D49 , TISRA THANA

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D49**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**TISRA THANA**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW27	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	118	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	98	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.53	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	79	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	17.58	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.31	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	126	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	229	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	736	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	620	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D5, JIYALGORA (NEAR P.O.)

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D5**	**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**JIYALGORA (NEAR P.O)**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW 20	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	126	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	98	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.63	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	66	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	13.64	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.52	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	135	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	265	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	738	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	586	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D59, SITALPUR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D59**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**SITALPUR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW28	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	118	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	122	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.83	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	81	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	22.91	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.85	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	134	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	282	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	829	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	630	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D70 JALADIH

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D70**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**JALADIH**	**Date of Sampling**					
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW29	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	92	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	112	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.69	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.21	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	103	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	18.55	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.41	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	111	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	192	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	808	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	654	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.3	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.23	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D72, CHATI GOVINDPUR

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D72**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**CHATI GOVINDPUR**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW30	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	152	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	78	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.74	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	108	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	28.13	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.38	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	158	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_ac_{03}), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	278	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	966	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	824	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.5	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D80 DHANSAR MINE RESCUE STATION

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D80**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**DHANSAR MINE RESCUE STATION**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis			**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW31	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	116	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	138	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.61	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	63	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	21.46	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.56	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	133	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	278	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	748	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	548	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.2	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.19	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - D96 BANSHRA

Date of Sampling at Station: June 2024

Month & Year	**June 2024**	**Dug Well No.**	**D96**			**ULR No.**	
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**19.09.2024**
Project	**Jharia Coalfield**		**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**BANSHRA**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
			Period of Analysis		**to**		

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW32	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	126	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	94	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.79	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	50	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	27.68	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.44	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	165	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	232	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	637	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	522	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER SAMPLES

(Wherever not specified, characteristics are expressed in mg/l, maximum)

Ground Water Sampling at Monitoring Station Code : - DB2A

Date of Sampling at Station: June 2024

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
GROUND WATER ANALYSIS TEST REPORT

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Month & Year	**June 2024**	**Dug Well No.**	**DB-2A**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Joyrampur Village**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW36	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	98	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	88	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.61	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	98	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	24.31	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.94	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	162	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	245	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	782	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	650	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

(Amit Raj Mishra)

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-2A**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Joyrampur Village**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW36	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
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GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
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Month & Year	**June 2024**	**Dug Well No.**	**DB-4**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Sarbari**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW37	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	116	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	76	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.48	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	95	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	30.19	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.86	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	95	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	265	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	974	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	680	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
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Month & Year	**June 2024**	**Dug Well No.**	**DB-4**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Sarbari**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW37	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
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Month & Year	**June 2024**	**Dug Well No.**	**DB-8**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Chungei**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	Parameter	Method of Analysis	Observed Values GW38	Range Of Testing	LDL	IS 10500: 2012 Acceptable Limit (Max)*	Permissible Limit in the Absence of Alternate Source (Max)
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	92	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	58	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.48	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	46	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	2.60	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.01	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	44	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	178	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	537	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	420	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.7	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-8**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Chungei**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW38	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-10**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Kulti**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	Parameter	Method of Analysis	Observed Values GW-39	Range Of Testing	LDL	IS 10500: 2012 Acceptable Limit (Max)*	Permissible Limit in the Absence of Alternate Source (Max)
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	74	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	80	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.54	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	50	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	27.35	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.91	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	114	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	172	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	533	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	390	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.2	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.14	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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REVIEWED BY

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-10**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Kulti**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW39	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	IS 3025(Part 59) : 2006,R:2019, AAS-Flame Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-12**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Sabanpur**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW40	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	38	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	42	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.30	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.21	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	21	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	24.09	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.03	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	132	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	292	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	245	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	182	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.31	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-12**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Sabanpur**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW40	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	0.07	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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GROUND WATER ANALYSIS TEST REPORT

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Month & Year	**June 2024**	**Dug Well No.**	**DB-13**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Dendua More**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW41	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	58	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	40	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.49	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	33	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	34.4	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.02	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	108	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	158	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	350	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	280	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-13**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Hurriladih**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Dendua More**	**Date of Sampling**	**06.05.2024**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW41	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II

GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
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Month & Year	**June 2024**	**Dug Well No.**	**DB-18**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**RCF**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Luchibad**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**TO**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW42	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	62	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	54	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.36	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	39	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	8.07	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.00	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	64	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	162	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	400	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	316	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
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Month & Year	**June 2024**	**Dug Well No.**	**DB-18**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**RCF**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Luchibad**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW42	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.10-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	IS APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-26**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ledaharia**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW43	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	64	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	42	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.82	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	39	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	29.30	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.75	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	166	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	155	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	393	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	320	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	3.0	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-26**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ledaharia**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW43	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-27**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Hodla**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW44	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	54	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	60	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.56	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	45	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	5.16	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.92	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	58	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	228	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	428	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	320	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-27**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Hodla**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW44	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

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REVIEWED BY

(Amit Raj Mishra)
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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-29**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**RCF**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Kelyasol**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW45	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	128	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	164	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.59	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	51	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	6.37	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.93	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	74	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	245	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	692	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	530	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.6	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-29**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Keliyasol**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW45	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

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Month & Year	**June 2024**	**Dug Well No.**	**DB-30**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ramkanali**	**Date of Sampling**			
		Period of Analysis		**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW46	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	102	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	72	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.77	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	0.26	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	95	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	24.7	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.98	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	111	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	272	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	718	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	648	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.3	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.12	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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(Amit Raj Mishra)
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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-30**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ramkanali**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW46	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-38**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Lukudih**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**13.05.2024** to **07.08.2024**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW47	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	122	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	68	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.39	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	97	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	22.68	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.06	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	142	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	278	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	826	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	705	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.5	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

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Month & Year	**June 2024**	**Dug Well No.**	**DB-38**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Lukudih**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**13.05.2024** to **07.08.2024**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW47	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-39**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Pandra**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**06.05.2024** to **07.08.2024**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW48	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	3	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	120	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	84	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.86	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	73	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	9.54	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.09	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	71	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity (c_aco_3), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	264	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	748	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	602	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.2	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	0.18	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise.*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit.*

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(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**DB-39**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Pandra**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**06.05.2024** to **07.08.2024**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW48	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**K-12**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ethora**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**to**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW49	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	72	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	44	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.73	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	73	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	1.40	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.41	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	41	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	210	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	591	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	480	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**K-12**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ethora**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW49	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**K-20**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**Raniganj Coalfield**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Majhladih**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis		**to**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW50	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	62	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	58	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.76	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	40	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	28.55	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.64	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th edition, 4500 S , Turbidity Method	103	10.0-400.0	10	200	400
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_a co_3$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	235	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	438	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	318	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	2.9	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

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GROUND WATER ANALYSIS TEST REPORT

Month & Year	**June 2024**	**Dug Well No.**	**K-20**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**30.08.2024**
Project	**RCF**	**Sample Ref. No.**	**RI-II/HYDROGEOLOGY/24-25/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Majhladih**	**Date of Sampling**		**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**13.05.2024 to 07.08.2024**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW50	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 23rd Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24th Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Kumar Vaibhav)
REVIEWED BY

(Amit Raj Mishra)
Authorised Signatory

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Abbreviations

Abn.: Abandoned
AMSL: Above mean sea level
Avg.: Average
APT: Aquifer Pumping Test
BCCL: Bharat Coking Coal Ltd.
bgl: Below Ground Level
Buffer zone: periphery of the 10 km radius from the project boundary
Core zone: Project / mine / colliery boundary (leasehold area)
CMPDI: Central Mine Plan & Design Institute
DVC: Damodar Valley Corporation
DTW: Depth to water level
GW: Groundwater
IMD: Indian Meteorological Division
JCF: Jharia Coalfield
RCF: Raniganj Coalfield
MADA: Mineral Area Development Authority
MCM: Million Cubic Meter
MGD: Million Gallon per day
NTU: Nephlometric Turbidity unit
OC / UG: Opencast / Underground
OCP / UGP: Opencast Project / Underground Project
RL: Reduced Level
RWH: Rainwater Harvesting
FF: Fire Fighting

PLATES

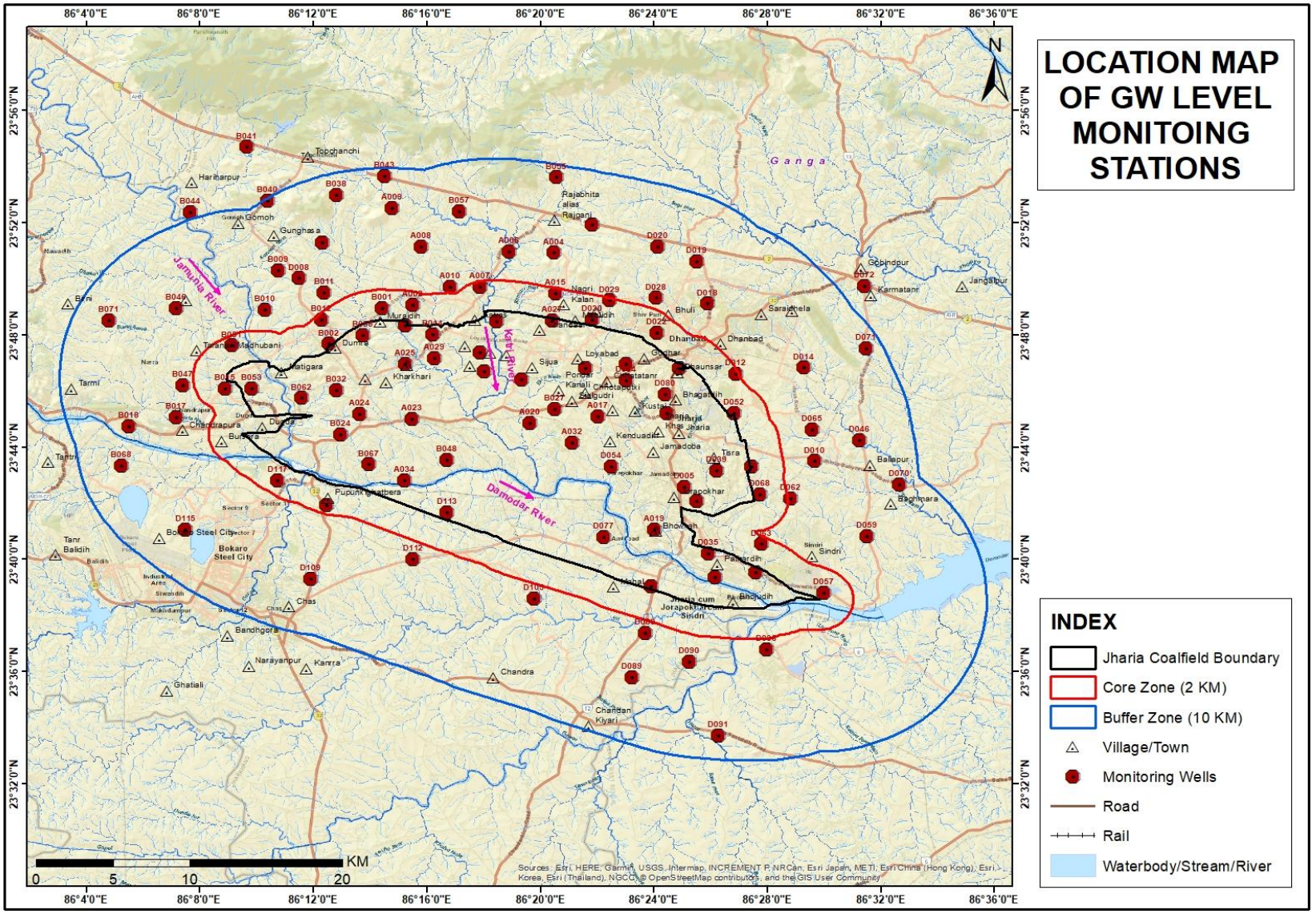


Plate- I: Location Map of Groundwater Level Monitoring stations

JOB NO: 200424005

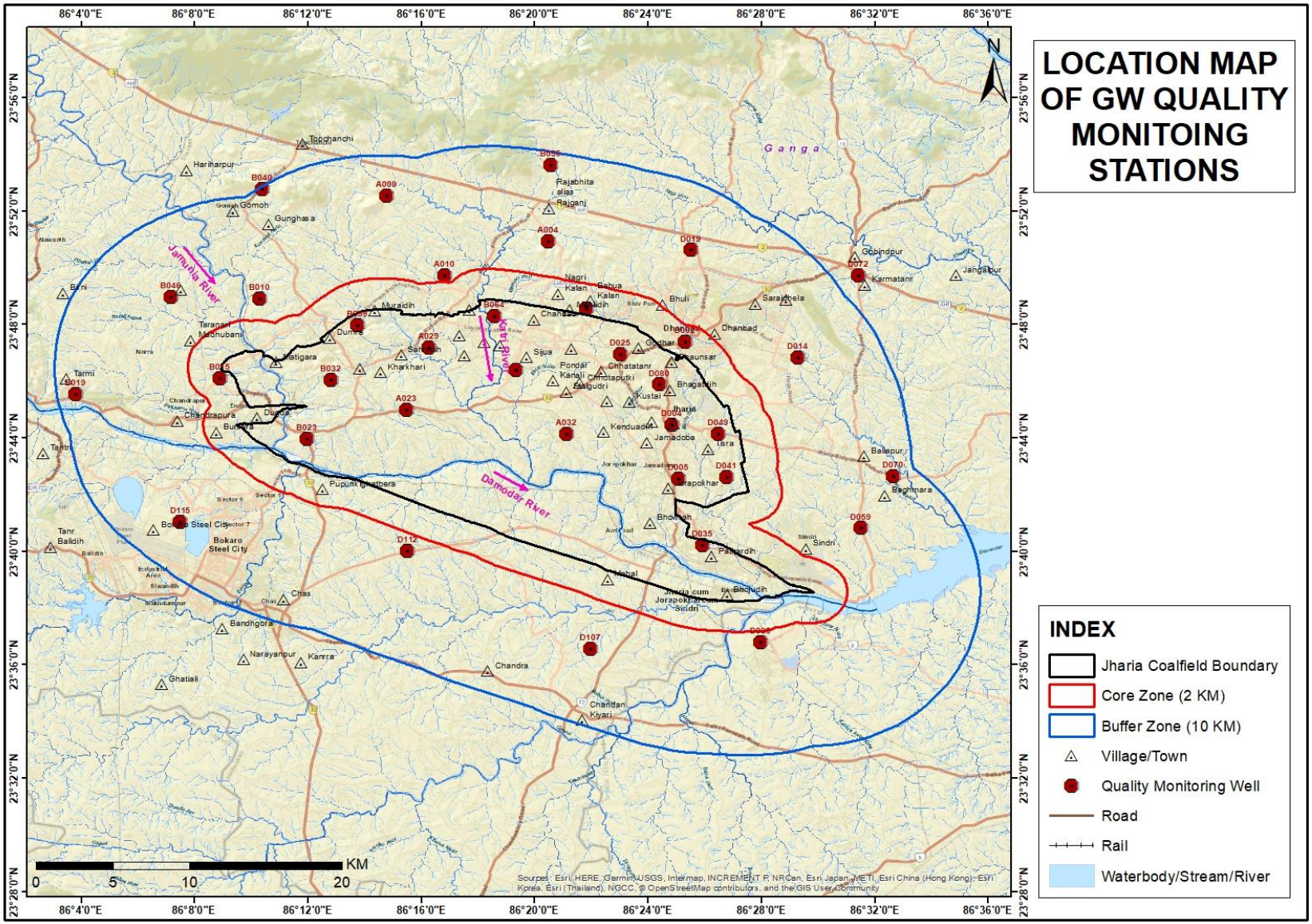


Plate- II: Location Map of Groundwater Quality Monitoring stations

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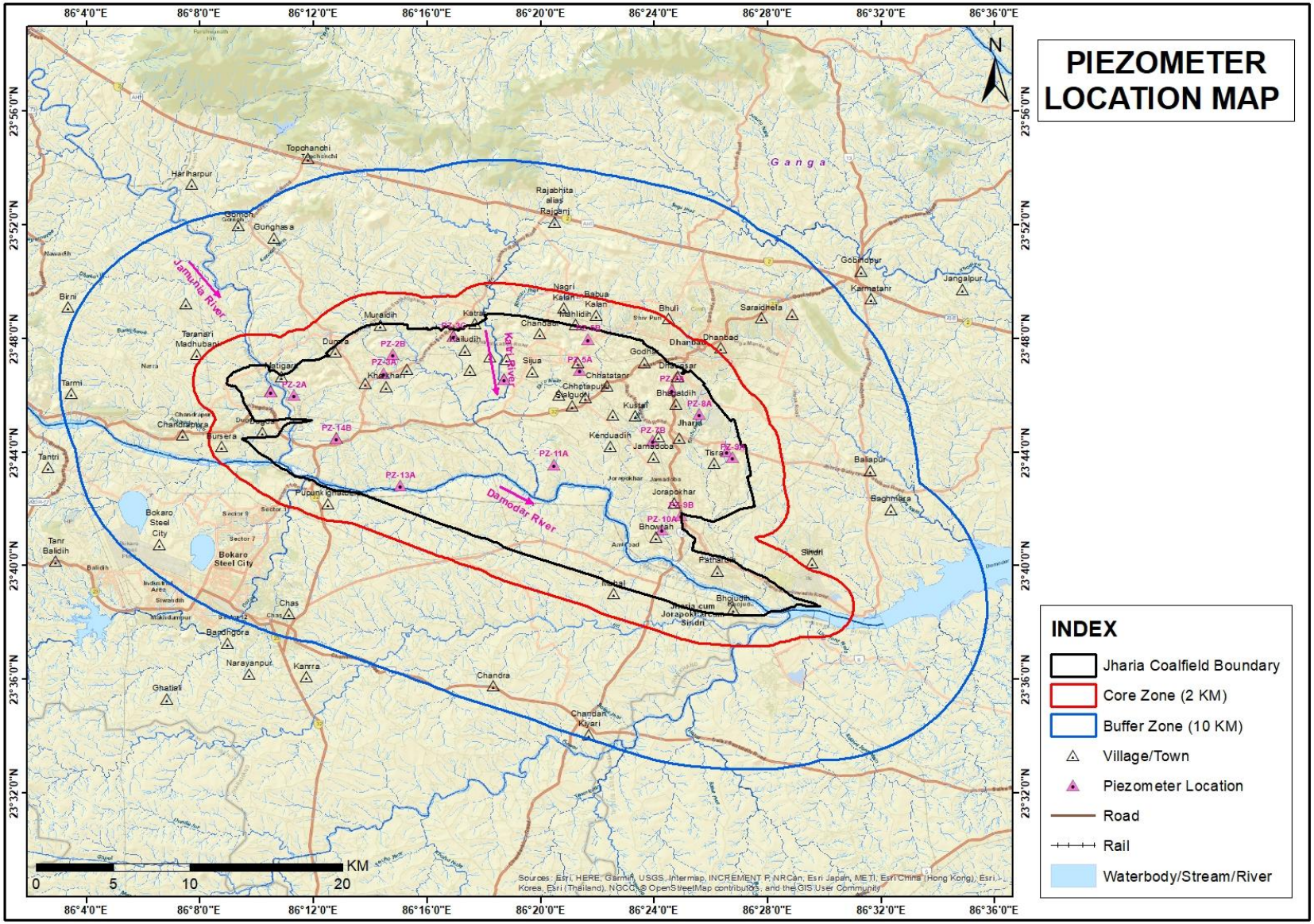


Plate- III: Location Map of Piezometers

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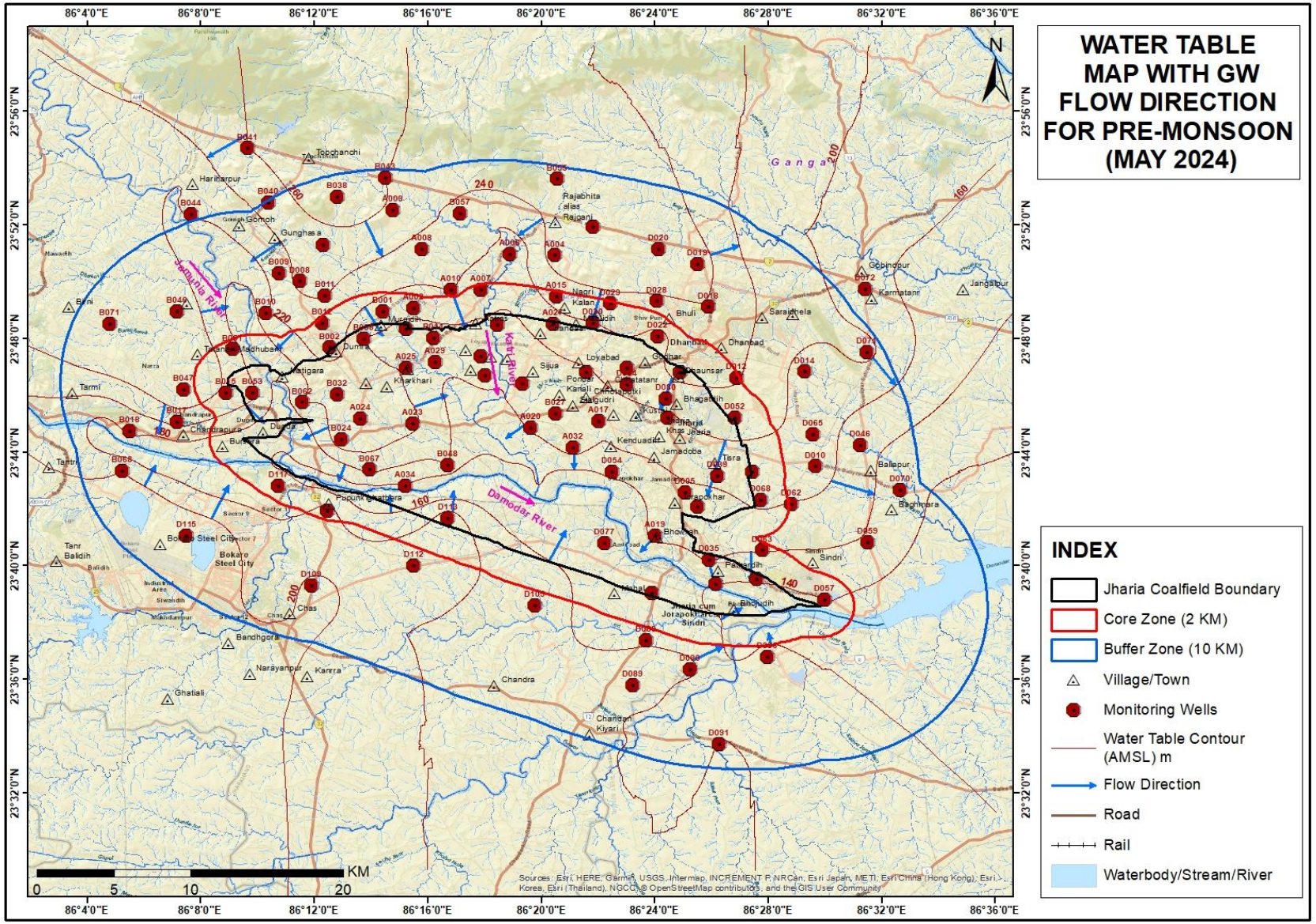


Plate- IVA: Water table Contour Map of JCF, Pre Monsoon (May'24)

JOB NO: 200424005

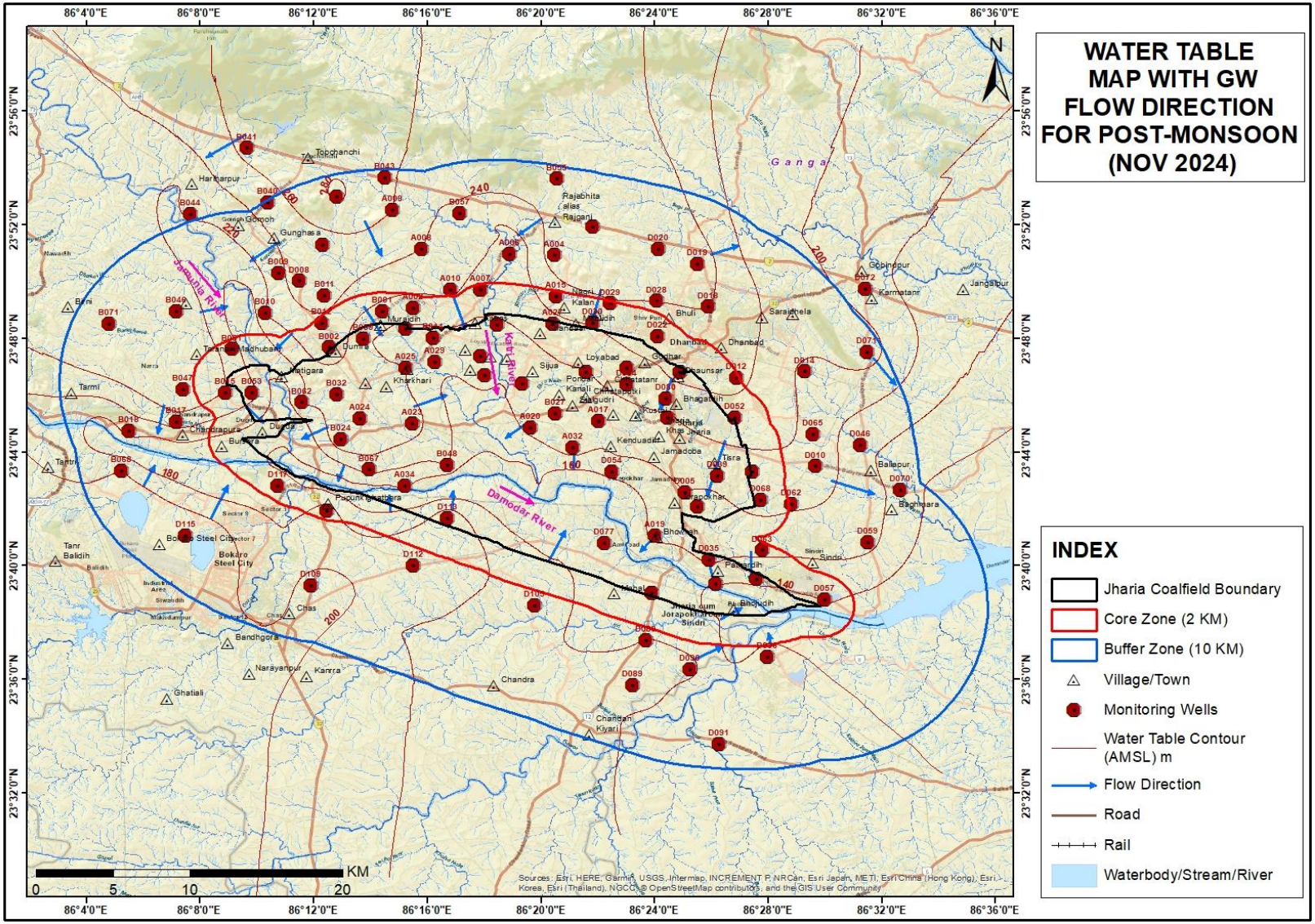


Plate- IVB: Water table Contour Map of JCF, Post Monsoon (Nov'24)

JOB NO: 200424005

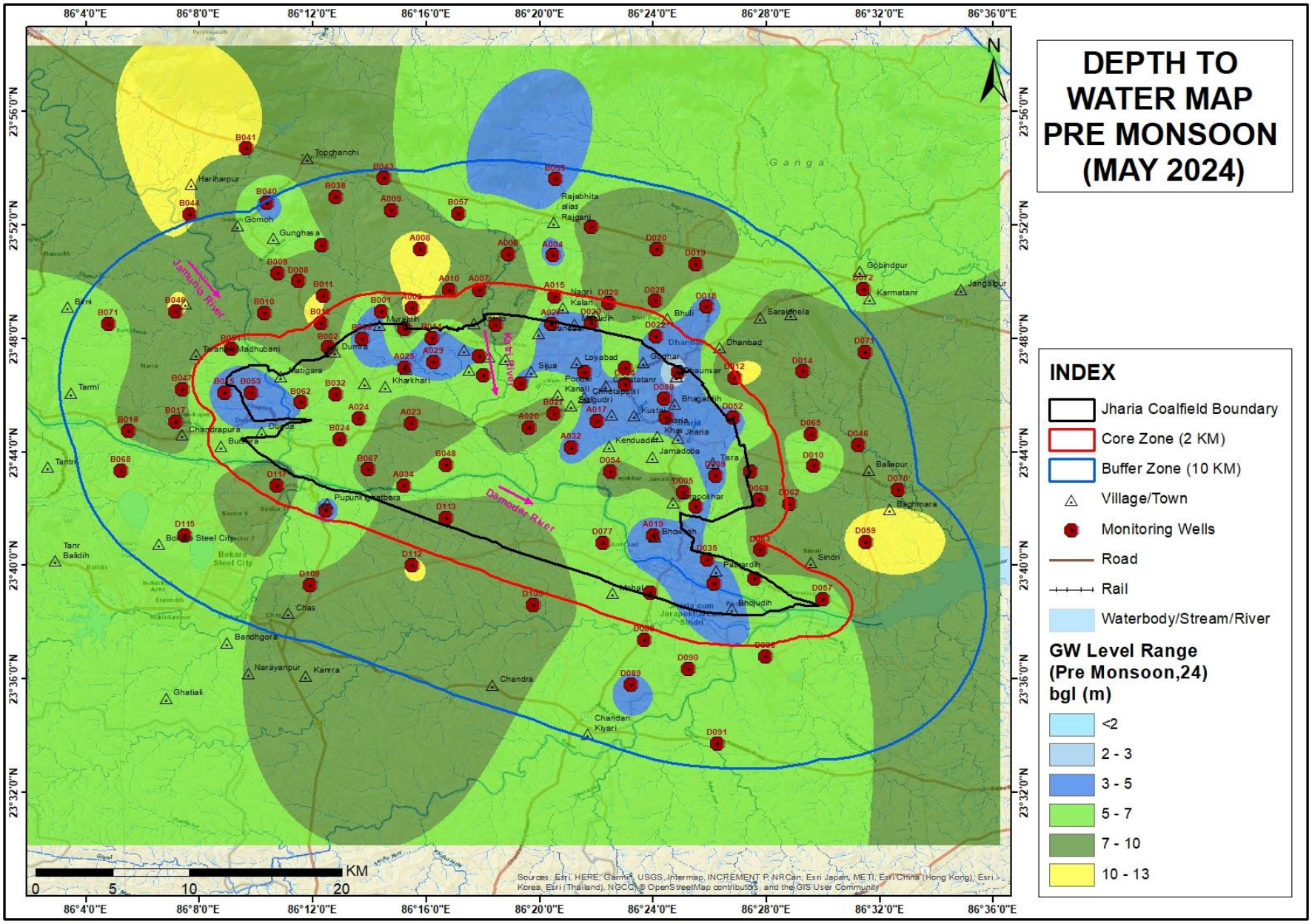


Plate- VA: Depth to Groundwater Level map of JCF, Pre Monsoon (May'24)

JOB NO: 200424005

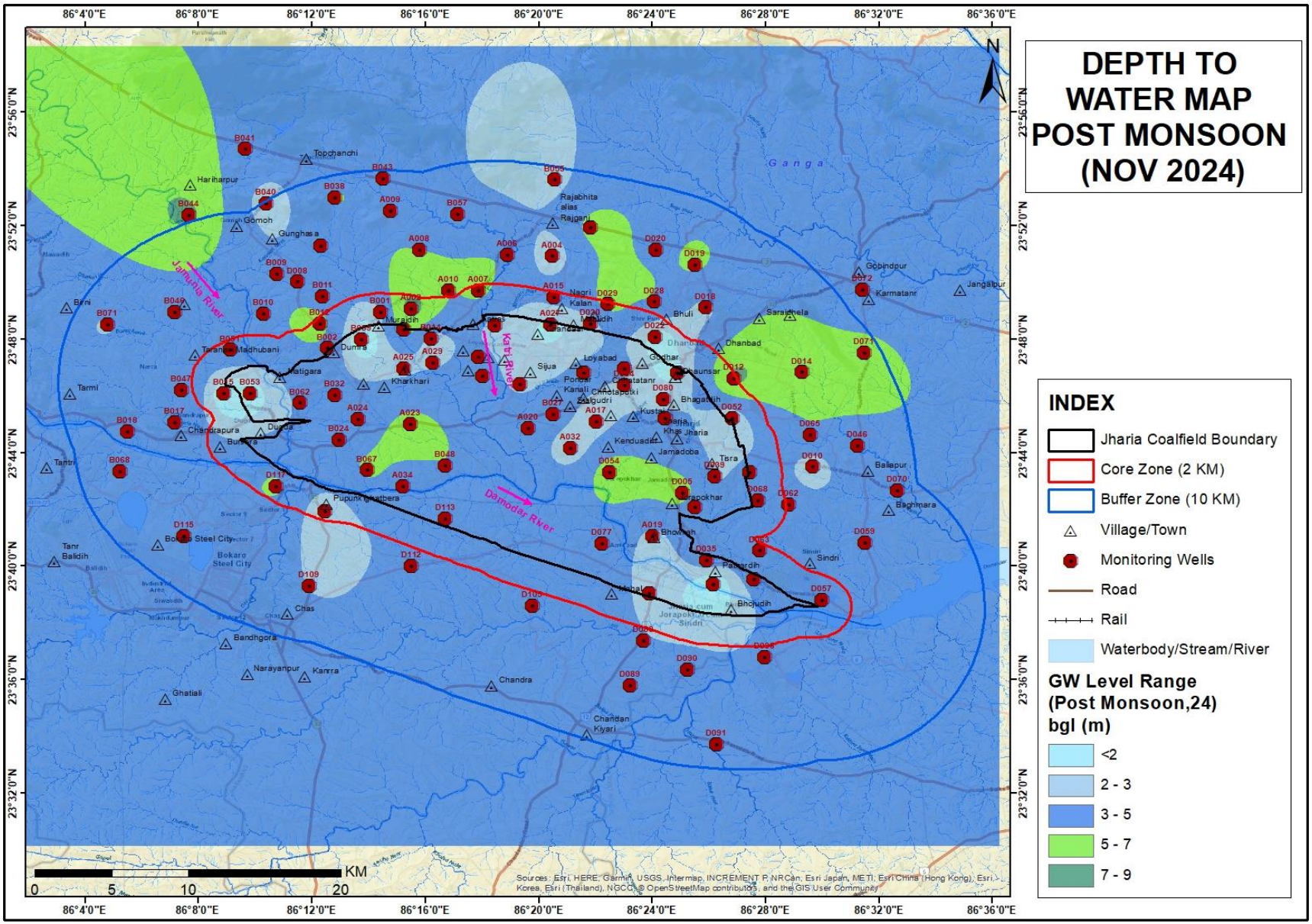


Plate- VB: Depth to Groundwater Level map of JCF, Post Monsoon (Nov'24)

JOB NO: 200424005

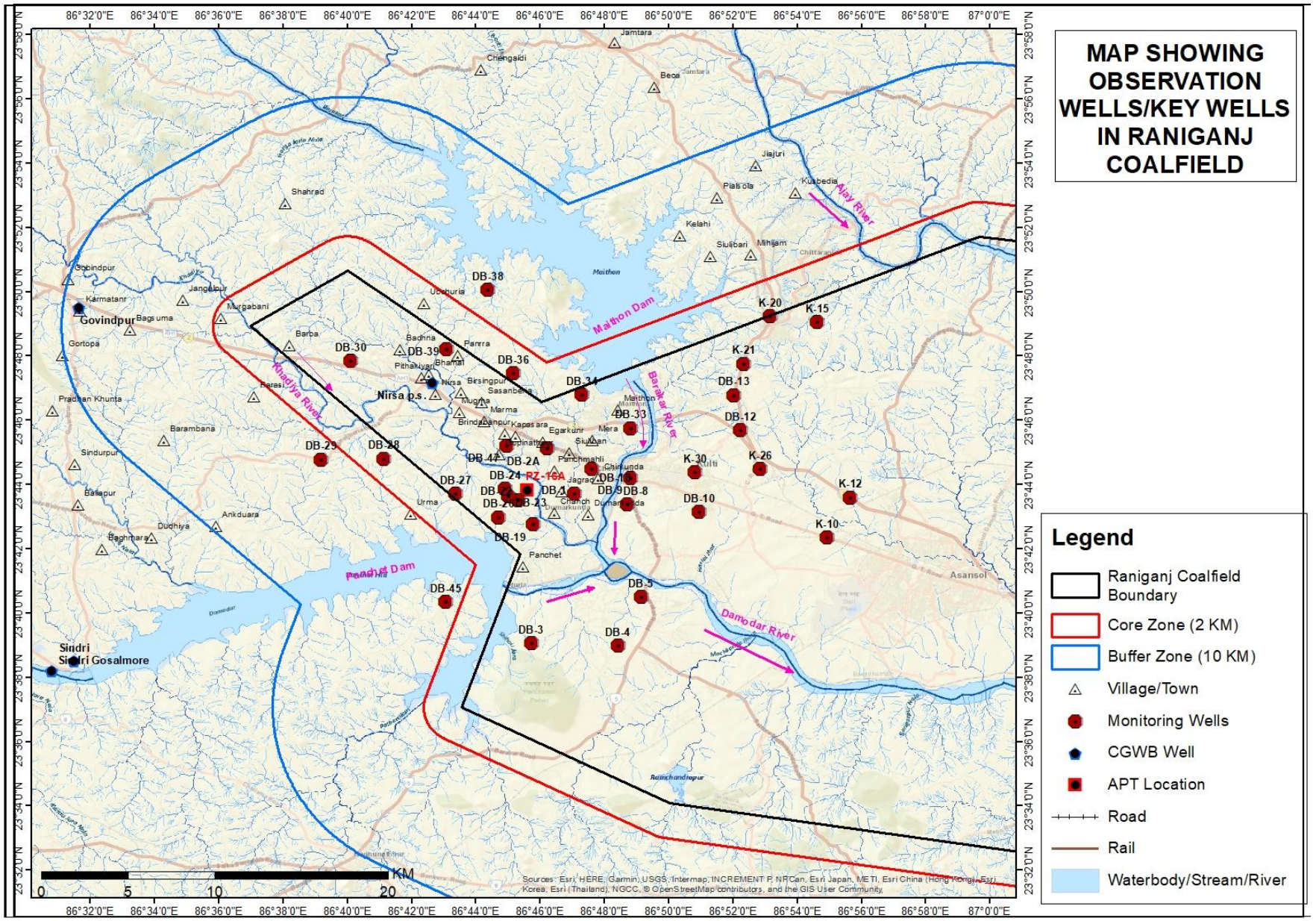


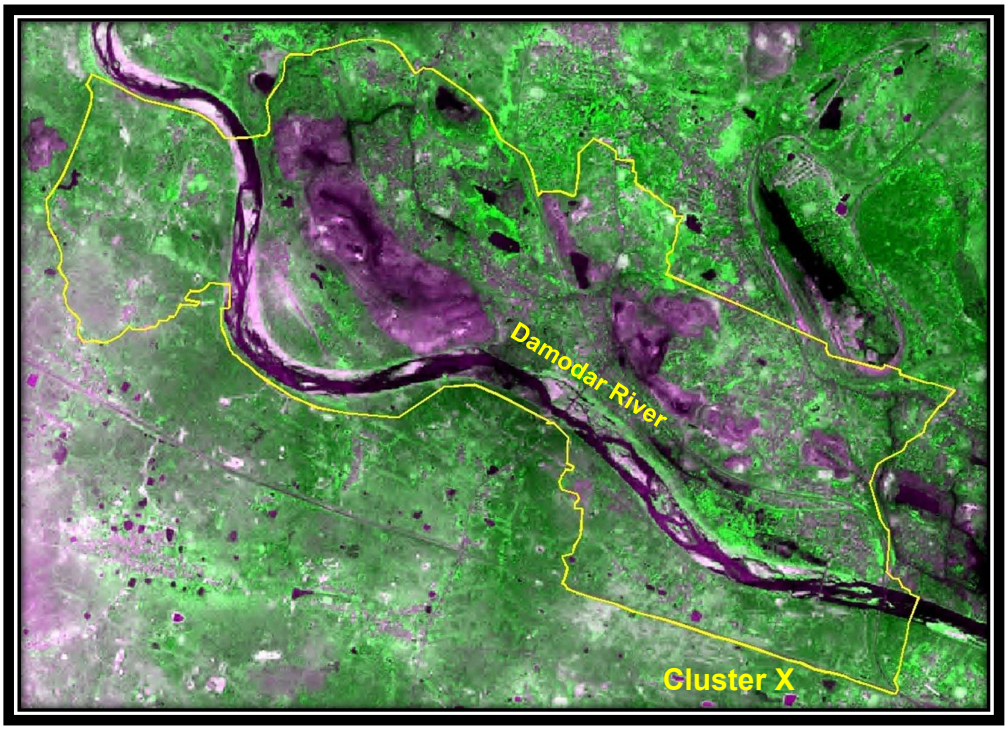
Plate- VI: Drainage Map (Part of RCF Coalfield under BCCL Command Area)

JOB NO: 200424005

Annexure-VI

भारत कोकिंग कोल लिमिटेड के ५ मिलियन घन मीटर (कोल+अधिभार) से कम उत्पादन क्षमतावाले ०५ क्लस्टर (खुली + भूमिगत खदानों के समूह) का भूमि पुनरुद्धार हेतु वर्ष २०२४ के उपग्रह डाटा के आधार पर निगरानी का प्रतिवेदन

Land Reclamation/ Restoration Monitoring of five Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data of the Year 2024



Submitted to

Bharat Coking Coal Limited

भारत कोकिंग कोल लिमिटेड के ५ मिलियन घन मीटर (कोल+अधिभार) से कम उत्पादन क्षमतावाले ०५ क्लस्टर (खुली + भूमिगत खदानों के समूह) का भूमि पुनरुद्धार हेतु वर्ष २०२४ के उपग्रह डाटा के आधार पर निगरानी का प्रतिवेदन

Land Reclamation/ Restoration Monitoring of five Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data of the Year 2024

March - 2025

Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

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कार्यकारी सारांश

१ परियोजना भारत कोकिंग कोल लिमिटेड के ५ मिलियन घन मीटर (कोल + अधिभार) से कम उत्पादन क्षमतावाले ०५ क्लस्टर अर्थात (भूमिगत + खुली) खदानों के समूह के पुनरुद्धार हेतु वर्ष २०२४ के उपग्रह डाटा पर आधारित तीन साल के अन्तराल पर नियमित निगरानी।

२ उद्देश्य भूमि पुनरुद्धार (लैंड रिक्लेमेशन) का उद्देश्य कुल पट्टाक्षेत्र में बैकफील, वृक्षारोपण, सामाजिक वानिकी, सक्रिय खनन क्षेत्र, जल निकाय (वाटर ड्रेनेज), बंजर भूमि, कृषि भूमि और जंगल के विभिन्न प्रकार के वितरण प्रणाली के क्षेत्र का आकलन करने के लिए है। यह अध्ययन उपरोक्त सभी क्लस्टरों के भूमि पुनरुद्धार (लैंड रिक्लेमेशन) का निगरानी के प्रगति का आकलन करने में मदद करेगा तथा इसके अतिरिक्त पर्यावरण संरक्षण के लिए आवश्यक उपचारात्मक उपायों को क्रियान्वित करने में भी सहायता करेगा।

३ मुख्य निष्कर्ष

- वर्ष २०२४-२५ में भूमि पुनरुद्धार (लैंड रिक्लेमेशन) हेतु चयन किये गए कुल ०५ क्लस्टरों का कुल पट्टाक्षेत्र अथवा माइन लीज होल्ड एरिया ९४११.५४ हेक्टेयर है, जिसमें १४६१.७७ हेक्टेयर उत्खनन क्षेत्र के अंतर्गत है तथा इस उत्खनन क्षेत्र में से ८१.०६ हेक्टेयर (५.५५%) क्षेत्र में जैविक पुनरुद्धार (बैकफील पर बृक्ष।रोपण) किया गया है तथा ९२३.४८ हेक्टेयर (६३.१८%) क्षेत्र में तकनीकी पुनरुद्धार (बैकफीलिंग) का कार्य प्रगति पर है और शेष ४५७.२३ हेक्टेयर (३१.२८%) क्षेत्र सक्रिय खनन के अन्तर्गत है। क्लस्टरवार भूमि पुनरुद्धार (लैंड रिक्लेमेशन) के निगरानी का वर्णन विस्तार रूप से तालिका संख्या ०१ में दर्शाया गया है ।

- सिआईएल से प्राप्त कार्य आदेश के खंड २.(ii) अनुसार तीन-वर्षीय चक्र में निगरानी के अंतर्गत आने वाले शेष १० क्लस्टरों की समग्र भूमि पुनरुद्धार स्थिति तालिका १.१ में दी गई है, ताकि सभी क्लस्टरों से संबंधित जानकारी हर वर्ष उपलब्ध कराई जा सके।

- वर्ष २०२४ के उपग्रह डाटा के विश्लेषण से यह देखा गया है कि तकनीकी पुनरुद्धार (बैकफ़िलिंग) के तहत क्षेत्र ७१२.९० हेक्टेयर (वर्ष २०२१) से बढ़कर ९२३.४८ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में २१०.५८ हेक्टेयर की वृद्धि दर्शाता है।

- जैविक पुनरुद्धार (बैकफील पर बृक्ष।रोपण) के तहत क्षेत्र ६१.९२ हेक्टेयर (वर्ष २०२१) से बढ़कर ८१.०६ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में १९.१४ हेक्टेयर की वृद्धि दर्शाता है।

- अधिभार पर किए गए वृक्षारोपण के तहत क्षेत्र १४९.८४ हेक्टेयर (वर्ष २०२१) से घटकर ९८.६९ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में ५१.१५ हेक्टेयर की कमी दर्शाता है।

- सामाजिक वानिकी के अंतर्गत वृक्षारोपण के तहत क्षेत्र ७५७.१८ हेक्टेयर (वर्ष २०२१) से घटकर ७५२.६२ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में ४.५६ हेक्टेयर की कमी दर्शाता है।

- सक्रिय खनन के अंतर्गत क्षेत्र ४४३.३६ हेक्टेयर (वर्ष २०२१) से बढ़कर ४५७.२३ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में १३.८७ हेक्टेयर की वृद्धि दर्शाता है।

- कुल उत्खनन क्षेत्र १२१८.१८ हेक्टेयर (वर्ष २०२१) से बढ़कर १४६१.७७ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में २४३.५९ हेक्टेयर की वृद्धि दर्शाता है।

- कुल वृक्षारोपण अथवा हरित आवरण के तहत कुल क्षेत्र ९६८.९४ हेक्टेयर (वर्ष २०२१) से घटकर ९३२.३७ हेक्टेयर (वर्ष २०२४) हो गया है जो वर्ष २०२१ के संबंध में ३६.५७ हेक्टेयर की कमी दर्शाता है।

- निगरानी के लिए बनाई गई तालिका-१ में उल्लिखित बिसीसीएल की विभिन्न क्लस्टरों में वर्ष २०२४ के लिए भूमि पुनरुद्धार की स्थिति की तुलना वर्ष २०२१ से करने पर, विश्लेषण से यह स्पष्ट है कि भूमि पुनरुद्धार के तहत क्षेत्र ७७४.८२ हेक्टेयर (वर्ष २०२१) से बढ़कर १००४.५४ हेक्टेयर (वर्ष २०२४) हो गया है।

- इस रिपोर्ट और निष्कर्षों को आगे की निगरानी और सुधार संबंधी गतिविधियों के लिए आधार माना जाएगा।

Executive Summary

1. **Project** — Land reclamation/ restoration monitoring of five clusters of (Opencast + Underground) coal mines of Bharat Coking Coal Ltd. (BCCL), based on satellite data on every three-year basis.

2. **Objective** — Objective of land reclamation/ restoration monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, distribution of wasteland, agricultural land and forest in the leasehold area of the project. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.

3. **Salient Findings**

- Out of the total mine leasehold area of 9411.54 Ha. of the 05 clusters producing less than 5mcm (Coal+OB) annually considered for monitoring during the year 2024-25; total excavated area is 1461.77 Ha. out of which 81.06 Ha. area (5.55%) has been planted on backfill (Biological Reclamation) and 923.48 Ha. area (63.18%) is under backfilling (Technical Reclamation) and 457.23 Ha. area (31.28%) under active mining. Cluster wise details of land reclamation of the above Clusters is given in Table-1.

- A composite land reclamation status of the remaining 10 Clusters that are covered under monitoring in the three-year cycle is given in Table 1.1 so that information related to all Clusters will be made available every year as per clause 2.(ii) of the received work order from CIL.

- It has been observed from the analysis of Satellite Data of the year 2024 that area under technical reclamation (backfilling) has increased from 712.90 Ha. (Yr.2021) to 923.48 Ha. (Yr.2024)

which indicates an increase of 210.58 Ha. with respect to the year 2021.

- Area under biological reclamation has increased from 61.92 Ha. (Yr.2021) to 81.06 Ha. (Yr.2024) which indicates an increase of 19.14 Ha. with respect to the year 2021.

- Plantation on OB dump has decreased from 149.84 Ha. (Yr.2021) to 98.69 Ha. (Yr.2024) which indicates a decrease of 51.15 Ha. with respect to the year 2021.

- Plantation under social forestry has decreased from 757.18 Ha. (Yr.2021) to 752.62 Ha. (Yr.2024) which indicates a decrease of 4.56 Ha. with respect to the year 2021.

- Area under active mining has increased from 443.36 Ha. (Yr.2021) to 457.23 Ha. (Yr.2024) which indicates an increase of 13.87 Ha. with respect to the year 2021.

- Total excavated area has increased from 1218.18 Ha. (Yr.2021) to 1461.77 Ha. (Yr.2024) which indicates an increase of 243.59 Ha. with respect to the year 2021.

- Total area under plantation (green cover) has decreased from 968.94 Ha. (Yr.2021) to 932.37 Ha. (Yr.2024) which indicates a decrease of 36.57 Ha. with respect to the year 2021.

- On comparing the status of land reclamation for the year 2024 with respect to the year 2021 in different Clusters of BCCL mentioned in Table 1, undertaken for monitoring, it is evident from the analysis that area under land reclamation has increased from 774.82 Ha. (Yr.2021) to 1004.54 Ha. (Yr.2024).

- This report and the findings will be considered as basis for further monitoring and reclamation related activities.

Table-1
Land Reclamation Status in five Clusters (Underground + Opencast Mines) of BCCL based on Satellite Data of the Year 2024

(Area in Hectare)

Sl. No.	Cluster No.	Total Leasehold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold)		Total Area under Reclamation	
						Biological Reclamation		Other Plantations											
				Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External OB Dumps		Social Forestry, Avanue Plantation Etc.									
1	*2*	*3*		*4*		*5*		*6*		*7*		*8*		*9 (=4+5+8)*		*10 (=5+6+7)*		*11(=4+5)*	
		2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024
1	Cluster I	575.00	575.00	11.10	31.80	7.29	8.53	45.21	32.94	25.53	25.53	27.61	29.60	46.00	69.93	78.03	67.00	18.39	40.33
				24.13%	45.47%	15.85%	12.20%					60.02%	42.33%			13.57%	11.65%	39.98%	57.67%
2	Cluster IV	1123.79	1123.79	176.03	259.63	0.00	7.29	27.11	27.45	165.09	160.53	152.29	117.13	328.32	384.05	192.20	195.27	176.03	266.92
				53.62%	67.60%	0.00%	1.90%					46.38%	30.50%			17.10%	17.38%	53.62%	69.50%
3	Cluster VII	2127.70	2127.70	351.68	362.12	25.47	8.56	11.43	1.33	238.67	238.67	183.42	198.90	560.57	569.58	275.57	248.56	377.15	370.68
				62.74%	63.58%	4.54%	1.50%					32.72%	34.92%			12.95%	11.68%	67.28%	65.08%
4	Cluster X	2057.47	2057.47	143.64	217.71	29.16	54.25	66.09	36.00	140.75	140.75	45.71	74.17	218.51	346.13	236.00	231.00	172.80	271.96
				65.74%	62.90%	13.34%	15.67%					20.92%	21.43%			11.47%	11.23%	79.08%	78.57%
5	Cluster XI	3527.58	3527.58	30.45	52.22	0.00	2.43	0.00	0.97	187.14	187.14	34.33	37.43	64.78	92.08	187.14	190.54	30.45	54.65
				47.01%	56.71%	0.00%	2.64%					52.99%	40.65%			5.31%	5.40%	47.01%	59.35%
	TOTAL (A)	**9411.54**	**9411.54**	**712.90**	**923.48**	**61.92**	**81.06**	**149.84**	**98.69**	**757.18**	**752.62**	**443.36**	**457.23**	**1218.18**	**1461.77**	**968.94**	**932.37**	**774.82**	**1004.54**
				58.52%	**63.18%**	**5.08%**	**5.55%**					**36.40%**	**31.28%**			**10.30%**	**9.91%**	**63.60%**	**68.72%**

(% is calculated with respect to Excavated Area as applicable)

Note: In reference of the above Table, different parameters are classified as follows:

1. Area under Biological Reclamation includes Areas under Plantation done on Backfilled Area Only.
2. Area under Technical Reclamation includes Area under Barren Backfilling only.
3. Area under Active Mining Includes Coal Quarry, Advance Quarry Site and Quarry filled with water etc., if any.
4. Social Forestry and Plantation on External OB Dumps are not included in Biological Reclamation and are put under separate categories as shown in the above Table.
5. (%) calculated in the above Table is in respect to Total Excavated Area except for “Total Area under Plantation” where % is in terms of “Leasehold Area”.
6. Leasehold Boundaries of the above 5 clusters are as per EC.

Table 1.1 Composite Land Reclamation Status in remaining ten Clusters (Underground + Opencast Mines) of BCCL as per clause 2.(ii) of the received work order from CIL

(Area in Hectare)

Sl. No.	Cluster No.	Total Leasehold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold)		Total Area under Reclamation	
						Biological		Other Plantations											
				Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External OB Dumps		Social Forestry, Avanue Plantation Etc.									
1	*2*	*3*		*4*		*5*		*6*		*7*		*8*		*9 (=4+5+8)*		*10 (=5+6+7)*		*11(=4+5)*	
		2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023
6	Cluster III	1552.53	1420.61	60.37	68.71	3.89	4.96	21.11	28.67	162.33	141.36	104.79	84.88	169.05	158.55	187.33	174.99	64.26	73.67
				35.71%	43.34%	2.30%	3.13%					61.99%	53.54%			12.07%	12.32%	38.01%	46.46%
7	Cluster V	1724.52	1957.08	187.59	193.60	7.19	7.41	23.85	19.84	105.29	158.45	103.52	182.86	298.30	383.87	136.33	185.70	194.78	201.01
				62.89%	50.43%	2.41%	1.93%					34.70%	47.64%			7.91%	9.49%	65.30%	52.36%
8	Cluster VIII	1331.95	1183.92	206.91	198.08	9.93	4.08	21.97	16.86	24.70	22.63	124.49	151.45	341.33	353.61	56.60	43.57	216.84	202.16
				60.62%	56.02%	2.91%	1.15%					36.47%	42.83%			4.25%	3.68%	63.53%	57.17%
9	Cluster IX	1967.22	1942.12	77.53	108.00	6.80	3.23	41.79	22.40	168.58	151.33	217.24	240.24	301.57	351.47	217.17	176.96	84.33	111.23
				25.71%	30.73%	2.25%	0.92%					72.04%	68.35%			11.04%	9.11%	27.96%	31.65%
10	Cluster XVII	1412.00	1397.18	125.09	125.09	0.00	0.00	5.00	5.00	43.33	43.33	65.40	65.40	190.49	190.49	48.33	48.33	125.09	125.09
				65.67%	65.67%	0.00%	0.00%					34.33%	34.33%			3.42%	3.46%	65.67%	65.67%
	TOTAL (B)	**7988.22**	**7900.91**	**657.49**	**693.48**	**27.81**	**19.68**	**113.72**	**92.77**	**504.23**	**517.10**	**615.44**	**724.83**	**1300.74**	**1437.99**	**645.76**	**629.55**	**685.30**	**713.16**
				50.55%	**48.23%**	**2.14%**	**1.37%**					**47.31%**	**50.41%**			**8.08%**	**7.97%**	**52.69%**	**49.59%**
		2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022
11	Cluster II	2260.54	2025.71	422.51	422.00	86.42	87.42	43.28	47.29	154.37	128.03	129.98	148.85	638.91	658.27	284.07	262.74	508.93	509.42
				66.13%	64.11%	13.53%	13.28%					20.34%	22.61%			12.57%	12.97%	79.66%	77.39%
12	Cluster VI	831.83	876.55	134.15	134.15	0.00	0.00	5.89	9.70	26.79	28.41	77.75	70.36	211.90	204.51	32.68	38.11	134.15	134.15
				63.31%	65.60%	0.00%	0.00%					36.69%	34.40%			3.93%	4.35%	63.31%	65.60%
13	Cluster XIV	1418.25	1577.22	0.00	0.00	0.00	0.00	0.00	0.00	74.13	72.42	0.00	0.00	0.00	0.00	74.13	72.42	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			5.23%	4.59%	0.00%	0.00%
14	Cluster XV	-	1696.55	-	0.00	-	0.00	-	0.00	-	80.72	-	0.00	-	0.00	-	80.72	-	0.00
					0.00%		0.00%						0.00%				4.76%		0.00%
15	Cluster XVI	2008.4	1964.21	67.57	65.25	25.36	27.68	13.31	13.31	51.26	51.26	65.77	75.14	158.70	168.07	89.93	92.25	92.93	92.93
				42.58%	38.82%	15.98%	16.47%					41.44%	44.71%			4.48%	4.70%	58.56%	55.29%
	TOTAL (C)	**6519.02**	**8140.24**	**624.23**	**621.40**	**111.78**	**115.10**	**62.48**	**70.30**	**306.55**	**360.84**	**273.50**	**294.35**	**1009.51**	**1030.85**	**480.81**	**546.24**	**736.01**	**736.50**
				61.83%	**60.28%**	**11.07%**	**11.17%**					**27.09%**	**28.55%**			**7.38%**	**6.71%**	**72.91%**	**71.45%**
***GRAND TOTAL (A+B+C)**		**23918.78**	**25452.69**	**1994.62**	**2238.36**	**201.51**	**215.84**	**326.04**	**261.76**	**1567.96**	**1630.56**	**1332.30**	**1476.41**	**3528.43**	**3930.61**	**2095.51**	**2108.16**	**2196.13**	**2454.20**
				56.53%	**56.95%**	**5.71%**	**5.49%**					**37.76%**	**37.56%**			**8.76%**	**8.28%**	**62.24%**	**62.44%**

Grand Total (A+B+C) is the composite value of all 15 clusters of BCCL covered in 3 years cycle of Land Reclamation Monitoring ***(% is calculated with respect to Excavated Area as applicable)***

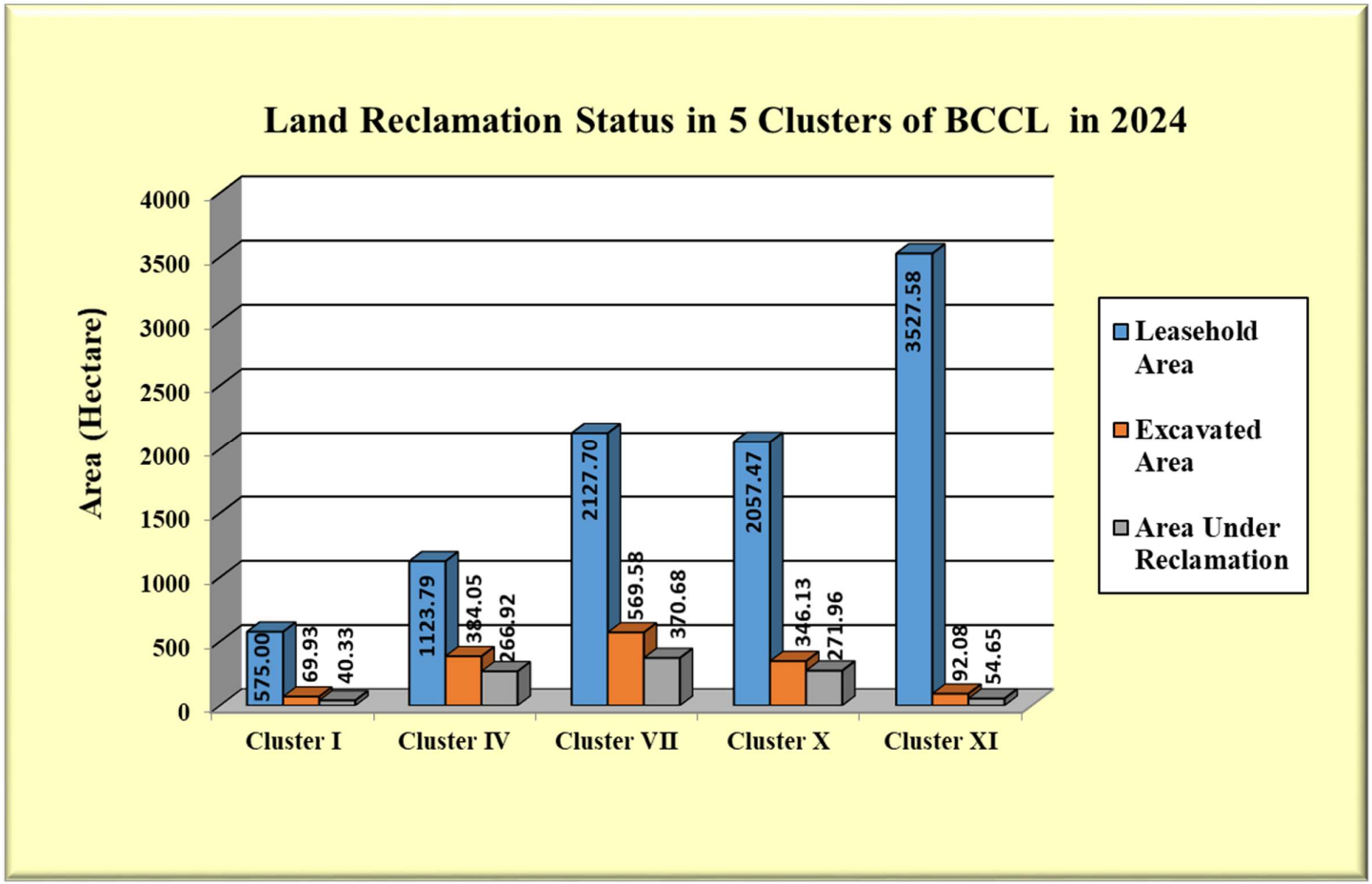


Fig. 1: Cluster wise Land Reclamation Status in five Clusters - 2024 (BCCL)

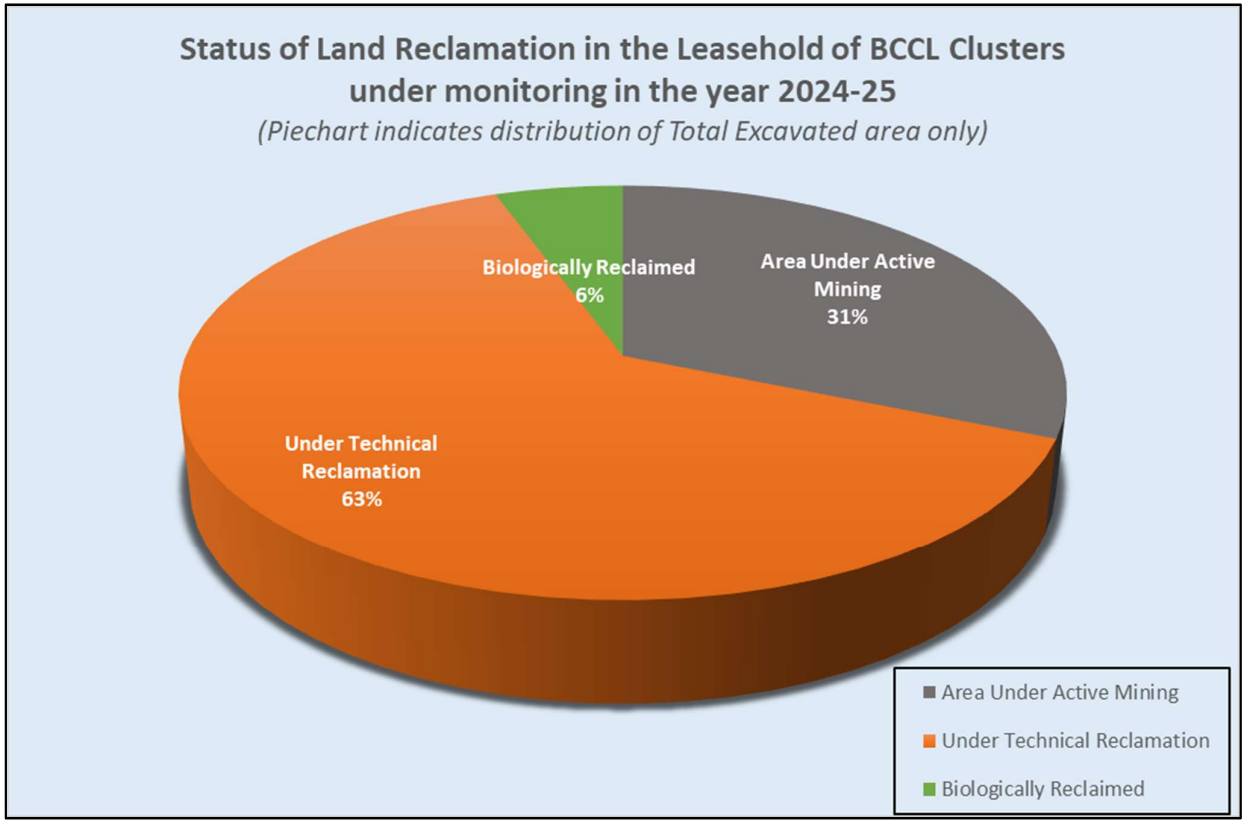


Fig. 2: Pie Chart showing distribution of total Excavated area in BCCL Clusters

1.0 Background

1.1 Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land which is the scarcest natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do affect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future.

1.2 Keeping above in view, Coal India Ltd. (CIL) issued a work order vide letter no. CIL/WBP/ENV/2017/DP/8391 dated 22.06.2017 to Central Mine Planning & Design Institute (CMPDI), Ranchi, for monitoring of clusters with coal mines (both underground and open cast projects) having less than 5 million m^3 per annum capacity (Coal +OB) at an interval of three years based on remote sensing satellite data for sustainable development of mining. Earlier, CMPDI used to carry out land reclamation monitoring for individual projects of less than 5 million capacities, but from 2017 the same was carried out cluster wise for mines of BCCL. For operational reasons and convenience, underground and opencast mines (often with multiple overlapping seams), have now been clustered together. After this, the work order was renewed periodically, and the latest work order is issued vide letter no. CIL/ENV/11463 dated 03.07.2024 from Coal India Limited for the period 2024-25 to 2026-27. According to this work order, 75 OC projects having more than 5 million cu. m (coal +OB) per annum capacity shall be monitored every year and also land reclamation monitoring of 39 (mines + clusters) having less than 5 million cu. m (coal +OB) per

annum capacity, totaling 114 (OC mines & clusters) will be monitored in 2024-25 covering all the subsidiaries of Coal India Ltd. The result of land reclamation status of all such mines are hosted on the website of CIL, (www.coalindia.in), CMPDI (www.cmpdi.co.in) and the concerned coal companies in public domain. Detailed report is submitted to Coal India and respective subsidiaries.

1.3 Land reclamation monitoring of all clusters of coal mining projects would also comply the statutory requirements of Ministry of Environment, Forest & Climate Change (**MoEF & CC**). Such monitoring would not only facilitate in taking timely mitigation measures against environmental degradation, but would also enable coal companies to utilize the reclaimed land for larger socio-economic benefits in a planned way.

1.4 Present report is embodying the finding of the study based on satellite data of the year 2024 carried out for five clusters of mines comprising both underground and opencast projects of Bharat Coking Coal Ltd.

2.0 Objective

Objective of the land reclamation/restoration monitoring is to assess the area under backfilling, plantation, OB dumps, social forestry, active mining area, settlements, water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

3.0 Methodology

There are number of steps involved between satellite data procurement and preparation of final map. National Remote Sensing Centre (NRSC) Hyderabad, being the nodal agency for satellite data supply in India, provides satellite data through its website Bhoonidhi, which needs further digital image processing for extracting the information and map preparation before uploading the same in the website. Methodology for land reclamation monitoring is given in fig 2. Following steps are involved in land reclamation/ restoration monitoring:

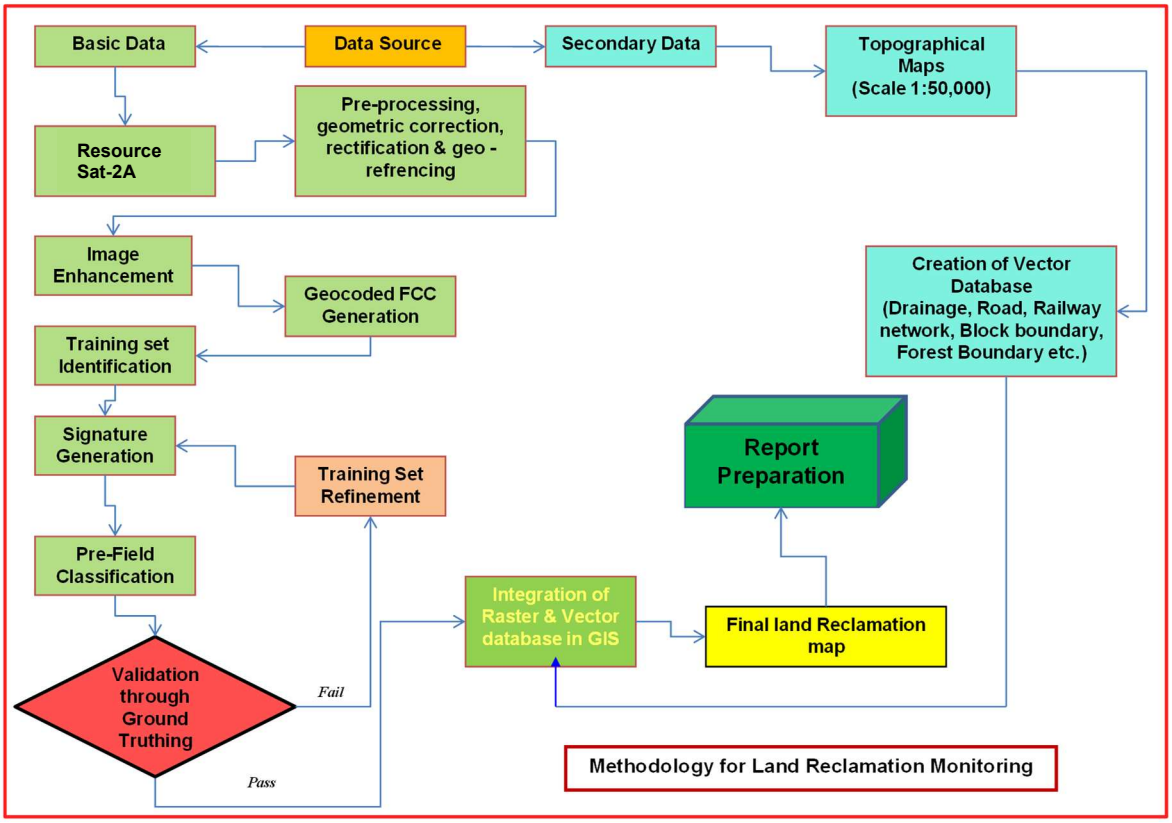


Fig. 3: Methodology of Land Reclamation Monitoring

3.1 Data Procurement: After browsing the data quality and date of pass on internet, data is downloaded from Bhoonidhi. Secondary data like leasehold boundary, toposheet are procured for creation of vector database.

3.2 **Satellite Data Processing:** Satellite data are processed using ERDAS IMAGINE 2022 digital image processing s/w. Methodology involves the following major steps:

- **Rectification & Geo-referencing:** Inaccuracies in digital imagery may occur due to 'systematic errors' attributed to earth curvature and rotation as well as 'non-systematic errors' attributed to satellite receiving station itself. Raw digital images may contain geometric distortions, which make them unusable as maps. Therefore, geo-referencing is required for correction of image data using ground control points (GCP) to make it compatible with the new series WGS-84 compatible SoI toposheet.

- **Image enhancement:**

  To improve the interpretability of the raw data, image enhancement is necessary. Local operations modify the value of each pixel based on brightness value of neighbouring pixels using ERDAS IMAGINE 2022 s/w. and enhance the image quality for interpretation.

- **Training set selection**

  Training set requires to be selected, so that software can classify the image data accurately. The image data are analysed based on the interpretation keys. These keys are evolved from certain fundamental image-elements such as tone/colour, size, shape, texture, pattern, location, association and shadow. Based on the image-elements and other geo-technical elements like land form, drainage pattern and physiography; training sets were selected/identified for each land use/cover class. Field survey was carried out by taking selective traverses in order to collect the ground information (or reference data) so that training sets are selected accurately in the image. This was intended to serve as an aid for classification.

- **Classification and Accuracy assessment**

  Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between the classes that resulted from computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

  The area of each land use class in the leasehold is determined using ERDAS IMAGINE v. 2022 s/w.

- **Overlay of Vector data base**

  Vector data base is created based on secondary data. Vector layer like drainage, railway line, leasehold boundary, forest boundary etc. are superimposed on the image as vector layer in the Arc GIS database.

- **Pre-field map preparation**

  Pre-field map is prepared for validation of the classification result.

3.3 Ground Truthing:

Selective ground verification of the land use classes is carried out in the field and necessary corrections if required, are incorporated before map finalization.

3.4 Land reclamation database on GIS:

Land reclamation database is created on GIS platform to identify the temporal changes identified from satellite data of different cut - of dates. The database boundary shape files (.shp), kml files and the maps thus prepared confirm to the WGS-84 datum and UTM projected co-ordinate system.

4.0 Land Reclamation Status in Bharat Coking Coal Ltd.

4.1 Following 5 clusters of mines comprising both opencast and underground projects of Bharat Coking Coal Ltd. have been taken up for land reclamation monitoring during the year 2024-25:

- **Cluster I** (Damoda Colliery)
- **Cluster IV** (Amalgamated Keshalpur West Mudidih Colliery, Amalgamated Angarpathra Ramkanali Colliery, Salanpur Colliery, Katras Choitudih Colliery, Gaslitand Colliery)
- **Cluster VII** (Kusunda Colliery, Alkusa Colliery, Amalgamated Dhansar Industry Colliery, Ena Colliery, Kustore Colliery, ROCP/South Jharia, Amalgamated East Bhuggatdih Simlabahal Colliery, Burragarh Colliery, Hurriladih Colliery, Bhutgoria Colliery)
- **Cluster X** (Bhowrah North UG & OC, Bhowrah South UG & OC, Amalgamated Sudamdih Patherdih OC, Sudamdih Shaft UG, Amlabad UG)
- **Cluster XI** (Kendwadih Colliery, Gopalichak Colliery, Pootkee Colliery, 5/6 Pit KB, 5/7 Pit SB, 10/12 Pit KB Colliery, Bhagaband Colliery, Moonidih Colliery)

4.2 Cluster wise Land Reclamation status of above mentioned clusters in BCCL is given in Table 1 and also shown graphically in Fig 1 and Fig 2. Cluster wise Land Reclamation status of the remaining 10 clusters that are covered under monitoring in the 3-year cycle is given in Table 1.1. Area statistics of different land use classes present in the mine leasehold of the above clusters for the year 2024 are shown in Table 2. Land use maps derived from the satellite data are shown in Plate 1 - 5. Both national grid and UTM grid are used in the maps. Different land use classes based on satellite data are depicted in bar charts in Fig. 4 - 8.

4.3 Study reveals that out of total mine leasehold area of 9411.54 ha. of the 5 clusters of mines (Opencast + Underground) of BCCL mentioned above taken for this study in 2024-25, total excavated area is 1461.77 ha. out of

which 81.06 ha. (5.55%) has been planted (*Biologically Reclaimed*), 923.48 ha. (63.18%) is under backfilling (*Technically Reclaimed*) and balance 457.23 ha. (31.28%) is under active mining.

4.4 The leasehold boundaries of the above mentioned 5 clusters are as per EC.

4.5 It is seen that technical reclamation in the above 5 Clusters has increased from 712.90 ha. (Year 2021) to 923.48 ha. (Year 2024).

4.6 Study indicates that Cluster I, Cluster IV, Cluster X and Cluster XI of BCCL considered for this study in the year 2024-25 indicate increasing trend in Biological Reclamation (plantation on backfill) with respect to the year 2021. Whereas in Cluster VII plantation on backfill has decreased from 25.47 ha. (Year 2021) to 8.56 ha. (Year 2024) due to rehandling of backfill. But in this Cluster new plantations has been started by BCCL but their height and canopy cover are not enough to be captured in satellite imagery.

4.7 On comparing the status of plantation on OB dumps for the year 2024 with respect to the year 2021 in the above Cluster of mines of BCCL, it is evident from the analysis that area under plantation on OB dumps has decreased from 45.21 ha. (Year 2021) to 32.94 ha. (Year 2024) in Cluster I and from 11.43 ha. (Year 2021) to 1.33 ha. (Year 2024) in Cluster VII due to rehandling of OB dumps. In Cluster IV plantation on OB dumps has increased marginally from 27.11 ha. (Year 2021) to 27.45 ha. (Year 2024). The decrease in area under plantation on OB in Cluster X is due to reclassification of plantation on OB to plantation on backfill classes (updated as per surface plan received from RI II and area). In Cluster XI plantation on OB dumps has been started during the last three-year duration.

4.8 It is seen that total plantation under social forestry has decreased from 757.18 ha. (Year 2021) to 752.62 ha. (Year 2024) which is due to decrease in plantation under social forestry in Cluster IV from 165.09 ha. (Year 2021) to 160.53 ha. (Year 2024). This decrease in 4.56 ha. in Cluster IV is due to

increase in mining area. In all the other Clusters there is no change or plantation under social forestry is static during the last three-year duration.

4.9 It is seen that total excavated area has increased from 1218.18 ha. (Year 2021) to 1461.77 ha. (Year 2024).

4.10 After analyzing the satellite data of the year 2021 vs 2024, it reveals that area under total plantation (Green cover) carried out on backfilled area, OB dumps as well as under social forestry in the above clusters of BCCL has decreased from 968.94 ha. (10.30%) to 932.37 ha. (9.91%) in span of last three years. The reason for this reduction in area under green cover has been described separately earlier in point no. 4.6, 4.7 and 4.8.

4.11 On comparing the status of land reclamation for the year 2024 with respect to the year 2021 it is evident from the analysis that total area under land reclamation has increased from 774.82 ha. (Year 2021) to 1004.54 ha. (Year 2024). This increase of 229.72 ha. area under land reclamation is due to increase in reclamation activities in Cluster I, Cluster IV, Cluster X & Cluster XI. In Cluster VII, it is seen that total area under reclamation has decreased from 377.15 ha. (Year 2021) to 370.68 ha. (Year 2024). This decrease of 6.47 ha. area is due to rehandling of area under backfilling in this cluster.

4.12 The area under total plantation (Green Cover) is maximum in Cluster IV (17.38%) followed by Cluster VII with (11.68%), Cluster I with (11.65%), Cluster X with (11.23%) and Cluster XI with (5.40%).

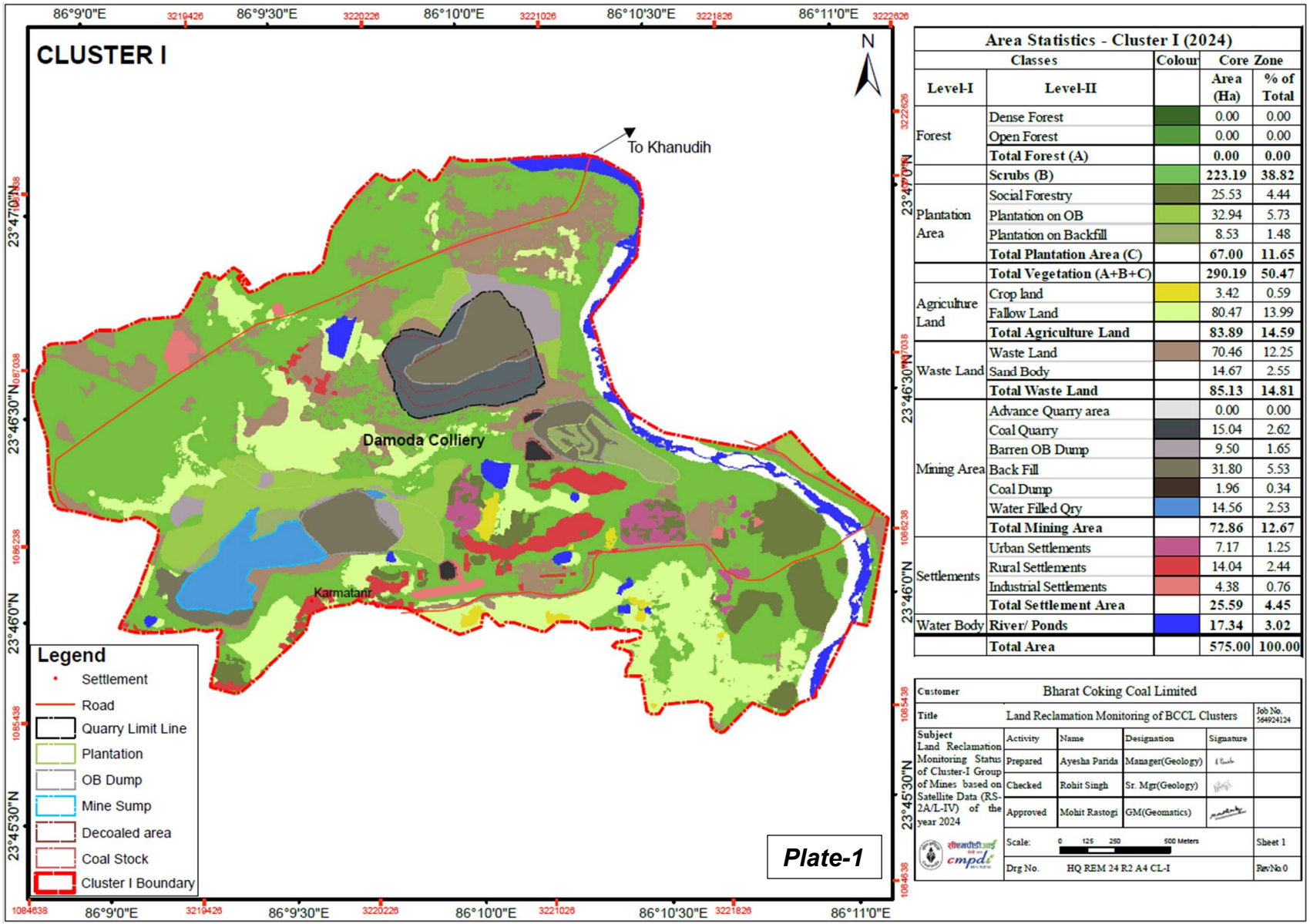
4.13 Out of the 5 Clusters in BCCL considered for satellite data based land reclamation monitoring in 2024-25, Cluster X tops with 78.57% reclamation followed by Cluster IV with 69.50%, Cluster VII with 65.08%, Cluster XI with 59.35% and Cluster I with 57.67%.

Table 2

Cluster wise Area Statistics of Land Use/ Cover classes in five Clusters of (OC+UG) mines of BCCL based on Satellite Data of the year 2024

(Area in Hectare)

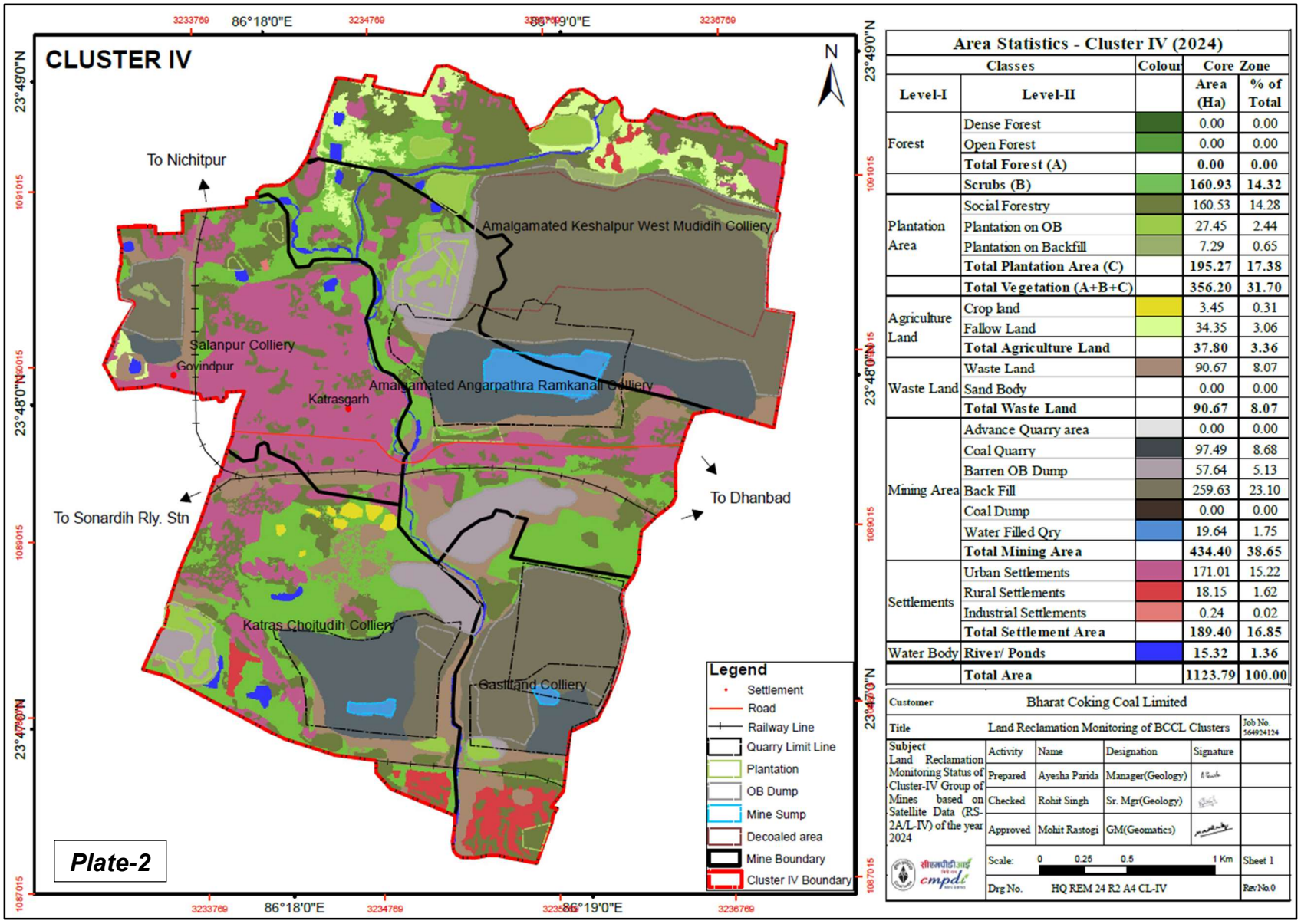
		CLUSTER I		CLUSTER IV		CLUSTER VII		CLUSTER X		CLUSTER XI		TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Open Forest	0.00	0.00	0.00	0.00	0.00	0.00	61.92	3.01	0.00	0.00	61.92	0.66
	Total Forest (A)	0.00	0.00	0.00	0.00	0.00	0.00	61.92	3.01	0.00	0.00	61.92	0.66
SCRUBS	**Scrubs (B)**	223.19	38.82	160.93	14.32	553.54	26.02	641.93	31.20	1169.43	33.15	2749.02	29.21
PLANTATION	Social Forestry/Avenue Plantation	25.53	4.44	160.53	14.28	238.67	11.22	140.75	6.84	187.14	5.31	752.62	8.00
	Plantation on OB Dump	32.94	5.73	27.45	2.44	1.33	0.06	36.00	1.75	0.97	0.03	98.69	1.05
	Plantation on Backfill (Biological Reclamation)	8.53	1.48	7.29	0.65	8.56	0.40	54.25	2.64	2.43	0.07	81.06	0.86
	Total Plantation (C)	67.00	11.65	195.27	17.38	248.56	11.68	231.00	11.23	190.54	5.40	932.37	9.91
	Total Vegetation (A+B+C)	**290.19**	**50.47**	**356.20**	**31.70**	**802.10**	**37.70**	**934.85**	**45.44**	**1359.97**	**38.55**	**3743.31**	**39.77**
	Coal Dump	1.96	0.34	0.00	0.00	12.51	0.59	1.12	0.05	1.66	0.05	17.25	0.18
ACTIVE MINING	Coal Quarry	15.04	2.62	97.49	8.68	194.77	9.15	62.59	3.04	36.74	1.04	406.63	4.32
	Advance Quarry Site	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.02	0.69	0.01
	Quarry Filled With Water	14.56	2.53	19.64	1.75	4.13	0.19	11.58	0.56	0.00	0.00	49.91	0.53
	Total Area under *Active Mining*	**29.60**	**5.15**	**117.13**	**10.42**	**198.90**	**9.35**	**74.17**	**3.60**	**37.43**	**1.06**	**457.23**	**4.86**
	Barren OB Dump	9.50	1.65	57.64	5.13	47.62	2.24	25.28	1.23	34.10	0.97	174.14	1.85
RECLAIMED	Area Under Backfilling (Technical Reclamation)	31.80	5.53	259.63	23.10	362.12	17.02	217.71	10.58	52.22	1.48	923.48	9.81
	Total Area under Mine Operation	**72.86**	**12.67**	**434.40**	**38.65**	**621.15**	**29.19**	**318.28**	**15.47**	**125.41**	**3.56**	**1572.10**	**16.70**
WASTELAND	Waste Lands	70.46	12.25	90.67	8.07	189.11	8.89	142.45	6.92	673.11	19.08	1165.80	12.39
	Fly Ash Pond / Sand Body	14.67	2.55	0.00	0.00	0.00	0.00	53.69	2.61	15.83	0.45	84.19	0.89
	Total Wasteland	**85.13**	**14.81**	**90.67**	**8.07**	**189.11**	**8.89**	**196.14**	**9.53**	**688.94**	**19.53**	**1249.99**	**13.28**
WATERBODIES	Reservoir, Nallah, Ponds	17.34	3.02	15.32	1.36	21.67	1.02	180.72	8.78	63.87	1.81	298.92	3.18
	Total Waterbodies	**17.34**	**3.02**	**15.32**	**1.36**	**21.67**	**1.02**	**180.72**	**8.78**	**63.87**	**1.81**	**298.92**	**3.18**
AGRICULTURE	Crop Lands	3.42	0.59	3.45	0.31	36.41	1.71	17.28	0.84	81.12	2.30	141.68	1.51
	Fallow Lands	80.47	13.99	34.35	3.06	17.18	0.81	105.99	5.15	821.68	23.29	1059.67	11.26
	Total Agriculture	**83.89**	**14.59**	**37.80**	**3.36**	**53.59**	**2.52**	**123.27**	**5.99**	**902.80**	**25.59**	**1201.35**	**12.76**
SETTLEMENTS	Urban Settlement	7.17	1.25	171.01	15.22	409.25	19.23	228.39	11.10	336.58	9.54	1152.40	12.24
	Rural Settlement	14.04	2.44	18.15	1.62	9.41	0.44	54.55	2.65	14.68	0.42	110.83	1.18
	Industrial Settlement	4.38	0.76	0.24	0.02	21.42	1.01	21.27	1.03	35.33	1.00	82.64	0.88
	Total Settlements	**25.59**	**4.45**	**189.40**	**16.85**	**440.08**	**20.68**	**304.21**	**14.79**	**386.59**	**10.96**	**1345.87**	**14.30**
	Grand Total	**575.00**	**100.00**	**1123.79**	**100.00**	**2127.70**	**100.00**	**2057.47**	**100.00**	**3527.58**	**100.00**	**9411.54**	**100.00**



Area Statistics - Cluster I (2024)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**223.19**	**38.82**
Plantation Area	Social Forestry		25.53	4.44
	Plantation on OB		32.94	5.73
	Plantation on Backfill		8.53	1.48
	Total Plantation Area (C)		**67.00**	**11.65**
	Total Vegetation (A+B+C)		**290.19**	**50.47**
Agriculture Land	Crop land		3.42	0.59
	Fallow Land		80.47	13.99
	Total Agriculture Land		**83.89**	**14.59**
Waste Land	Waste Land		70.46	12.25
	Sand Body		14.67	2.55
	Total Waste Land		**85.13**	**14.81**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		15.04	2.62
	Barren OB Dump		9.50	1.65
	Back Fill		31.80	5.53
	Coal Dump		1.96	0.34
	Water Filled Qry		14.56	2.53
	Total Mining Area		**72.86**	**12.67**
Settlements	Urban Settlements		7.17	1.25
	Rural Settlements		14.04	2.44
	Industrial Settlements		4.38	0.76
	Total Settlement Area		**25.59**	**4.45**
Water Body	River/ Ponds		17.34	3.02
	Total Area		**575.00**	**100.00**

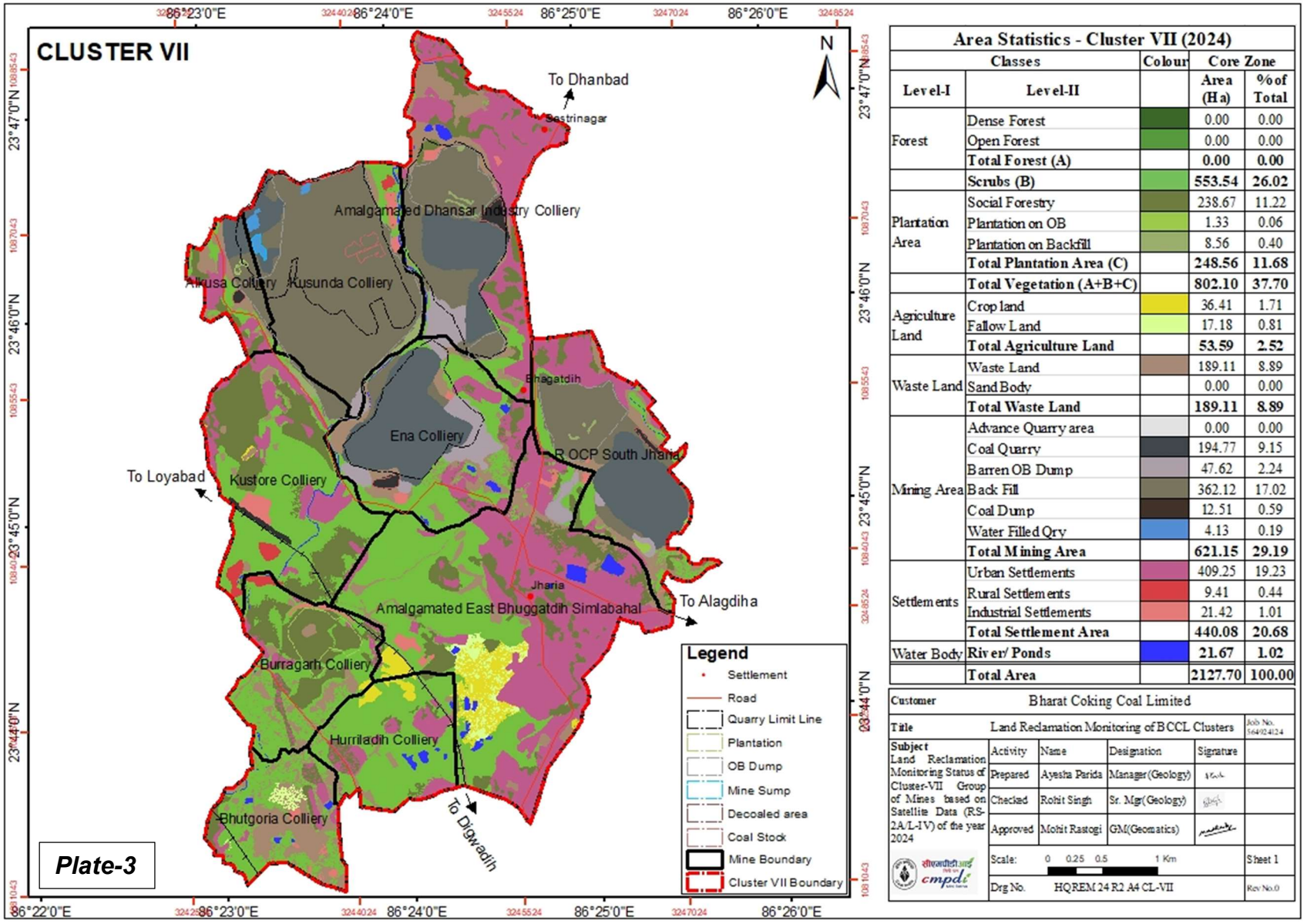
Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564924124
Subject	Activity	Name	Designation	Signature	
Land Reclamation Monitoring Status of Cluster-I Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2024	Prepared	Ayesha Parida	Manager(Geology)		
	Checked	Rohit Singh	Sr. Mgr(Geology)		
	Approved	Mohit Rastogi	GM(Geomatics)		
	Scale: 0 125 250 500 Meters				Sheet 1
	Drg No. HQ REM 24 R2 A4 CL-I				RevNo 0



Area Statistics - Cluster IV (2024)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**160.93**	**14.32**
Plantation Area	Social Forestry		160.53	14.28
	Plantation on OB		27.45	2.44
	Plantation on Backfill		7.29	0.65
	Total Plantation Area (C)		**195.27**	**17.38**
	Total Vegetation (A+B+C)		**356.20**	**31.70**
Agriculture Land	Crop land		3.45	0.31
	Fallow Land		34.35	3.06
	Total Agriculture Land		**37.80**	**3.36**
Waste Land	Waste Land		90.67	8.07
	Sand Body		0.00	0.00
	Total Waste Land		**90.67**	**8.07**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		97.49	8.68
	Barren OB Dump		57.64	5.13
	Back Fill		259.63	23.10
	Coal Dump		0.00	0.00
	Water Filled Qry		19.64	1.75
	Total Mining Area		**434.40**	**38.65**
Settlements	Urban Settlements		171.01	15.22
	Rural Settlements		18.15	1.62
	Industrial Settlements		0.24	0.02
	Total Settlement Area		**189.40**	**16.85**
Water Body	**River/ Ponds**		**15.32**	**1.36**
	Total Area		**1123.79**	**100.00**

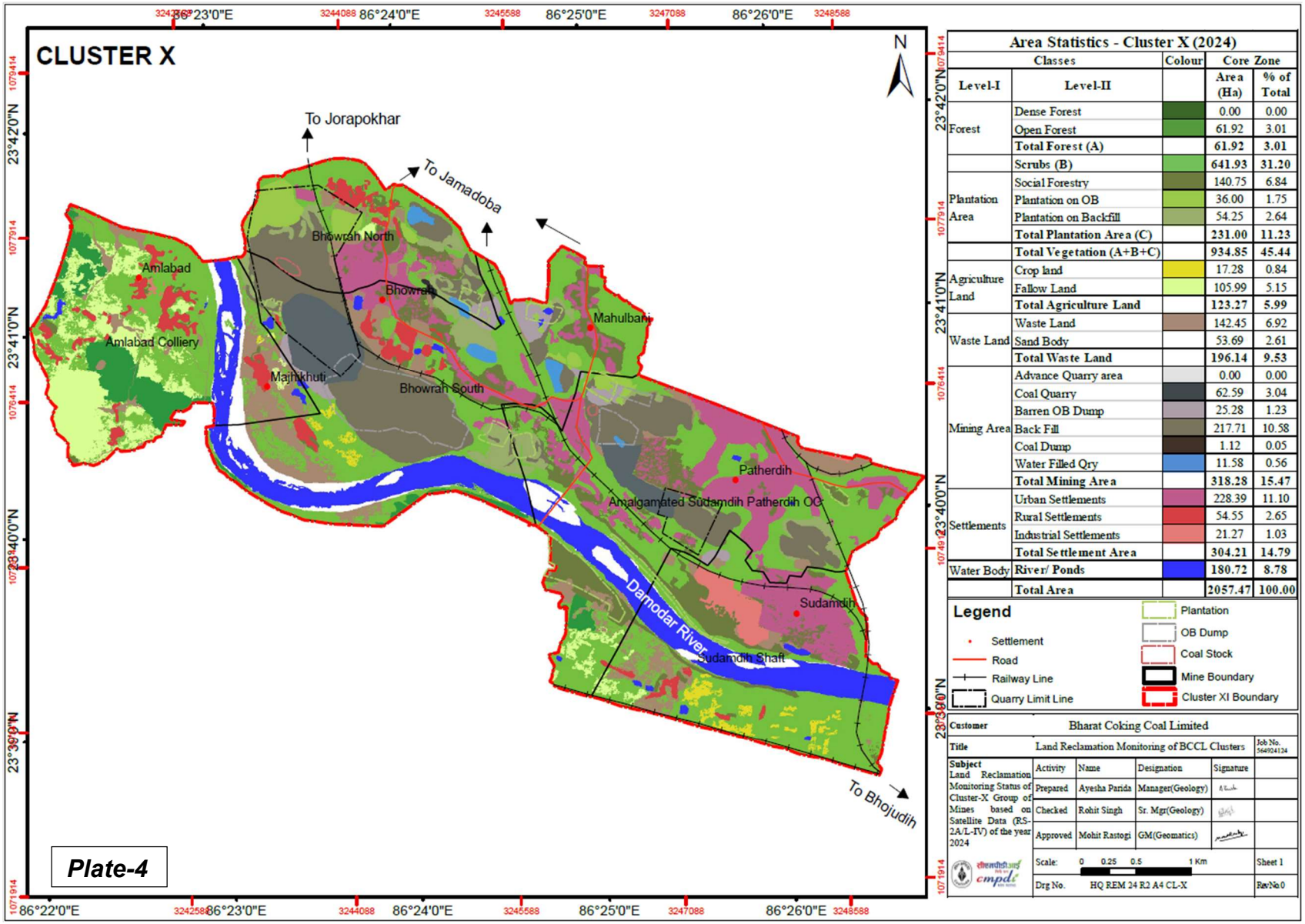
Customer	Bharat Coking Coal Limited			
Title	Land Reclamation Monitoring of BCCL Clusters			Job No. 564924124
Subject: Land Reclamation Monitoring Status of Cluster-IV Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2024	Activity	Name	Designation	Signature
	Prepared	Ayesha Parida	Manager(Geology)	
	Checked	Rohit Singh	Sr. Mgr(Geology)	
	Approved	Mohit Rastogi	GM(Geomatics)	
	Scale: 0 0.25 0.5 1 Km			Sheet 1
	Drg No. HQ REM 24 R2 A4 CL-IV			Rev No.0



Area Statistics - Cluster VII (2024)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**553.54**	**26.02**
Plantation Area	Social Forestry		238.67	11.22
	Plantation on OB		1.33	0.06
	Plantation on Backfill		8.56	0.40
	Total Plantation Area (C)		**248.56**	**11.68**
	Total Vegetation (A+B+C)		**802.10**	**37.70**
Agriculture Land	Crop land		36.41	1.71
	Fallow Land		17.18	0.81
	Total Agriculture Land		**53.59**	**2.52**
Waste Land	Waste Land		189.11	8.89
	Sand Body		0.00	0.00
	Total Waste Land		**189.11**	**8.89**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		194.77	9.15
	Barren OB Dump		47.62	2.24
	Back Fill		362.12	17.02
	Coal Dump		12.51	0.59
	Water Filled Qry		4.13	0.19
	Total Mining Area		**621.15**	**29.19**
Settlements	Urban Settlements		409.25	19.23
	Rural Settlements		9.41	0.44
	Industrial Settlements		21.42	1.01
	Total Settlement Area		**440.08**	**20.68**
Water Body	**River/ Ponds**		**21.67**	**1.02**
	Total Area		**2127.70**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564924124
Subject: Land Reclamation Monitoring Status of Cluster-VII Group of Mines based on Satellite Data (R.S-2A/L-IV) of the year 2024	Activity	Name	Designation	Signature	
	Prepared	Ayesha Parida	Manager (Geology)		
	Checked	Rohit Singh	Sr. Mgr(Geology)		
	Approved	Mohit Rastogi	GM(Geomatics)		
	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ/REM/24/R2/A4/CL-VII				Rev No.0



Area Statistics - Cluster X (2024)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		61.92	3.01
	Total Forest (A)		**61.92**	**3.01**
	Scrubs (B)		641.93	31.20
Plantation Area	Social Forestry		140.75	6.84
	Plantation on OB		36.00	1.75
	Plantation on Backfill		54.25	2.64
	Total Plantation Area (C)		**231.00**	**11.23**
	Total Vegetation (A+B+C)		**934.85**	**45.44**
Agriculture Land	Crop land		17.28	0.84
	Fallow Land		105.99	5.15
	Total Agriculture Land		**123.27**	**5.99**
Waste Land	Waste Land		142.45	6.92
	Sand Body		53.69	2.61
	Total Waste Land		**196.14**	**9.53**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		62.59	3.04
	Barren OB Dump		25.28	1.23
	Back Fill		217.71	10.58
	Coal Dump		1.12	0.05
	Water Filled Qry		11.58	0.56
	Total Mining Area		**318.28**	**15.47**
Settlements	Urban Settlements		228.39	11.10
	Rural Settlements		54.55	2.65
	Industrial Settlements		21.27	1.03
	Total Settlement Area		**304.21**	**14.79**
Water Body	River/ Ponds		180.72	8.78
	Total Area		**2057.47**	**100.00**

Legend

- Settlement
- Road
- Railway Line
- Quarry Limit Line
- Plantation
- OB Dump
- Coal Stock
- Mine Boundary
- Cluster XI Boundary

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564924124
Subject: Land Reclamation Monitoring Status of Cluster-X Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2024	Activity	Name	Designation	Signature	
	Prepared	Ayesha Parida	Manager(Geology)		
	Checked	Rohit Singh	Sr. Mgr(Geology)		
	Approved	Mohit Rastogi	GM(Geomatics)		
	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 24 R2 A4 CL-X				Rev No 0

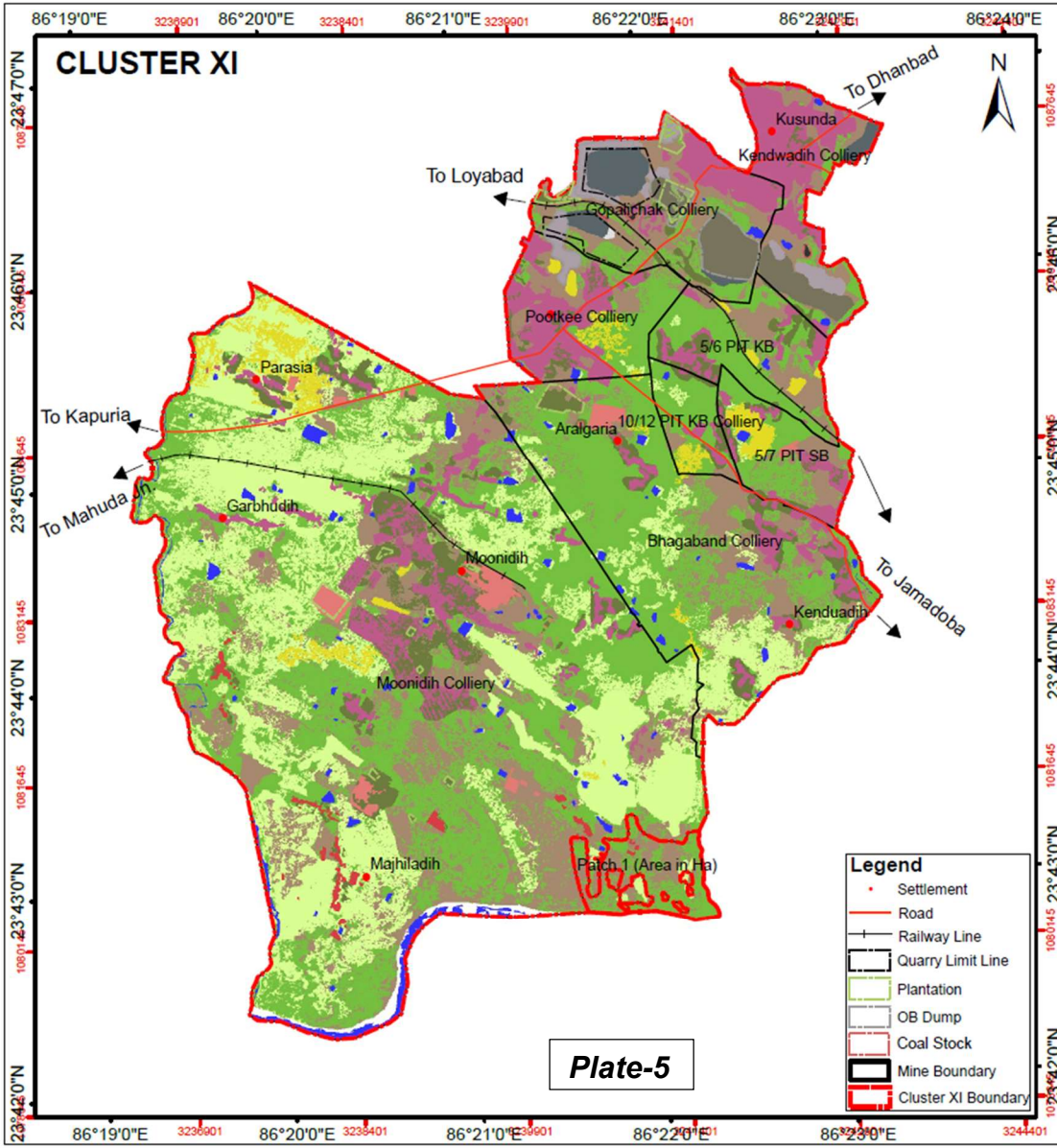


Plate-5

Area Statistics - Cluster XI (2024)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forest	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**1169.43**	**33.15**
Plantation Area	Social Forestry		187.14	5.31
	Plantation on OB		0.97	0.03
	Plantation on Backfill		2.43	0.07
	Total Plantation Area (C)		**190.54**	**5.40**
	Total Vegetation (A+B+C)		**1359.97**	**38.55**
Agriculture Land	Crop land		81.12	2.30
	Fallow Land		821.68	23.29
	Total Agriculture Land		**902.80**	**25.59**
Waste Land	Waste Land		673.11	19.08
	Sand Body		15.83	0.45
	Total Waste Land		**688.94**	**19.53**
Mining Area	Advance Quarry area		0.69	0.02
	Coal Quarry		36.74	1.04
	Barren OB Dump		34.10	0.97
	Back Fill		52.22	1.48
	Coal Dump		1.66	0.05
	Water Filled Qry		0.00	0.00
	Total Mining Area		**125.41**	**3.56**
Settlements	Urban Settlements		336.58	9.54
	Rural Settlements		14.68	0.42
	Industrial Settlements		35.33	1.00
	Total Settlement Area		**386.59**	**10.96**
Water Body	River/ Ponds		63.87	1.81
	Total Area		**3527.58**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of BCCL Clusters				Job No. 564924124
Subject: Land Reclamation Monitoring Status of Cluster-XI Group of Mines based on Satellite Data (RS-2A/L-IV) of the year 2024	Activity	Name	Designation	Signature	
	Prepared	Ayesha Parida	Manager(Geology)		
	Checked	Rohit Singh	Sr. Mgr(Geology)		
	Approved	Mohit Rastogi	GM(Geomatics)		
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	Drg No. HQ REM 24 R2 A4 CL-XI				Rev No.0

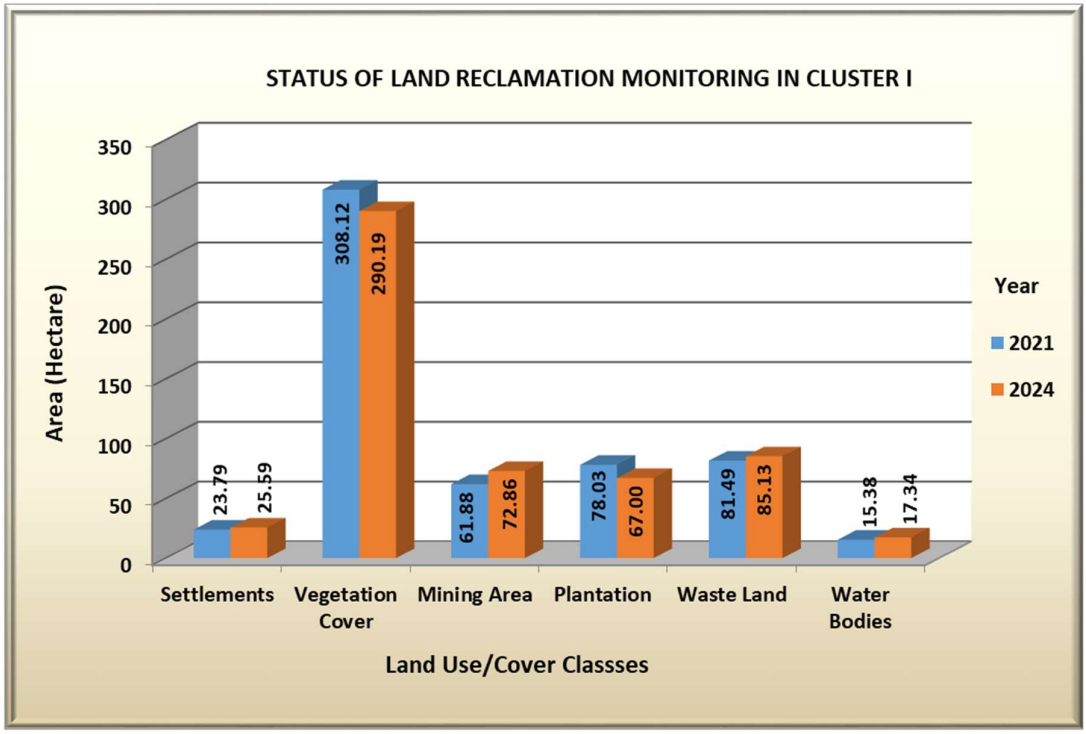


Fig. 4: Land Reclamation Status of Cluster I

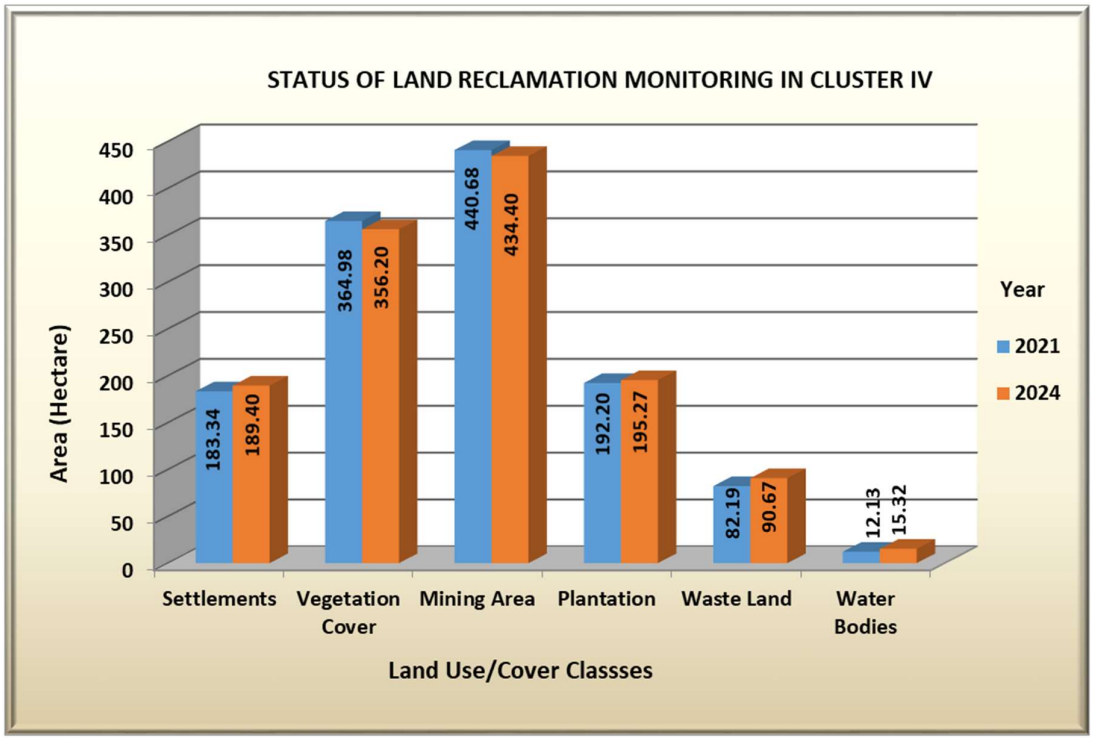


Fig.5: Land Reclamation Status of Cluster IV

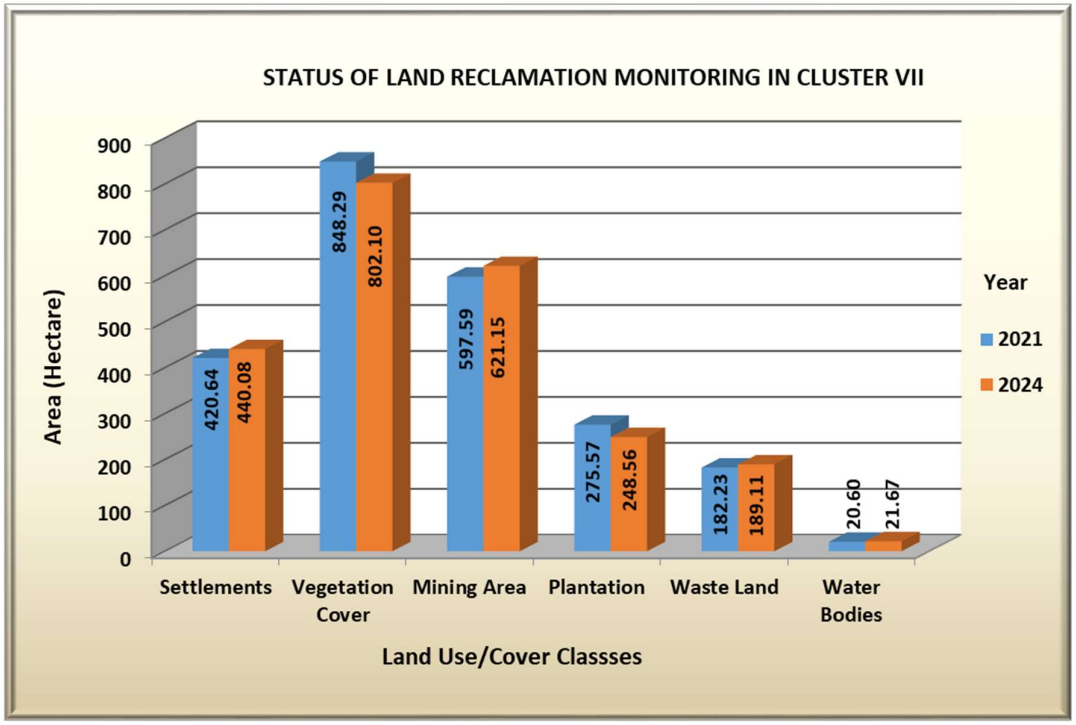


Fig. 6: Land Reclamation Status of Cluster VII

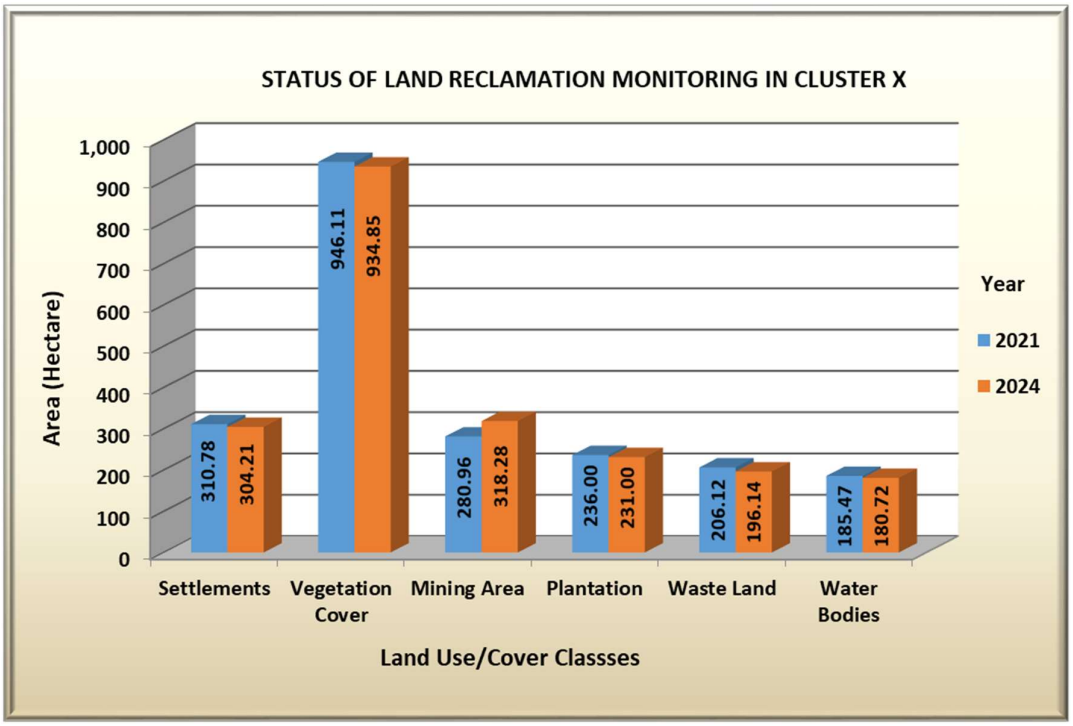


Fig. 7: Land Reclamation Status of Cluster X

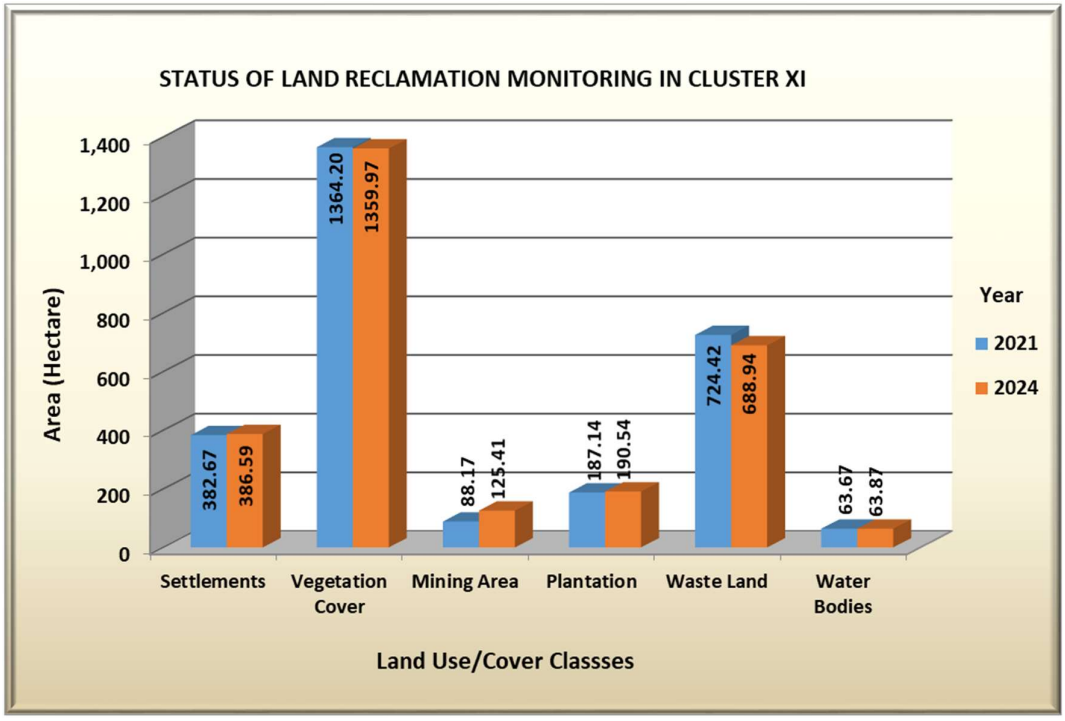


Fig. 8: Land Reclamation Status of Cluster XI



Photo 1: Plantation on OB dump, Cluster I



Photo 2: Plantation on OB dump, Cluster I



Photo 3: Plantation on Backfill, Cluster IV



Photo 4: Plantation on OB Dump, Cluster IV



Photo 5: Plantation on Backfill, Cluster VII



Photo 6: Social Forestry Plantation, Cluster VII



Photo 7: Plantation on Backfill, Cluster X



Photo 8: Plantation on OB Dump, Cluster X



Photo 9: Social Forestry Plantation, Cluster X



Photo 10: Plantation on Backfill, Cluster XI



Photo 11: Social Forestry Plantation, Cluster XI

शब्द-कोष

1	Land Reclamation	भूमि पुनरुद्धार
2	Over Burden	अधिभार
3	Monitoring	निगरानी
4	Report	प्रतिवेदन
5	Executive Summary	कार्यकारी सारांश
6	Opencast Mine	खुली खदान
7	Objective	उद्देश्य
8	Methodology	कार्य प्रणाली अथवा प्रक्रिया
9	Table	तालिका
10	List of Tables	तालिकाओं की सूची
11	Map	मानचित्र
12	Social Forestry	सामाजिक वानिकी
13	Plantation	पौधारोपण
14	Million	घनमीटर
15	Background	पृष्टभूमि
16	Planning	योजनाबद्ध
17	Asses	आकलन
18	Status	स्थिति
19	Regularly	निरंतर
20	Satellite	उपग्रह
21	Subsidiary	अनुषांगिक
22	Production	उत्पादन
23	Biological Reclamation	जैविक पुनरुद्धार
24	Technical Reclamation	तकनिकी पुनरुधार
25	Leasehold Area	पट्टाक्षेत्र
26	Excavated Area	उत्खनन क्षेत्र
27	Active mining	सक्रिय खनन
28	Environmental Protection	पर्यावरण संरक्षण
29	Remedial Measure	उपचारात्मक उपाय
30	Interval	अंतराल
31	Systematic Error	व्यवस्थित त्रुटियँ।
32	Error	अशुद्धियाँ
33	Curvature	वक्रता
34	Geometric	ज्यामितिक
35	Distortion	विरुपण
36	Plantation	पौधारोपण

शब्द-कोष		
37	Capacity	क्षमता
38	Software	सॉफ्टवेयर
39	Class	वर्ग
40	Accuracy	सटीकता
41	Statistical Separation	सांख्यिकीय पृथक्करण
42	Cubic meter	घनमीटर
43	Depicted	दर्शाया गया
44	Percentage	प्रतिशत
45	Salient Findings	मुख्य निष्कर्ष
46	Methodology	पद्धति
47	Data Procurement	डाटाक्रय
48	Satellite data Processing	उपग्रह डाटा प्रसंस्करण
49	Rectification and geo-referencing	सुधार और भूसन्दर्भ-
50	Image enhancement	छवि गुण वृद्धि
51	Training set selection	प्रशिक्षण सेट का चयन
52	Classification and Accuracy assessment	वर्गीकरण और मूल्यांकन की सटीकता
53	Area calculation	क्षेत्र गणना
54	Temporal	लौकिक
55	Processing	प्रसंस्करण
56	Overlay of Vector data base	वेक्टर डाटाबेस का अरोपन
57	Pre-field map preparation	क्षेत्र जाने के पहले नक्शे की त्तैयारी
58	Ground Truthing	भू-सत्यापन
59	Ground Information	भू- सुचना
60	Interpretation	व्याख्या
61	Eco-system	पारिस्थितिकी तंत्र
62	Minor	मामुली
63	Water Drainage	जलनिकाय
64	Interval	अंतराल
65	Maximum	अधिकतम
66	Coal field	कोयला क्षेत्र
67	Design	परिकल्पना
68	Superimpose	आरोपित
69	Update	अद्यतनीकरण/नवीनीकरण
70	Cumulative	संचयित
71	Embankment	तटबंध
72	Cluster	खुली तथा भूमिगत खदानों के समूह

ABBREVIATIONS

SoI	Survey of India
MoEF & CC	Ministry of Environment, Forest & Climate Change
CIL	Coal India Limited
ECL	Eastern Coalfields Limited
BCCL	Bharat Coking Coal Limited
CCL	Central Coalfields Limited
WCL	Western Coalfields Limited
SECL	South Eastern Coalfields Limited
NCL	Northern Coalfields Limited
MCL	Mahanadi Coalfields Limited
NEC	North Eastern Coalfields
CMPDIL	Central Mine Planning & Design Institute Ltd
NRSC	National Remote Sensing Centre
R2/ R2A	Resource Sat Satellites
LISS - 4	Linear Imaging and Self Scanning Sensor
FCC	False Color Composite
OCP	Opencast Project
UGP	Underground Project
OB	Over Burden
GCP	Ground Control points
GIS	Geographic Information System
WGS-84	World Geodetic System
UTM	Universal Transverse Mercator

GLOSSARY

Sl.	Term	Definition
1.	Land Reclamation	To manage, reclaim and restore mined out/ degraded land as close as possible to its original stage.
2.	Over Burden	The material that lies above the coal seam/ deposit
3.	Monitoring	A process of evaluation to check or keep record for a period of time.
4.	Opencast Coal Mine	Open-pit mining, also known as opencast mining, is a surface mining technique that extracts minerals from an open pit in the ground.
5.	Social Forestry	Social forestry is the management and protection of forests and afforestation of barren and deforested lands with the purpose of helping environmental, social and rural development. Plantation (Social/ Avenue or other) carried out outside mining area.
6.	Biological Reclamation	Plantation on Backfilled areas (Stabilized Internal Dumps)
7.	Technical Reclamation	Area under backfilling (Over burden dumped inside the mine voids) in mining area.
8.	Green Cover Generated	Total Plantation carried out in the lease area of Project. This includes Plantation on Backfill, Plantation on OB and Social Forestry.
9.	Leasehold Area	The area, for which lease is granted for the purpose of undertaking mining and allied operations.
10.	Excavated area	Mined out area which includes active mining, area under backfilling and plantation on backfilled areas
11.	Active Mining	Mining areas which include Coal Quarry, Advance Quarry, Quarry Filled with Water etc.
12.	Environmental Protection	It is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to mitigate damage and reverse trends.
13.	Remedial Measure	Any measure or action required or undertaken to investigate, monitor, clean up, remove, treat, prevent, contain or otherwise remediate the presence or release of any hazardous substance or activity.
14.	Systematic Error	Every measurement differing from the true measurement in the same direction, and even by the same amount in some cases.

Sl.	Term	Definition
15.	Geometric Distortion	It refers to the improper positioning of any image with respect to their true geographic position when viewed in a properly scaled common image display plane.
16.	Land Use/ Cover Class	Land cover is what covers the surface of the earth and land use describes how the land is used.
17.	Accuracy	The closeness of agreement between a measured quantity value and a true quantity value.
18.	Environmental Clearance	Environmental Clearance (EC) for any developmental projects like coal mining projects etc. has been made mandatory by the Ministry of Environment, Forests and Climate Change (MoEF & CC) through its Notification issued on 27.01.1994 under the provisions of Environment (Protection) Act, 1986.
19.	Rectification and Geo-referencing	Geo-referencing is the assigning of absolute location of a data point or data points. Geo-rectification refers to the removal of geometric distortions between sets of data points, most often the removal of terrain, platform, and sensor induced distortions from remote sensing imagery.
20.	Image Enhancement	It is the process of modifying digital images so that the results are more suitable for processing or further image analysis.
21.	Training set selection	It is a portion of a data set used to fit or train a model for prediction or classification of values that are known in the training set, but unknown in other (future) data.
22.	Image Classification	It refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps.
23.	Temporal Changes	The 'temporal change' means the change in any entity with a period of time.
24.	Ground Truthing	Collection of primary/ basic information from ground realities for satellite image interpretation and thematic mapping.
25.	Cluster	Group of opencast and/ or underground mines clubbed together for administrative purposes.
26.	Arc GIS	GIS Software used for Map preparation
27.	ERDAS IMAGINE	Satellite Image Data Classification Software

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Website : www.cmpdi.co.in, Email : cmpdihq@cmpdi.co.in

Details of Deposit in Escrow Accounts & Interst thereon in the year 2024-25:

Sr No	ESCROW ACCOUNT AT BOB	A/C No	2024-25	
			Deposit Amount	Interest income during the year
1	MURAIDIH,SHATBDI GRP.OF MINES	00150100008816	-	160.85
2	PHULARITAND MIXED MINES	00150100009052	-	109.32
3	DAMODA GRP OF MINES	00150100008869	51.81	125.31
4	AMAL MURAIDIH PHULARITAND PART	00150100012014	411.14	163.59
5	MADHUBAND UG MINE	469403800000280	-	24.24
	TOTAL		**462.95**	**583.31**
6	AMAL BLOCK II MINE	00150100009044	302.18	253.32
	TOTAL		**302.18**	**253.32**
7	MAHESHPUR COLLIERY	00150100008836	25.80	23.16
8	KHARKHAREE COLLIERY	00150100008824	27.39	22.07
9	JOGIDIH COLLIERY	00150100008823	13.98	14.41
10	GOVINDPUR UG	00150100008835	35.19	26.77
11	BLOCK IV /KOORIDIH MINE	00150100008834	172.45	128.56
12	NAKC	00150100008831	103.64	76.06
	TOTAL		**378.45**	**291.02**
13	AKWMC	00150100009051	187.68	178.04
14	AARC	00150100009053	136.86	87.33
15	SALANPUR UG MINE	00150100009050	17.05	42.63
16	KATRAS CHAITUDIH	00150100010086	116.94	104.93
17	GASLITAND COLLIERY	00150100011048	-	57.10
	TOTAL		**458.52**	**470.04**
18	NICHITPUR COLLIERY	00150100008825	82.42	102.44
19	TETULMARI COLLIERY	00150100008833	-	143.82
20	SENDRA BANSJORA COLLIERY	00150100008832	89.36	66.56
21	AAMAL SENDRA BASJORA NICHITPUR COLLIERY	00150100015633		6.36
22	MUDIDIH COLLIERY	00150100008829	4.73	126.61
23	LOYABAD COLLIERY	00150100008826	32.14	34.19
24	KANKANEE COLLIERY	00150100010973	227.16	121.81
25	BANSDEOPUR COLLIERY	00150100011831	111.049	48.368
	TOTAL		**546.86**	**650.15**
26	KUSUNDA OCP	00150100008870	177.57	147.17
27	EAST BASSURIYA OC	00150100008876	46.28	63.60
28	DHANSAR(ADIC)	00150100008939	59.169	84.226
29	GODHUR GRP OF MINES	00150100009048	94.46	78.73
30	BASSURIYA UG MINE	00150100008944	9.63	27.01
31	GONDUDIH/KHAS KUSUNDA OC	00150100008875	229.87	190.53
32	ENA OCP	00150100008938	138.84	76.32

	TOTAL		**755.83**	**667.60**
33	**PB GRP OF MINES**	**00150100009045**	55.88	53.41
34	**BURRAGARH UG**	**00150100008821**	11.41	8.55
35	**HURRLADIH UG**	**00150100008820**	11.76	8.99
36	**BHUTGORIA UG**	**00150100008818**	12.70	9.52
37	**GOPALICHOK UG**	**00150100008819**	-	12.75
38	**GOPALICHOK MINE**	**00150100010972**	86.90	45.20
39	**KENDWADIH OC MINE**	**00150100011209**	76.06	36.19
	TOTAL		**254.70**	**174.61**
40	**BASTACOLLA COLLIERY**	**00150100008877**	236.44	88.93
41	**BERA COLLIERY**	**00150100008873**	-	25.30
42	**DOBARI COLLIERY**	**00150100008935**	-	93.92
43	**GANHOODIH OCP**	**00150100008936**	-	53.85
44	**SIMLABAHAL COLLIERY**	**00150100008822**	162.72	101.41
45	**KUYA GRP OF MINES**	**00150100008874**	-	178.35
46	**AMALGAMATED BERA DOBARI KUYA GHANOODIH COLLIERY**	**00150100015511**	128.47	25.50
47	**RAJAPUR S/JHARIA OCP**	**00150100008937**	225.3210	134.3982
	TOTAL		**752.95**	**701.66**
48	**NT-ST-JEENAGORA GRP OF MINES**	**00150100009046**	662.86	493.45
49	**JOYRAMPUR UG MINE**	**00150100009049**	-	4.40
50	**BARAREE COLLIERY**	**00150100008940**	-	29.97
51	**LODNA COLLIERY**	**00150100008942**	-	14.23
52	**KUJAMA COLLIERY**	**00150100008941**	77.81	64.92
53	**AMALGAMATED JOYRAMPUR OC**	**00150100011026**	784.01	421.63
	TOTAL		**1,524.69**	**1,028.59**
54	**SUDAMDIH INC MINES**	**00150100008872**	-	10.77
55	**BHOWRA(N) GRP OF MINES**	**00150100008868**	9.10	40.68
56	**BHOWRA(S) GRP OF MINES**	**00150100008830**	150.99	168.61
57	**PATHERDIH GRP OF MINES**	**00150100008871**	-	41.23
58	**AMALGAMATED SUDAMDIH PATHERDIH**	**00150100011524**	60.87	19.87
59	**SUDAMDIH SHAFT MINES**	**00150100011673**	-	14.34
	TOTAL		**220.96**	**295.51**
60	**MOONIDIH UG PROJECT**	**00150100008943**	104.15	91.13
61	**MURLIDIH 20/21 PIT COLLIERY**	**00150100009047**	53.72	44.73
62	**LOHAPATTY COLLIERY**	**00150100009043**	217.23	214.72
	TOTAL		**375.11**	**350.58**
63	**BASANTIMATA COLLIERY**	**00150100008827**	-	47.52
64	**DAHIBARI BASANTIMATA OCP**	**00150100008828**	219.90	163.66
65	**KALYANESHWARI GRP OF MINES**	**00150100009042**	557.35	301.46
66	**BEGUNIA COLLIERY**	**00150100011365**	-	9.31
	TOTAL		**777.25**	**521.96**
	GRAND TOTAL		**6,810.45**	**5,988.35**

1	**Name of the Mine : Damoda Colliery, M/S B.C.C.L**			
2	**Manpower Details (On Roll): 229**			
	Departmental		**Contractual**	
	Male	Female	Male	Female
	128	12	89	0
3	**Number and Name of the Contractual Agencies**			
	No. of Contractor(s):		1	
	Name of the Contractor(s):		SUPL JV	
4	**Production Details:**			
	Year	**Target**		**Achieved**
		Coal (T)	**OB (Cu.m)**	**Coal (T)**	**OB (Cu.m)**
	2021-22	2,85,000	34,80,000	4,50,050	25,59,861
	2022-23	3,30,000	35,10,000	5,19,565	25,52,336
	2023-24	4,31,000	29,93,257	5,55,780	19,39,845
5	**IME/PME Details**			
	Year	**IME**		**PME**	
		Departmental	**Contractual**	**Departmental**	**Contractual**
	2022	10	79	119	0
	2023	0	10	50	0
	2024	0	0	40	0
6	**MVTC Details**			
	Year	**MVTC**		
		Departmental	**Contractual**	
	2022	104	79	
	2023	1	10	
	2024	8	0	
7	**Accident Details:**			
	Year	**Serious**	**Reportable**	**Minor**

	2019	0	0	0
	2020	0	0	0
	2021	0	0	0
	2022	0	0	0
	2023	1	0	0
	(a) Date of Accident: 15.11.2023			
	(b) Name and Designation of the person(s) injured: Mahadeo Rajwar, Line Mistry Authorized to work as Explosive Carrier.			
	© Cause of the Accident: Fall on the ground.			
	(d) Action Taken (Wherever applicable) *: Warning Letter Issued.			

PME, IME and VTC data for calendar year 2025-26 (Jan 2025 - Sept 2025)

Sl. No.	Category	Data Details
1.	**PME**	34
2.	**IME**	33
3.	**VTC**	Basic Training: 33 Refresher Training: 41 **Total = 74**

Annexure- IX

STRICTLY RESTRICTED
FOR COMPANY USE ONLY RESTRICTED
The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL / GOVERNMENT.

TRACE METAL CONCENTRATION OF AMBIENT AIR QUALITY REPORT OF BHARAT COKING COAL LIMITED,

(FOR THE HALF YEAR ENDING, JUNE, 2025)

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

(FOR THE Q.E. JUNE, 2025)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.	CHAPTER - I	EXECUTIVE SUMMARY INTRODUCTION
2.	CHAPTER-II	AIR SAMPLING & ANALYSIS
3.	**PLATES:** PLATE NO. - I	SURFACE PLAN SHOWING AIR & NOISE MONITORING LOCATIONS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the environment around us. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. One of these major attributes is water.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

3.0 Methodology of sampling and analysis

3.1 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were Cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) were used for sampling these heavy metals on EPM filter paper. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environment Laboratory of CMPDI, RI-II, Dhanbad.

4.0 Results and interpretations

4.1 Heavy Metal in Ambient Air

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

CHAPTER - I

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guidelines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a subsidiary company of Coal India Limited (CIL) is operating UG Mines and Opencast Mines in Jharia Coalfield (JCF). The Jharia Coalfield (JCF) having an area of 450 Sq.KM.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.
In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & JSPCB and other statutory authorities.

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Results and interpretations

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

TRACE METAL CONCENTRATION IN AMBIENT AIR QUALITY

Name of the Company: **Bharat Coking Coal Limited** Year : **2025-26.**

PERIOD: **HALF YEAR ENDING JUNE, 2025**

HEAVY METAL ANALYSIS REPORT OF AMBIENT AIR QUALITY

Results of 6 Heavy Metal for the month of May-2025								
SAMPLE CODE	**DATE**	**Station Name**	**Cd** CONC. IN µg/m3	**Hg** CONC. IN µg/m3	**As** CONC. IN ng/m3	**Cr** CONC. IN µg/m3	**Ni** CONC. IN ng/m3	**Pb** CONC. IN µg/m3
A1	20.05.25	Karmatand Village	BDL	BDL	BDL	BDL	2.03	0.005
A2	19.05.25	Damoda	BDL	BDL	BDL	BDL	2.14	BDL
A3	20.05.25	Madhuband Washery	BDL	BDL	BDL	BDL	BDL	BDL
A4	19.05.25	Block-II	BDL	BDL	BDL	BDL	BDL	0.006
A5	16.05.25	Muraidih	BDL	BDL	BDL	BDL	2.25	BDL
A6	29.05.25	Block-IV	BDL	BDL	BDL	BDL	BDL	BDL
A7	30.05.25	Govindpur/Ramkanali	BDL	BDL	BDL	BDL	BDL	0.032
A8	26.05.25	Nichitpur	BDL	BDL	BDL	BDL	BDL	BDL
A9	27.05.25	East Basseriya	BDL	BDL	BDL	BDL	BDL	BDL
A10	16.05.25	Dhansar/Kusunda	BDL	BDL	BDL	BDL	BDL	BDL
A11	16.05.25	Dobari	BDL	BDL	BDL	BDL	BDL	0.006
A12	30.05.25	Kusmatand Village	BDL	BDL	BDL	BDL	BDL	BDL
A13	30.05.25	Jeenagora	BDL	BDL	BDL	BDL	BDL	BDL
A14	22.05.25	Bhowrah North	BDL	BDL	BDL	BDL	BDL	BDL
A15	20.05.25	Sudamdih Washery	BDL	0.001	BDL	BDL	BDL	0.030
A16	21.05.25	Pootki	BDL	BDL	BDL	BDL	BDL	0.015
A17	21.05.25	Moonidih UGP	BDL	BDL	BDL	BDL	BDL	BDL
A18	22.05.25	Rudih Basti	BDL	BDL	BDL	BDL	BDL	0.007
A19	28.05.25	Murlidih 20/21	BDL	BDL	BDL	BDL	BDL	BDL
A20	21.05.25	Lohapatti	BDL	BDL	BDL	BDL	BDL	BDL
A21	26.05.25	Kharkharee	BDL	BDL	BDL	BDL	BDL	BDL

Results of 6 Heavy Metal for the month of May-2025								
SAMPLE CODE	**DATE**	**Station Name**	**Cd** CONC. IN µg/m3	**Hg** CONC. IN µg/m3	**As** CONC. IN ng/m3	**Cr** CONC. IN µg/m3	**Ni** CONC. IN ng/m3	**Pb** CONC. IN µg/m3
A22	29.05.25	Dahibari	BDL	BDL	BDL	BDL	BDL	0.010
A23	29.05.25	Basantimata	BDL	BDL	BDL	BDL	BDL	BDL
A24	30.05.25	Gopinathpur	BDL	BDL	BDL	BDL	BDL	BDL
A25	28.05.25	Guliardih	BDL	BDL	BDL	BDL	BDL	0.005
A26	27.05.25	Begunia	BDL	BDL	BDL	BDL	2.32	0.021
A27	26.05.25	Damagoria	BDL	BDL	BDL	BDL	BDL	0.030
A28	16.05.25	Hurriladih	BDL	BDL	BDL	BDL	BDL	0.010
A29	21.05.25	Moonidih Washery	BDL	0.005	BDL	BDL	BDL	BDL
A30	19.05.25	Sitanala	BDL	BDL	BDL	BDL	BDL	0.025
A31	30.05.25	Dumarda	BDL	BDL	BDL	BDL	BDL	BDL
A32	21.05.25	Telmacho Bridge	BDL	BDL	BDL	BDL	BDL	BDL
A33	27.05.25	Madhuband UGP	BDL	0.002	BDL	BDL	BDL	BDL
A34	19.05.25	Bhojudih Washery	BDL	0.01	BDL	BDL	BDL	0.033
A35	21.05.25	Dugda Washery	BDL	0.001	BDL	BDL	BDL	0.026
A36	22.05.25	Mahuda	BDL	0.002	BDL	BDL	BDL	BDL
A37	30.05.25	Katras Choitudih	BDL	BDL	BDL	BDL	BDL	BDL
A38	29.05.25	Sinidih Workshop	BDL	BDL	BDL	BDL	BDL	0.010
A39	20.05.25	Patherdih	BDL	BDL	BDL	BDL	BDL	BDL
A40	22.05.25	Koyla Nagar	BDL	BDL	BDL	BDL	BDL	BDL
A41	20.05.25	Sudamdih Shaft	BDL	BDL	BDL	BDL	BDL	0.020
A42	16.05.25	RHB	BDL	BDL	BDL	BDL	2.05	0.010
A43	16.05.25	Pandwabhita	BDL	BDL	BDL	BDL	BDL	BDL
A44	16.05.25	Sadariadih	BDL	BDL	BDL	BDL	BDL	0.005
A45	19.05.25	Bhojudih Buffer	BDL	BDL	BDL	BDL	BDL	BDL
A46	22.05.25	C.H. D	BDL	BDL	BDL	BDL	BDL	BDL

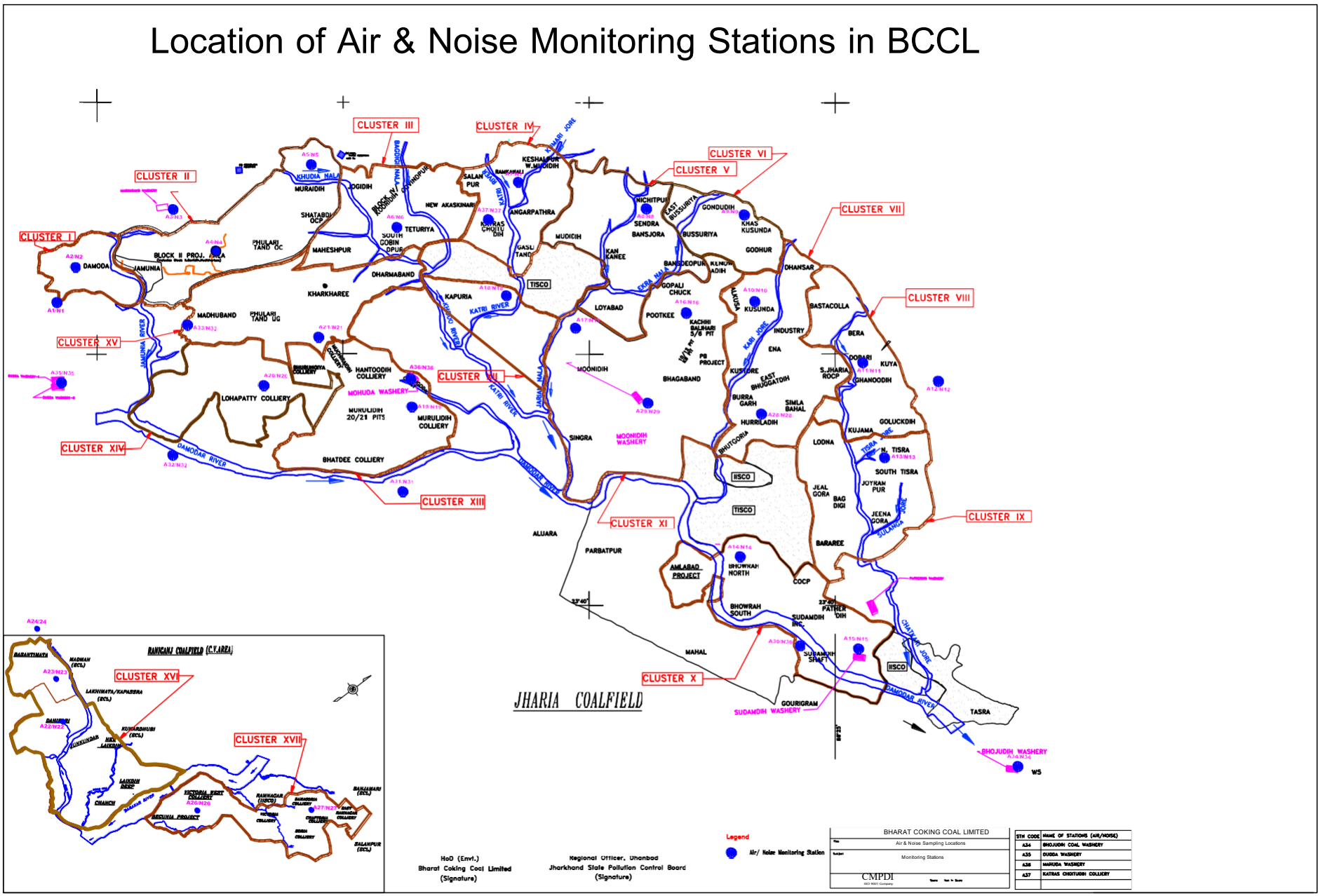
#BDL-Below detection limit

Metal	BDL	Standard as per NAAQS
Hg (µg/m^3)	0.001	*Standard Not defined
Cr(µg/m^3)	0.01	*Standard Not defined
As (ng/m^3)	1	6
Pb (µg/m^3)	0.005	0.5
Ni (ng/m^3)	2	20
Cd (µg/m^3)	0.001	*Standard Not defined

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Location of Air & Noise Monitoring Stations in BCCL



Annexure X

Bharat Coking Coal Limited

BHARAT COKING COAL LIMITED

(A Mini Ratna Company)
(A Subsidiary of coal India Limited)
Regd. off: Koyla Bhawan, Koyla Nagar,
CIN: U10101JH1972GOI000918

Office of the Project Officer

Damoda Colliery, Barora Area, BCCL

Ref No: - DC/AR-1/PO/2025/674 Date: - 23.07.2025

To,
The Member Secretary
Jharkhand State Pollution Control Board
E-1,CTI Colony, Dhurwa
Ranchi - 834004.

Sub: Environmental Statement for the financial year ending the 31st March, 2025, Cluster-I (Damoda Colliery) of Barora Area, M/S BCCL

Dear Sir,

Kindly find enclosed herewith the Environmental Statement for the financial year ending the 31st March, 2025, Cluster-I (Damoda Colliery) of Barora Area, M/S BCCL

Yours faithfully,

23.7.25

Project officer
Damoda colliery

Encl: as above

C.C to

1. Regional office, H.I.G.-1, Sardar Patel Nagar, Hirapur , Dhanbad.
2. HoD (Env.), Koyla Bhawan
3. Nodal officer (Env.) Barora Area.

ENVIRONMENTAL STATEMENT FORM-V FOR CLUSTER-I (DAMODA COLLIERY), BCCL

[FORM – V]

(See rule 14)

Environmental Statement for the financial year ending the 31st March, 2025

Part- A

Name and address of mine	Damoda Colliery (Cluster-I)
Name of owner	Sri Manoj Kr Agarwal, DT (P&P), BCCL
Industry category	Coal Mining Industry
Production capacity	0.90 MTPA Normative (1.17 MTPA Peak)
Year of establishment	Colliery operating since pre-nationalisation
Date of the last environmental statement submitted	17.09.2024

Part- B

1. Water and Raw Material consumption

Water Consumption	
1. Process (Dust Suppression)	70 KL/Day (as per CHR report)
2. Cooling	NIL
3. Domestic	286 KL/Day (as per CHR report)

Name of Product	Process water consumption per unit product output	
	During previous FY	During current FY
Coal	NA	NA

2. Raw material consumption

Name of the raw material	Name of the product	Process raw material consumption per unit product output	
		During FY (2023-24)	During FY (2024-25)
Diesel	Coal	2.52 L/Ton	2.98 L/Ton (only for departmental)
Explosive	Coal	2.22kg/Ton	1.96 kg/Ton

Part- C

Pollution discharged to Environment/unit of output (Parameter as specified in the consent issued)

Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
Water	.....	Report Enclosed	Within limit

Air	.....	Report Enclosed	Within limit

Part- D

Hazardous waste (As specified under Hazardous waste management and handling rules 1989)

S. No.	Wasted generation	Quantity (2023-24)	Quantity (2024-25)
1	Burnt Oil	5.0 KL	5695 Litres
2	Cotton Waste	500 Kg	200 Kg
3	Oil Filters	650 Nos.	247 nos.

Part- E

Solid Waste

	Total Quantity in cubic meters.	
	During financial year (2023-24)	During financial year (2024-25)
(a)From Process (Mining) Overburden	1940565.00 cum	709256 cum
(b) From pollution control facilities	NA	NA
(c)Quantity recycled or reutilized	1465028 cum backfilled OB	709256 cum backfilled OB

Part- F

Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes

Type of rock : NA
Type of soil : NA
Chemical properties of soil : NA
Disposal process for solid waste (Backfilling process) : By Dumper for backfilling of excavated area

Part- G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.

Ecological restoration on 1.26 Ha OB Dump has been done.

Part- H

Additional measures/investment proposal for environmental protection including abatement of pollution.

1. Water sprinkling is done on haul and transportation roads.
2. Fencing of the Ecological restoration site being done.
3. Monitoring of air quality, water quality and noise level are being done periodically.
4. Coal is being transported by covered trucks.

Part- I

Any other particulars in respect of environmental protection and abatement of pollution- NA

Prepared by
23/7/25

23.7.25
Project Officer
Damoda Colliery

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The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL / GOVERNMENT.

WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED, CLUSTER – I

(FOR THE Q.E. JUNE, 2025)

E. C. no. J-11015/93/2009-IA.II (M) dated 06.02.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - I

(FOR THE. Q.E. JUNE, 2025)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**PLATES:** PLATE NO. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the environment around us. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. One of these major attributes is water.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Water sampling stations

The Water sampling stations were selected for mine sump water, Ground water supply, wells / Hand pump water also surface water samples.

3.0 Methodology of sampling and analysis

3.1 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis and for 27 parameters on half yearly basis. The Ground and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI RI-II, Dhanbad.

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Ground water) and IS: 2296 (Surface water), are with in permissible limits.

CHAPTER - I

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a subsidiary company of Coal India Limited (CIL) is operating UG Mines and Opencast Mines in Jharia Coalfield (JCF). The Jharia Coalfield (JCF) having an area of 450 Sq.KM.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster I is in the westernmost part of the Jharia coalfield. It includes Damoda OCP, Damoda UG. The Cluster – I is situated at a distance of about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Jamunia River.

1.2 The Cluster I is designed to produce 0.9 Mtpa (normative) and 1.17 Mtpa peak capacity of coal. The average grade of coal W-II to W-IV.

The Project is being worked by deploying shovel dumper combination.

The Project has been granted Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 0.9 MTPA (normative) and 1.17 MTPA peak capacity of coal production vide letter no **E. C. no. J-11015/93/2009-IA.II (M) dated 06.02.2013.**

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & JSPCB and other statutory authorities.

CHAPTER – II

WATER QUALITY MONITORING

2.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Ground Water Quality at **Ghutway Village (GW1)**

ii) Surface Water Quality at **U/S of Jamunia River (SW1)**

iii) Surface Water Quality at **D/S of Jamunia River (SW2)**

iv) Mine Water Quality at Damoda Colliery **(MW1)**

v) Mine Water Quality at Madhuband Colliery **(MW22)**

2.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis and for 27 parameters on half yearly basis. The Ground and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI, RI-II, Dhanbad.

2.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results show that most of the parameters are within the permissible limits.

TC-14321

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
GROUND WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
KOYLA BHAWAN COMPLEX
DHANBAD. -826005
Phone:0326-223-850
email: rdri2cmpdi@coalindia.in

Month & Year	**QUARTER ENDING JUNE 2025**	**Cluster**	**I**	**ULR No.**	**TC1432125000002050 P**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**16.09.2025**
Project	**Ghutway Village**	**Sample Ref. No.**	**REM/BCCL/25-26/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ghutway Village**	**Date of Sampling**	**05.05.25**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**05.05.2025 TO 20.07.2025**	

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW-1	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
	Colour, Hazen unit	APHA, 24th Edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	2	1-500.0	1	5	15
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	60	2.0-800.0	2	75	200
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	55	2.0-1500.0	5	250	1000
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method,2023	0.63	0.2-2.00	0.2	1	1.5
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation
6	Magnesium	APHA 24th Edition, 3500-Mg B: Calculation Method,2023	50	6.0-700	6	30	100
7	Nitrate , mg/l	APHA, 24th Edition, UV-Spectrophotometric Method,2023	7.22	0.5-45.0	0.5	45	No relaxation
8	Odour	APHA, 24th Edition, , 2150-C,2023	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	7.55	1-14	0.1	6.5-8.5	No relaxation
10	Sulphate, mg/l	APHA –24th Edition, 4500 S , Turbidity Method,2023	164	10.0-400.0	10	200	400
11	Taste	APHA,24th Edition, 2160-C , 2023	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable
12	Total Alkalinity ($c_ac_{o_3}$), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	150	4.0-2000.0	4	200	600
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	712	25.0-5000.0	25	500	2000
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	355	4.0-2000.0	4	200	600
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditimetric Method	1.8	1-800	0.1	1	5
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 – 10.0	0.1	5	15

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

GROUND WATER ANALYSIS TEST REPORT

Month & Year	**QUARTER ENDING JUNE 2025**	**Cluster**	**I**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**16.09.2025**
Project	**Ghutway Village**	**Sample Ref. No.**	**REM/BCCL/25-26/GW**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**Ghutway Village**	**Date of Sampling**	**05.05.2025**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	
			Period of Analysis	**05.05.2025** **TO**	**20.07.2025**

Sl. No.	**Parameter**	**Method of Analysis**	**Observed Values**			**IS 10500: 2012**	
			GW-1	**Range Of Testing**	**LDL**	**Acceptable Limit (Max)***	**Permissible Limit in the Absence of Alternate Source (Max)**
1	Boron (as B), mg/l, Max	APHA, 24th d Edition ,Carmine,2023	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 24th Edition, , 4500-Cl-B. (Iodometric Method-I),2023	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 22nd Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th Edition IS-3025,part 56:2003, R-2019/, AAS-VGA,2023	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th Edition, AAS-GTA,2023	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th Edition, AAS-GTA,2023	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24TH Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
SURFACE WATER ANALYSIS TEST REPORT

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Month & Year	Quarter Ending JUNE 2025	Cluster	I	ULR No.	TC1432125170000 2067P TC1432125180000 2068P
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	16.09.2025

Project		REM/SW/BCCL/25-26/	Sampling Method	(IS 3025 , Part-1) CMPDI/RI-II/LPM 13	
Sampling Stations	(i) Upstream in Jamunia River(SW1)	Date of Sampling	04.06.2025	Period of Analysis	
	(ii) Downstream in Jamunia River(SW2)	Date of Sampling	04.06.2025	04.06.2025 to 20.08.2025	

Sl. No.	Parameter	Method of Analysis	Observed Values		IS : 2296 INLAND SURFACE WATER [1982] Class 'C	Range of Testing	LDL
1	BOD (3 days 27°C), mg/l	IS 3025 (Part 44) : 1993, R-2019 , 3 day incubation at 27°C	<2.0	<2.0	3	2.00-100.00	2
2	Colour,Hazen Units	APHA 24th Edition , 2120-B-:2023	1	1	10	1-500.0	1
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 Argentometric Method	38	38	600	2.0-1500.0	5
4	Copper, mg/l	IS 3025 (Part 42) : 1992 R : 2019, AAS-Flame Method	<0.2	<0.2	1.5	0.2-10.0	0.2
5	Dissolved Oxygen, mg/L	IS 3025 (Part 38) : 1989, R:2003 Winkler Azide Method	6.5	6.2	4	1.0-10.0	0.1
6	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method,2023	0.73	0.62	1.5	0.2-2.00	0.2
7	Hexavalent Chromium, mg/l	APHA 24th Edition, 1,5-Diphenylcarbohydrazide Method IS 3025 (Part 52) : 2003,R-2023	<0.01	<0.01	0.05	0.01-1.4	0.01
8	Iron, mg/l	IS 3025 (Part 53):2003,R:2019, AAS-Flame Method	<0.2	<0.2	50	0.2-10	0.2
9	Nitrate , mg/l	APHA, 24th Edition, UV-Spectrophotometric Method,2023	4.92	4.31	50	0.5-45.0	0.5
10	pH value	IS 3025, (Part 11) : 1983 R-2023 Electrometric (Ph Meter) method	7.84	7.68	6.5-8.5	1.0-14.0	2
11	Sulphate, mg/l	APHA –24th Edition,4500- S, Turbidity Method,2023	37	46	400	10.0-400.0	10
12	Total Dissolved Solids, mg/l	IS 3025, (Part 16): 1984 R-2023 Gravimetric method	426	436	1500	25.0-10000.0	25
13	Zinc, mg/l	IS 3025(Part 49) : 1994, R : 2019, AAS-Flame Method	<0.1	<0.1	15	0.10 – 10.0	0.1

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit*

****All units in mg/L unless specified otherwise,* ***Sample Collected in 5 Ltr Jerricane , Colour as observed is transparent***

Analysed by

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
Environment Laboratory, Regional Institute-II
SURFACE WATER ANALYSIS TEST REPORT

CMPDIL, RI-II
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Month & Year	**QUARTE ENDI NG JUNE 2025**	**Cluster**	**I**		
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**16.09.2025**
Project	**Sample Ref. No.**		REM/BCCL/25-26/SW /	**Sampling Method**	**(IS 3025 , Part-1) CMPDI/RI-II/LPM 13**
Sampling Stations	**(i)**	**Upstream in Jamunia River(SW1)**	**Date of Sampling**	04.06.2025	**Period of Analysis**
	(ii)	**Downstream in Jamunia River(SW2)**	**Date of Sampling**	04.06.2025	04.06.2025 to 20.08.2025

Sl. No.	Parameter	Method of Analysis	Observed Values (i)	Observed Values (ii)	IS : 2296 INLAND SURFACE WATER [1982] Class 'C	Range of Testing	LDL
1	Arsenic (as As), mg/l, Max	IS-3025,Part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	<0.006	0.2	0.006-10	0.006
2	Lead (as Pb), mg/l, Max	APHA, 24th Edition, AAS-GTA	<0.005	<0.005	0.1	0.005-10	0.005
3	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 22nd Edition 4-Amino Antipyrine	<0.002	<0.002	0.005	0.002-10	0.002
4	Selenium, mg/l, Max	IS-3025 ,Part 56:2003, R-2019/ APHA 24th edition, AAS-VGA	<0.007	<0.007	0.05	0.007-10	0.007

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit*

****All units in mg/L unless specified otherwise* ***Sample Collected in 5 Ltr Jerricane , Colour as observed is transparent***

(Gaurav Kant)

(Kumar Vaibhav)

Analysed by ***REVIEWED BY*** ***Authorised Signatory***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED
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MINE EFFLUENT ANALYSIS TEST REPORT

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Month & Year	**QUARTER ENDING JUNE 2025**	**Name of Cluster**	**CLUSTER I**	**ULR No.**	**TC143212559000002109P**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**16.09.2025**
Project	**Damoda Colliery**	**Sample Ref. No.**	**REM/BCCL/25-26/MW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**MW1**	**Date of Sampling**	**23.06.2025**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	

Period of Analysis **23.06.2025** **to** **10.09.2025**

Sl. No.	Parameter	Method of Analysis	MW1	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-10000.0	2	30
2	Colour	APHA,24th Edition ,2120-B-:2023	<1	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 24th Edition 5220 C Titrimetric Method,2023	44	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	0.083	0.1-5.0	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 24th Edition, Page 4-90 to , 4500 – F- D (SPADNS Method),2023	0.62	0.2-2.0	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.40	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 24th Edition, AAS-Flame	<0.1	0.1-10	0.1	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 24th Edition,UV-Spectrophotometric	1.06	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2023, Electrometric	7.79	1 -14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	29.8	1-100	.	Shall not exceed 5° C above the receiving temp.
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2023, Gravimetric	46	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.1	0.1-10.0	0.1	5
18	Odour	APHA, 24th Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

	(Gaurav Kant)	(Kumar Vaibhav)
ANALYSED BY	***REVIEWED BY***	***Authorised Signatory***

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

Environment Laboratory, Regional Institute-II

MINE EFFLUENT ANALYSIS TEST REPORT

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Month & Year	**QUARTER ENDING JUNE 2025**	**Name of Cluster**	**CLUSTER I**			
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**				**Date of Issue**	**16.09.2025**
Project	**Damoda Colliery**	**Sample Ref. No.**	**REM/BCCL/25-26/MW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**MW1**	**Date of Sampling**	**23.06.2025**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**		

Period of Analysis **23.06.2025** **to** **10.09.2025**

Sl. No.	Parameter	Method of Analysis	MW1	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th Edition AAS-VGA,2023	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2023 AAS-GTA/APHA, 24th Edition, 3111B, AAS-GTA	<0.005	0.005-10	0.005	2
5	Phenolic compounds	APHA, 24th Edition4-Amino Antipyrine,2023	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 24th Edition, AAS-VGA,2023	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 24th Edition Methylene Blue Method,2023	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 24th Edition, , 4500-Cl B. (Iodometric Method-I),2023	<0.04	0.04-5.00	0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY	(Gaurav Kant) ***REVIEWED BY***	(Kumar Vaibhav) ***Authorised Signatory***

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TC-14321

MINE EFFLUENT ANALYSIS TEST REPORT

Month & Year	**QUARTER ENDING JUNE 2025**	**Name of Cluster**	**CLUSTER I**	**ULR No.**	**TC143272500000213 0P**
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**			**Date of Issue**	**16.09.2025**
Project	**Madhuband Colliery**	**Sample Ref. No.**	**REM/BCCL/25-26/MW/**	**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**
Sampling Stations	**MW22**	**Date of Sampling**	**16.06.2025**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**	

Period of Analysis **16.06.2025** **to** **10.09.2025**

Sl. No.	Parameter	Method of Analysis	MW22 M1280	Range Of Testing	LDL	MOEF -SCH-VI STANDARDS Class 'A'
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-10000.0	2	30
2	Colour	APHA,24th edition ,2120-B-:2023	2	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 24th edition 5220 C Titrimetric Method	40	4.0-800.0	4	250
4	Copper (as Cu), mg/l, *Max*	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	0.1	0.1-5.0	0.1	5
6	Fluoride (as F) mg/l, *Max*	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)	0.78	0.2-2.0	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.40	0.01	0.1
8	Iron (as Fe), mg/l, *Max*	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 24th edition, AAS-GTA	<0.1	0.1-10	0.005	0.1
10	Nickel (as Ni), mg/l, *Max*	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, *Max*	APHA, 23 rd Edition,UV-Spectrphotometric	0.87	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2023, Electrometric	7.85	1 -14	0.1	5.5 to 9.0
14	Temperature (°C)	IS-3025/09:1984, Thermometeric	31.1	1-100	.	Shall not exceed 5° C above the receiving temp.
15	Total Chromium (as Cr), mg/l, *Max*	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2023, Gravimetric	41	10-5000	10	100
17	Zinc (as Zn), mg/l, *Max*	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.1	0.1-10.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

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CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED

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MINE EFFLUENT ANALYSIS TEST REPORT

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Month & Year	**QUARTER ENDING JUNE 2025**	**Name of Cluster**	**CLUSTER I**				
Customer	**Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)**					**Date of Issue**	**16.09.2025**
Project	**Madhuband Colliery**	**Sample Ref. No.**	**REM/BCCL/25-26/MW/**		**Sampling Method**	**CMPDI/RI-II/LPM 13,(IS 3025:Part -1)**	
Sampling Stations	**MW22**	**Date of Sampling**	**16.06.2025**	**Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**			
				Period of Analysis	**16.06.2025**	**to**	**10.09.2025**

Sl. No.	**Parameter**	**Method of Analysis**	**MW22**	**Range Of Testing**	**LDL**	**MOEF -SCH-VI STANDARDS Class 'A'**
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nesseler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, *Max*	IS-3025(Part 59):2006, R 2023 AAS-GTA/APHA, 24th Edition, 3111B, AAS-GTA	<0.005	0.005-10	0.005	2
5	Phenolic compounds	APHA, 24th edition4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 24th edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S^{2-}) mg/l Max.	APHA 24th edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nesseler's	<1	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)	<0.04	0.04-5.00	0.04	1

****All units in mg/L unless specified otherwise,*

***Grab sampling carried out for water samples. *LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

ANALYSED BY

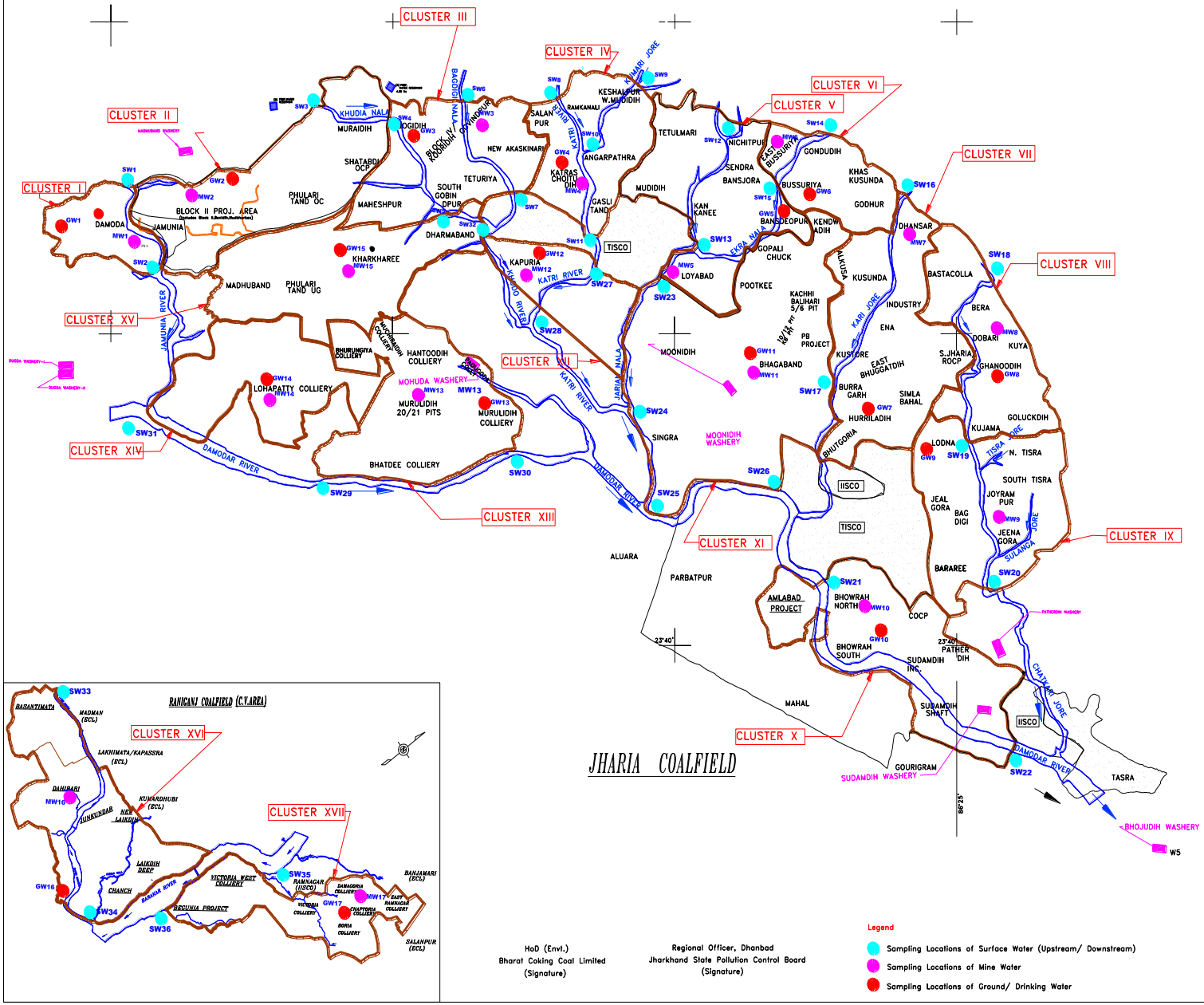
(Gaurav Kant)
REVIEWED BY

(Kumar Vaibhav)
Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murilidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer	BHARAT COKING COAL LIMITED
Title	WATER SAMPLING LOCATIONS
Subject	MONITORING STATIONS
CMPDI (ISO 9001 Company)	Scale: Not to Scale

Annexure- XII

भारत सरकार
Govt. of India
श्रम एवं रोजगार मंत्रालय
Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय
Directorate-General of Mines Safety

NO: 010310|CZ|Koderma Region|Perm|2025|274937 Date: 03/07/2025

प्रेषक:
खान सुरक्षा निदेशक,
कोडरमा क्षेत्र, कोडरमा-825409, झारखंड।

सेवा में ,
अभिकर्ता/परियोजना अधिकारी,
दामोदा कोलियरी, बरोरा क्षेत्र,
मे॰ भारत कोकिंग कोल् लिमिटेड,
दामोदा, पोस्ट: कर्माताड़, जिला: बोकारो, झारखंड। - 828 307.

विषय : Permission under Regulation 196(3) of the Coal Mines Regulations, 2017 for conducting Controlled Deep Hole Blasting within the Danger Zone of 500 m but beyond 100 m from the surface structures whether belonging to the owner or not, i.e. from B.J Section Quarters, Damoda Office, Sijua Pahari village, Sijua village and public road at Damoda Colliery, Barora Area of M/s Bharat Coking Coal Limited.

महाशय,

Please refer to your online application vide reference ID No. 274937, dated 22.05.2025 and the offline documents submitted vide letter No. BCCL/PO/DC/AR-1/Permission 196(3)/2025/278, dated 22.05.2025 enclosing Surface Plan Nos. DC/Perm./Surface/2025/365, dated

22.05.2025 (on scale 1:2000) and DC/Perm./Surface/2025/366, dated 22.05.2025 (on scale 1:4000) and a Scientific Study Report titled "Scientific study on Blasting in Danzer Zone at proposed Patch A-3 (revised) of Ghutway Station of Damoda Colliery under Barora Area of M/s BCCL", by Department of Mining Engineering, Indian Institute of Technology (BHU), Varanasi, submitted vide Registration No. Min./const./Reg./21-22/002, dated 01.07.2021", prepared by Dr. Suresh Kumar Sharma, Assistant Professor and Dr. Piyush Rai, Professor, Department of Mining Engineering, Indian Institute of Technology (BHU), Varanasi, Uttar Pradesh, on the above cited subject.

The matter has since been examined on the basis of information furnished in your application under reference and shown on the enclosed plans/sections submitted by you.

In exercise of the powers conferred on the Chief Inspector of Mines (also designated as Director-General of Mines Safety) under the provisions of Regulation 196(3) of the Coal Mines Regulations, 2017 and by virtue of authorization granted to me by the Chief Inspector of Mines under Section 6(1) of the Mines Act, 1952, I, hereby grant permission under Regulation 196(3) of the Coal Mines Regulations, 2017 for conducting Controlled Deep Hole Blasting within 500 m but beyond 100 m distance from the structures whether belonging to the owner or not i.e. from B.J Section Quarters, Damoda Office, Sijua Pahari village, Sijua village and public road at Damoda Colliery, Barora Area of M/s Bharat Coking Coal Limited, in the area bounded by the coordinates A: N104370/E67924, B: N104412/E/67986, C: N104382/E68112, D: N104270/E68062 and A: N104370/E67924 as shown on the Surface Plan Nos. Nos. DC/Perm./Surface/2025/365, dated 22.05.2025 (on scale 1:2000) and DC/Perm./Surface/2025/ 366, dated 22.05.2025 (on scale 1:4000), subject to the strict compliance of the following conditions:

1.0 This permission is being granted to conduct Controlled Deep Hole Blasting only in the area bound by the coordinates A: N104370/E67924, B: N104412/E/67986, C: N104382/E68112, D: N104270/E68062 and A: N104370/E67924 as shown on the Surface Plan Nos. Nos. DC/Perm./Surface/2025/365, dated 22.05.2025 (on scale 1:2000) and DC/Perm./Surface/2025/366, dated 22.05.2025 (on scale 1:4000), submitted with your letter under reference.

2.0 Except where otherwise provided for in this permission, all provisions of the Coal Mines Regulations, 2017 relating to opencast working, use of explosives and machinery etc., shall be strictly complied with.

3.0 No blasting shall be done within 100 m of any buildings/dwellings/hutments, other structures and public road belonging to the private owners and permanent private structures, whether belonging to the Owner or not. These distances shall be demarcated on the field/ground by suitable boundary pillars, which shall be easily identifiable from distance as well as on the plan maintained under Regulation 65(1)(a) of the Coal Mines Regulations, 2017.

4.0 No blasting operations shall be conducted in the areas demarcated, other than in the area bounded by coordinates as above unless a fresh permission is obtained from this Directorate, and the land has been acquired by M/s Bharat Coking Coal Limited and is under the possession of the mine management with no disputes whatsoever.

5.0 No working shall be made or extended to any point within 45 m of any permanent surface structures or railway not belonging to the owner of the mine and any public road, without a prior permission in writing of the Chief Inspector of the Mines and subject to such conditions as he may specify therein.

6.0 Barricades/drop gates on either end of public road within 500 m radius from the blasting site shall be maintained and two persons shall be posted on either direction at the two extreme points so that the vehicles or passersby are warned and stopped while passing within 500 m (Danger Zone) during blasting period in the mine.

7.0 Standard Operating Procedures (S.O.P) based on the risk assessment, for conducting controlled blasting shall be prepared and implemented. All concerned persons shall be issued with the signed copies of Standard Operating Procedures (S.O.P) and they shall be made aware of the S.O.P's.

8.0 Based on the Scientific Study of Department of Mining Engineering, Indian Institute Technology (BHU), Varanasi, the following parameters given in the below Table, shall be adopted for blasting in coal and overburden benches within the leasehold area (i.e. in the area bounded by coordinates A: N104370/E67924, B: N104412/E/67986, C: N104382/E68112, D: N104270/E68062 and A: N104370/E67924) at a distance of 100 m away from hutments/dwellings, other structures and public road whether belonging to the owner or not with suggested Maximum Charge Per Delay (MCPD) and Total Charge Per Delay (TCPD) for overburden benches at Damoda Colliery. The flowing parameters shall be strictly adhered.

Distance	**Maximum Charge Per Delay - Q (Kg)**			**Total Charge Per Round – TQ (Kg)**		
(m)	**Allowable PPV(5)***	**Allowable PPV(10)****	**Allowable PPV(15)*****	**Allowable PPV(5)***	**Allowable PPV(10)****	**Allowable PPV(15)*****
100	6	16	29	225	648	1204
125	9	25	46	351	1013	1881
150	13	36	66	506	1459	2709
175	18	49	90	689	1985	3687
200	23	65	118	900	2593	4816

*5 mm/sec for Kutchha house/dwelling not belonging to the Owner, ** 10 mm/sec for Pakka house/dwelling not belonging to the Owner, *** 15 mm/sec for house/dwelling belonging to the Owner

9.0 The dominant excitation frequencies vis-à-vis Peak Particle Velocity (PPV) at the foundation level of structures in mining areas (in mm/sec) measured at a distance of 100 m from the site of blasting shall not exceed the limits/values stipulated in DGMS (Tech.) Circular No. 07 of 1997, as given below:

Type Of Structure	Dominant Excitation Frequency (Hz).		
	< 8 Hz	8 - 25 Hz	> 25 Hz
(A) Building/structure not belonging to Owner			
(i) Domestic houses/structures (Kuchha, Brick and cement)	5	10	15
(ii) Industrial Buildings (RCC and framed structures).	10	20	25
(iii) Objects of historical importance and sensitive structures	2	5	10
(B) Building belonging to Owner with limited span of life			
(i) Domestic houses /structures (Kuchha, Brick in cement)	10	15	25
(ii) Industrial Buildings (RCC and framed structures).	15	25	50

10.0 The Manager shall satisfy himself that all the recommendations/conclusions including pattern of holes (i.e. size and depth of hole, spacing, burden and sequence of delay etc.) made by Department of Mining Engineering, Indian Institute of Technology (BHU), Varanasi are being strictly complied with.

11.0 To reduce the Blast Induced Ground Vibrations and Air Over Pressure, only **Electronic Delay Initiation System** with a delay range of 17 milliseconds to 300 milliseconds (ms) shall be used for the blasting zone of 100 m to 200 m from the dwellings/hutments, other structures and public road not belonging to the Owner.

11.1 The inter-hole delay shall be maintained as more than or equal to 17 ms while programming the firing sequence of holes using Electronic Detonators. The initiation point shall be selected in such a way that a minimum magnitude of vibration is propagated towards the village and other permanent structures.

12.0 The precautions as prescribed in Regulation 149 of the Coal Mines Regulations, 2017 regarding danger from the surface water shall be strictly complied with.

13.0 As per the conditions laid down in Regulation 192(7) of the Coal Mine Regulations, 2017, ‘Standing Orders’ shall be framed and enforced at the mine for the safe use of two types of explosives i.e., Site Mixed Slurry (SMS) or Site Mixed Emulsion (SME) and booster in any shot hole.

14.0 Precautions as laid down in Regulation 194 of the Coal Mines Regulations, 2017 read with the Gazette Notification No. G.S.R. 985(E), Dhanbad, dated 01.10.2018 regarding Deep Hole Blasting shall be strictly complied with.

15.0 Blasting operations shall be carried out under the personal supervision of an Assistant Manager holding a First Class Manager's Certificate of Competency. He shall be assisted with adequate number of trained supervisors and competent persons. Shots shall be charged, stemmed & fired by a person holding at least Overman’s Certificate of Competency granted under the Coal Mines Regulations, 2017. He

shall maintain records of blasting parameters for every blast in a bound paged book kept for this purpose. The records shall be duly signed by him and countersigned by the Manager.

16.0 The Manager of the mine shall design the pattern of holes to be drilled in consultation and under the guidelines given by the Scientific Agency so as to minimize the Blast Induced Ground Vibrations, Air Over Pressure and to control flying fragments within 10 m in any direction from the place of blasting.

17.0 The mine management shall indemnify any person including the private Owners of the surface structures, who may be affected for any damage or loss to their life and property arising out of mining operations.

18.0 Mobile phones shall not be allowed in the blasting area at the time of handling, charging and blasting of explosives. Two-way communication by wireless or walkie-talkie sets shall be provided to the Assistant Manager/In-charge of blasting, Shot-Firers, and to the assistants of the Shot-Firer. The wireless or walkie-talkie sets shall remain switched off during handling and charging of explosives.

19.0 The Maximum Charge Per Delay (MCPD) and Total Charge Per Round (TCPR) shall not exceed the quantities mentioned in the above Table; and additional precautions for safe blasting mentioned in Para No. 5.3 (Page No. 15), suggestions for fly rock control mentioned in Para No. 6.0 (Page No. 16) and conclusions/recommendations mentioned in Para No. 7.0 (Page Nos. 17 and 18) of the Scientific Study Report prepared by Department of Mining Engineering, Indian Institute of Technology (BHU), Varanasi, submitted vide Registration No. Min./const./Reg./21-22/002, dated 01.07.2021, shall be strictly complied with.

20.0 No hole shall be blasted without proper muffling. Muffling of shot holes shall be done with conveyor belt/wire netting pieces (at least 1.8 m X 1.2 m) or 1 to 1.5 m wide expandable wire mesh nets of 30 x 30 mm to 50 x 50 mm openings overlain by 3 to 4 sandbags each of 30 to 40 kg by weight. Controlled and restricted muffle blasting shall be adopted so that no damage is caused to the residential buildings or the houses.

21.0 Free faces shall always be maintained and blasting material shall be cleared off before commencement of blasting operation.

21.1 All loose debris should be removed from the place where drilling and blasting is to be done.

21.2 No blasting shall be done in crushed, broken or sliced ground.

21.3 Charging of explosives shall be such as to ensure continuity of the explosive column. Where deck charging is done, continuity shall be ensured for each deck of explosive charge.

21.4 The cartridge of explosives shall be lowered carefully into the shot-holes so as to avoid sticking of cartridges in the shot holes thereby causing air spaces in column of explosive charge. After each hole with explosive, the length of the remaining hole shall be measured to ensure

that the cartridges are in close contact with each other and there is no air gap between any two cartridges of explosives. In case of the length of uncharged portion of the hole is not found as per the calculation thereby indicating the presence of air space, attempt may be made to push down the charge (in case of slurry explosives only). The remaining hole shall then be stemmed with moist sand before blasting the shot-hole.

21.5 The area of the loaded holes shall be conspicuously marked by visible bright red flags during daylight hours. The entire area shall be cordoned off to prevent unauthorized or inadvertent entry.

21.6 Sand/drill cuttings shall only be used as stemming material.

21.7 In case water is encountered in any shot-hole, the shot hole shall be dewatered by blowing compressed air into the hole before charging.

22.0 The blasting operations in overburden and coal seams shall be conducted in the following manner:

22.1 Storage and use of cap sensitive and non-cap sensitive slurry/emulation explosives in the opencast workings shall be strictly done in accordance with the provisions of the Coal Mines Regulations, 2017.

22.2 Competent persons trained in controlled blasting and duly authorized by the Manager shall only be permitted to fire the shots.

22.3 A record of blasts showing the pattern of shot holes and the particulars of blast parameters (spacing, burden and depth of hole), number of holes fired in the round, charge per hole, charge per delay, charge per round, initiation pattern (with proper sketches), place of blasting (latitudes, longitudes or grid coordinates of all the extreme corner points), results of ground vibrations observed (Peak Particle Velocity, frequency and air-over pressure), place of the instrument (with latitudes, longitudes or grid coordinates), the distance of site of blasting from the nearest structure, and distance upto which the flying fragments resulting out of blastings projected shall be maintained in a bound paged book and the same shall be signed and dated by the Blasting Officer or Assistant Manager and countersigned by the Manager

22.4 Instrument(s) for measuring the Blast Induced Ground Vibrations (Peak Particle Velocities, frequencies and air-over pressures) shall be procured and maintained in proper working order at the mine.

22.5 No blasting shall be done within 500 m of any underground workings measured in any plane where persons are employed.

22.6 Mobiles or cell phones shall not be carried or used in the blasting area at the time of transport, handling, charging and blasting of explosives.

23.0 In case of misfires, precautions as laid down in the Regulation 204 of the Coal Mines Regulations, 2017 shall be taken.

24.0 In case, peak particle velocity is observed more than the value stipulated in the DGMS (Tech.) Circular No. 07 of 1997 or flying fragments are projected to a distance beyond 10 m from the place of firing, the blasting operations shall be discontinued/stopped. Information in this regard shall be sent to this Directorate immediately and blasting operations shall not be resumed unless a fresh express permission in writing is accorded by this Directorate.

25.0 The Shot-Firer shall not fire the shots unless sufficient warning, by efficient signals or other means approved by the Manager, is given over the entire area falling within a radius of 500 meters from the place of firing (i.e. within the danger zone) and also, he has ensured that all persons within such area have taken proper shelter. The Code of Blasting Signals shall be framed by the Manager and the same shall be strictly followed.

26.0 Blasting time shall be fixed by the manager of the mine in consultation with the local people and a caution board prepared in the local language depicting the time of blast shall be placed prominently at strategic places all around the proposed area. No blasting shall be done in deviation of the blasting time fixed except for reasons to be recorded in writing by the Manager of the mine.

27.0 Blasting shall be conducted only during daylight hours. The explosive charges shall not be allowed to sleep over in bore-holes unless express permission in writing to that effect has been obtained from this Directorate.

28.0 Ten (10) minutes before firing, a siren installed for the purpose, shall be blown three times for one minute each, at an interval of one minute and no shot shall be fired unless the blasting Overman with the assistance of sufficient number of persons appointed in writing by the Manager for the purpose, has ensured that all persons have left the danger zone or had taken adequate shelter.

29.0 The precautions laid down against dangers due to flying projectiles in DGMS (SOMA)/(Tech.) Circular No. 02 of 2003, DGMS (Tech.) Circular No. 15 of 1977 and DGMS (Tech.) Circular No. 08 of 1982 shall also be complied with during blasting operations.

30.0 No shot shall be fired when there is traffic on any road or on railway track within the danger zone.

31.0 Substantially built Blasting Shelters of permanent nature or of portable type of adequate capacity shall be provided to Shot-Firer and his assistants, if any, for taking shelter in danger zone to protect from flying fragments. Blasting shelter without bottom plate shall not be used for taking shelter. Blasting shelter shall not be placed in the direction of free face of the blasting site.

32.0 Notwithstanding anything contained in the Coal Mines Regulations, 2017, the preparation of charges and the charging and stemming of holes shall be carried out under the personal supervision of an Overman who shall fire the shots himself in respect of deep holes.

33.0 The Manager shall assign to every Official and Competent Person, their particular duties defining their sphere of responsibilities as per the Regulations, Rules and Bye-laws made thereunder which affect him and shall take all possible steps to ensure that every such person understands, carries out and enforces the provisions contained therein in a proper manner.

34.0 Drilling and charging of deep-holes shall not be carried out in the same area at the same time.

35.0 During the approach and progress of electric storm no explosives shall be handled. If charging operation has already begun the work shall be discontinued and all exposed wires shall be coiled up and placed in the mouth of the holes and covered by something other than a metal plate. Charging operation shall be resumed only after the storm has completely passed. If the firing circuit has been set up before the thunderstorm, the persons at the blasting site shall be withdrawn at the earliest and the shot holes of blast shall be fired off immediately after giving efficient warning and ensuring that all persons within the danger zone have taken proper shelter.

36.0 After firing of the shots, no person shall enter or be allowed to enter the place until it has been inspected by an Assistant Manager or Overman and declared safe.

37.0 The provisions of Regulation 196(1) and 196(2) of the Coal Mines Regulations, 2017 shall be strictly complied with.

38.0 The guidelines stipulated in DGMS (Tech.) Circular Nos. 03 of 1980 and 04 of 1983 regarding precautions against danger of coal dust explosion while extracting pillars by opencast mining method.

39.0 The conditions for conducting blasting in fire areas in an opencast coal mine specified under the Gazette Notification No. G.S.R. 986(E) dated 1stOctober 2018 shall be complied with.

39.0 The conditions for transportation of explosives in bulk specified under Gazette Notification No. G.S.R. 982(E) dated 1 st October 2018 shall be complied with.

40.0 The precautions laid down against premature blast of Site Mixed Emulsion (SME)/Site Mixed Slurry (SMS) Explosives in DGMS (Tech.) Circular No. 14 of 2020 shall also be complied with during blasting operations.

41.0 This permission is being issued under Regulations 196(3) of the Coal Mines Regulations, 2017, only and without prejudice to any other provisions of the law, which may be or may become applicable to any time.

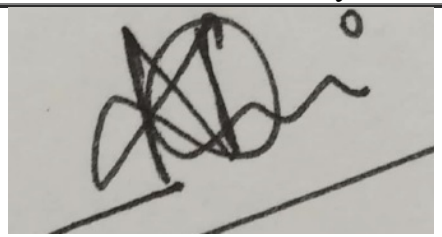
42.0 The Directorate shall be informed as soon as the mining operations are commenced in accordance with the above permission. Intimation about the completion of the mining operation should also be sent promptly and in any case not later than one month thereof.

43.0 If any time any one of the conditions subject to which this permission has been granted is violated or not complied with, this permission shall be deemed to have been revoked with immediate effect.

44.0 The above permission may be amended or withdrawn at any time, if considered necessary in the interest of safety.

45.0 In the event of any change in the circumstances connected with this permission, which is likely to endanger the mine, the mining operations for which this permission has been granted shall be stopped forthwith and intimation thereof sent to this Directorate. The said operation shall not be resumed without an express and fresh permission in writing from this Directorate.

46.0 The permission shall remain valid for the period of **five (05) years** from the date of issue of this letter, unless renewed.

Yours faithfully,

(NAVA PROKASH DEORI) Director of Mines Safety/Regional Inspector, Koderma Region, Central Zone, DGMS
“This is a system generated document and does not require any signature”

Rain water harvesting structure is present at Guest House of Barora Area, Regional Hospital Baghmara and Nehru Balika vidyalay



RAIN WATER HARVESTING STRUCTURE



Filter Plant





136. SRI - Pinku Kr. Vishwakarma
Designation: Sr. office (Nursing)
P. No -

Nursing Shoe No 78 pair Dt. 26.05.2023	FI Jacket one P.C. Dt. 26.5.2023	Helament one P.C. Dt. 26.05.2023
M/ Shoe no. 08 01 pair Dt: 24.02.2024 24.02.24	(Cotton) Jacket 01 Dt. 05.03.24 05.04.24	
1. Dust mask (vary) 2. White 1+1=2 05.04.24		
Gum boot 01 (one) Dt: 25.03.24 (E)		

NAME - Ray. Ka. Beldar.
Dig. No. Roof Bolt
P.NO- 02947638

(57)

(7)

Mining Shoe	F. Tonic	Helmet
23.3.2021	23.03.2021	Helmet 03.08.22

Sd.

07.05.22
राजकु म्हात्रे.

Mining Shoe.
No of pairs
12.05.23
राजकु म्हात्रे.

M/Shoe No. 07
Replacement
Dt: 22/11/23
राजकु म्हात्रे.

Gumboot
No. 7 04 pair
Dt: 25/06/24
राजकु म्हात्रे.

1. Jacket 01 (one)
2. Dust mask 01 (one)
3. Ear plege 01 (one)
4. Whistle 01 (one)
राजकु म्हात्रे.

Sh. Deepak Kr. Rawani

Mining shoe	F-I Jacket	Helmet
06.07.22	06.07.22	06.07.22
09.02.23 old damage Deepak Kumar Rawani M/shoe no. 07 (damaged) Dt. 03.11.2023 Deepak Kumar Rawani	02.02.23	Deepak Kumar Rawani Helmet 01 (one) Dt: 06.05.2024 Deepak Kumar Rawani
m/shoe 07 01 pair Dt: 25/06/24 Deepak Rawani Deepak Kumar Rawani		
1. Jacket 01 (one) 2. Dust mask 01 (one) 3. Cover glass 01 (one) 4		
Deepak Kumar Rawani		

NAME- MAHADEO Rajwar
Dig (--) Line Mistry
P.NO - 01319838

(1/2)

MINING SHOE (06)	F. JACKET	HELMET
23.03.2021	23.03.2021	24/05/21
Sig.		
07.05.22		
02.03.23		
M/Shoe NO. 06 01 pair (for damage) Dt: 02.11.2023 महादेव रजवार		
1 Jacket 01 (one) 2 Dush mask 01 (one) 3 Whistle 01 (one) 4 Cap lamp 01 (one) महादेव रजवार		
M/Shoe NO. 06 01 (one) pair Dt 23.9.24 महादेव रजवार		

NAME - SOMRA MUNDA
Deg - Timber Mazdoor
P.No - 03019973

(47)

(07)

MINING SHOE
23.03.21

F. JACKET
23.03.21

HELMET
06/09/21

S.S. 7.5.22
सोमरा मुंडा

23.01.23 old damage
सोमरा मुंडा

M/Shoe no. 07
Replacement
Dt: 22/11/23
सोमरा मुंडा

Gumboot no. (8)
Dt: 25/06/24
Somra munda

1. Jacket 01 (one)
2. Dust mask 01 (one)
3. Whistle 01 (one)
4. Ear plug 01 (one)

सोमरा मुंडा

NAME - ATWari Mahto (56)
Dept - Roof Bolt
P.NO - 02946916

Mining Shoe(06)	F. Jacket	Helmet
23.03.2021	23.03.2021	24/05/21
28.7.5.21 हस्तगत महतो		
28.01.23 oldone हस्तगत महतो	———	——
mining shoe NO. 6 Replacement on: 06/06/2023 हस्तगत महतो		
Gum boot NO. 5 01 pair (one) दि: 27.6.2024 हस्तगत महतो		
1. Jacket 01 (one) 2. Dust mask 01 (one) 3. Whistle 01 (one) 4 Lamp play 01 (one) हस्तगत महतो		
M/Shoes NO. 05 (01) Pair हस्तगत महतो		

NAME - MAHENDRA RAWANI
Dig - Timber Mazdoor (46)
P.No - 02898724

MINING SHOE (02)	F. JACKET	HELMET	MASK
23.03.2021	23.03.2021	24/05/21	24/5/21
Sig.			
06.05.22			
01.02.23			
M/Shoe NO 08 01 Pair Dt. 03.11.2023 Hd Rawat			
m/shoe no. 9 burnboot no. 8 Dt. 25/6/24 maheshota Rawani			
1. Jacket 01 (one) 2. Dust mask 01 (one) 3. Whistle 01 (one) 4. Ear plug 01 (one) 5. Reg plug 04 (four) ← Hd Rawat			

136. SRI - Pintu Kr. Vishwakarma
Designation: Sr. office (Cooking)
P. No -

Running Shoe
No 7½ pair
Dt: 26.05.2023

M/Shoe No-08
01 pair
Dt: 24.02.2024
24.02.24

1. Dust mask (Van)
2. White 1+1=2
05.09.24

Gumboot 01 (one)
Dt: 25.09.24 (E)

FI Jacket
one P.C.
Dt: 26.5.2023

Cotton Jacket 01
Dt: 05.09.24
05.9.24

Saheed Mahali Saheb Mahi
Mirinjshoe

125

Mairng shoe

03.12.22

mjshae of 9
Saheed mahali
Rf: 25/6/24

[illegible]

1 earplay all(ons)
2 Dust mast all(ons)
3 Whistle all(ons)
4 cotton Jacket all(ons)

[illegible]

f. Jadket

03.12.22

Helmet

03 12.22

Helmet
Saheed mahali
Rf: 25/6/24
Damage

[illegible]

NAME - MAHENDRA RAWANI
Dig - Timber Mazdoor (46)
P.No - 02898724

MINING SHOE (08)	F. JACKET	HELMET	MASK
23.03.2021	23.03.2021	24/05/21	24/5/21

Sig.

06.05.22

01.02.23

M/Shoe No 08
01 pair
Dt. 03.11.2022
Mahendra Rawani

M/Shoe No. 9
Jumpboot No. 8
Dt. 25/6/24
Mahendra Rawani

1. Jacket 01 (one)
2. Dust Mask 01 (one)
3. Whistle 01 (one)
4. Ear plug 01 (one)
5. Reg Plug 04 (four)

← महेन्द्र रावणी

NAME - Dasrath manghi
Dig. - Dusting mazdoor (52)
P.No - 02795722

MINING SHOE	F. JACKET	HELMET
03/04/21 (6)	03/04/21	11.09.21
Sd. दशरथ मांझी	दशरथ मांझी	दशरथ मांझी
6.5.22		
01.02.23		
Dasrath Manji		
M/Shoe no-06 1 pair Dt: 13/12/2023 Dashrath Manji		
Gum boot no. 6 01 pair Dt: 27/6/24 Dashrath Manji		
1 Dust mask 01(one) 2 Jacket 01(one) 3 Whistle 01(one) 4 Ear plug 01(one) ← Dashrath Ma		

NAME- DUMARCHAND MAHTO (34)
Dig - Explosive carrier
P.No - 01400829

MINING SHOE	F. JACKET	HELMET Mask
24.03.2021 (18)	24.03.2021	06/09/21 27/9/21
b.5.22 Sig. M/shoe 30.01.23	Fl Jacket 30.01.23	
M/Shoes 01 pair(01) Dt: 11.12.2023 (damage) कुमरचन्द महतो		
Drum boot No. 07 01 pair (one) Dt 28/6/24 कुमरचन्द महतो		
1. F. Jeeket 01(one) 2. Dust mask 01(one) 3. ear plug 01(one) 4 Whiste 01(one) कुमरचन्द महतो		

Name - Pw Kishun Rawani
Design - Blasting Crewman
Per. no. - 62885085-5

Mining Shoe	Jacket	Helmet	Gumboots
(2) NO Mining Shoes (one) pairs 23.09.24	f/Jacket (one) s PS 23.09.24	Helmet (one) 23.09.24	
पान सिंह गुप्ता	पान सिंह गुप्ता	पान सिंह गुप्ता	
	Jacket cotton a1 (one) P.C		
	Dist mask a1 (one) P.C		
	पान सिंह गुप्ता Dt: 29.10.2024		

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**22/12/2024**
Time	:	**13:13:45 PM**
Validity upto	:	**21/12/2025**

Certificate SL. No.	:	JH01000650003507
Registration No.	:	JH10BQ7173
Date of Registration	:	05/Nov/2018
Month & Year of Manufacturing	:	September-2018
Valid Mobile Number	:	******5655
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	1.18

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**17/12/2024**
Time	:	**13:40:14 PM**
Validity upto	:	**16/12/2025**

JH10BV1613

Certificate SL. No.	:	JH01000650003502
Registration No.	:	JH10BV1613
Date of Registration	:	01/Jul/2019
Month & Year of Manufacturing	:	May-2019
Valid Mobile Number	:	******5655
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	1.13

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date : **17/12/2024**
Time : **13:38:24 PM**
Validity upto : **16/12/2025**

JH10BV8297

Certificate SL. No.	:	JH01000650003501
Registration No.	:	JH10BV8297
Date of Registration	:	01/Jul/2019
Month & Year of Manufacturing	:	May-2019
Valid Mobile Number	:	******5655
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	0.93

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**18/03/2025**
Time	:	**13:03:03 PM**
Validity upto	:	**17/09/2025**

Certificate SL. No.	:	JH01000650003687
Registration No.	:	JH10AJ5655
Date of Registration	:	27/Apr/2013
Month & Year of Manufacturing	:	April-2013
Valid Mobile Number	:	******2578
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	1.66

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**18/03/2025**
Time	:	**12:37:29 PM**
Validity upto	:	**17/09/2025**

Certificate SL. No.	:	JH01000650003684
Registration No.	:	JH10AB8807
Date of Registration	:	18/Oct/2011
Month & Year of Manufacturing	:	September-2011
Valid Mobile Number	:	******2578
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	1.19

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**18/03/2025**
Time	:	**12:56:27 PM**
Validity upto	:	**17/09/2025**

JH10AK8155

Certificate SL. No.	:	JH01000650003686
Registration No.	:	JH10AK8155
Date of Registration	:	12/Aug/2013
Month & Year of Manufacturing	:	July-2013
Valid Mobile Number	:	******2578
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	1.02

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 0perator
60mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
Government of Jharkhand

Date	:	**18/03/2025**
Time	:	**12:35:07 PM**
Validity upto	:	**17/09/2025**

JH10AG4955

Certificate SL. No.	:	JH01000650003683
Registration No.	:	JH10AG4955
Date of Registration	:	09/Nov/2012
Month & Year of Manufacturing	:	October-2012
Valid Mobile Number	:	******2578
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	JH0100065
GSTIN	:	
Fees	:	Rs.300.00
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	2.1

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 0perator
60mm x 20 mm

Form 59

(See rules 115 (2))

Pollution Under Control Certificate

Authorised By

Government of West Bengal

Date	:	05/07/2024
Time	:	08:16:45 AM
Validity upto	:	04/07/2025

Certificate SL. No.	:	
Registration No.	:	WB53C5461
Date of Registration	:	08/Apr/2023
Month & Year of Manufacturing	:	[illegible]
Vehicle Mobile Number	:	[illegible]
Emission Norms	:	[illegible]
Fuel	:	BHARAT STAGE VI
PUC Code	:	DIESEL
GSTIN	:	[illegible]
Fees	:	Rs.100.00
MIL Observation	:	No

GST 19AAHAD0282H1ZR

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	0.7	0.07

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
(50mm x 20 mm

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By

Government of Jharkhand

Date	:	**04/05/2025**
Time	:	**14:03:02 PM**
Validity upto	:	**03/05/2026**

Certificate SL No	:	JH01002000002576
Registration No	:	JH13F1502
Date of Registration	:	06/Aug/2019
Month & Year of Manufacturing	:	[illegible]2018
Valid Mobile Number	:	[illegible]6852
Emission Norms	:	BHARAT STAGE IV
Fuel	:	DIESEL
PUC Code	:	JH0100200
GSTIN	:	
Fees	:	Rs.300.00
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	1.62	0.36

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

[illegible] to link their mobile numbers to registered vehicle by logging to https://[illegible].gov.in