Bharat Coking Coal Ltd.
(A Subsidiary of Coal India Limited)
Office of the General Manager, Katras Area
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Ref. No.-BCCL/ IV/2021/ 276

Dated- 29/05/2021
31

To
The Director,
Ministry of environment, forest and climate charge
Regional office (ECZ)
Bungalow office no.42, Shyamali colony
Ranchi-834002

Sub:-six monthly compliance report on implementation of environmental measures for the period from Oct 2020 to March 2021

Dear Sir

Kindly find enclosed herewith the six monthly compliance report on implementation of environmental measures for the period from Oct 2020 to March 2021 in respect of cluster IV group of mines under Katras Area, BCCL.

Hope you will find in order.

Enclosed:-As Above.

Yours Faithfully

29/5/2021

General Manager
Cluster-IV, BCCL

Copy:-
1.The Director,IA Monitoring cell,Paryavaran Bhawan,CGO Complex, New Delhi-110003
2. Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032, INDIA
3. The Director,(S) Ministry of Environment & Forest,Govt.of India –Bhuneshwar751023
4.The Member Secretary, Jharkhand state Pollution Control Board,Ranchi-834004
5. The Regional Officer, Jharkhand state Pollution Board,Dhanabad-826001
6.Dy.GM(ENV),BCCL,Koyla Bhawan,Dhanbad
6.Office Copy

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SL	Mining	Compliance
1	The environmental clearance shall be valid for a period of one year from the issue of this letter. Further extension/continuance of the project shall be based on evaluation of the action taken on each of the observations of this Ministry's Regional Office during their site visit on 22nd August, 2016.	Agreed. Validity extension of Environmental clearance has been made. EC validity has been extended for life of mine or 30 years whichever is earlier vide EC order no J-11015/372/2013-IA-II(M), dated 23.10.2019. **Annexure 1-** EC order
2	The project proponent shall obtain Consent to establish from the State Pollution Control Boards of Jharkhand for the proposed peak capacity of 9.55 MTPA prior to commencement of the increased production.	Agreed.
3	Transportation of coal from face to Coal heap shall be carried out by truck. Further, the coal transportation from Coal heap to Coal Handling Plant shall be carried out through covered trucks.	It is being complied. **Annexure 2- Pictures of Tarpaulin covered coal transportation in Cluster IV of Bharat Coking Coal Limited**
4	Mitigative measures to be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient numbers of water sprinklers.	It is being complied. Mobile water tanker is used for dust suppression. Fixed Water sprinkling system has been installed. 2 no's of Water tanker of capacity 28KL with mist fitting arrangement has been deployed in FY 2019-2020 and 3 nos of water tanker of capacity 28 KL has been deployed in Fy 2020-21 respectively in the cluster IV group of mines. **Annexure 3- Pic of Mobile water tanker with mist fitting and fixed water sprinkler.**
5	Sufficient coal pillars shall be left un-extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	It is Being Complied. Sufficient coal pillars have been left un-extracted around the air shaft .
6	Solid barrier shall be left below the roads falling within the block to avoid any damage to the roads and no depillaring operation shall be carried out below the township/colony.	Solid barrier have been left below the roads falling within the block to avoid any damage to the roads and no depillaring operation have been carried out below the township/colony.
7	Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.	It is being complied.
8	Sufficient number of pumps of adequate capacity shall be deployed to pump out mine water during peak rain fall.	It is being complied.
9	The company shall obtain approval of CGWA for use of groundwater for mining operations at its enhanced capacity of 9.55 MTPA.	Application for obtaining approval of CGWA vide application no 21-4/320/JH/MIN/2018 for use of groundwater for mining operations has been made.
10	Continuous monitoring of occupational safety and other health hazards, and the corrective actions need to be ensured.	It is being complied. Safety talk is being given to workers at mine during starting of shift. PPE has been provided to workers. **Annexure 4-** safety talk pic and Distribution list of PPE.

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11	The fire dealing operations by excavating out fire should be expedited.	It is being complied. **Annexure 5-** Pic of fire dealing operation.
1	Mining shall be carried out under strict adherence to provisions of the Mines Act, 1952 and subordinate legislations made there-under as applicable.	It is being Complied.
2	Mining shall be carried out as per the approved mining plan(including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).	It is being Complied. Mining Plans of mines of Cluster-IV approved on 03.08.2017 on 333th Board Meeting. **Annexure 6-** Copy of approved mining plan
3	No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980	There is no forest land existing under the leasehold of Cluster IV. **Annexure 7-** No forest land certificate
4	No change in mining method i.e. UG to OC, calendar programme and scope of work shall be made without obtaining prior approval of the Ministry of Environment, Forests and Climate Change (MoEFCC).	It is being Complied. OCP based on shovel-dumper combination and UG based on bord and pillar are in operation at present.
5	Underground work place environmental conditions shall be rendered ergonomic and air breathable with adequate illumination in conformance with DGMS standards.	It is being Complied.
	Land reclamation and water conservation	
1	Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by the Ministry of Environment, Forest and Climate Change from time to time shall be submitted to MoEFCC/Regional Office.	The proponent has got a study carried out through NRSC Hyderabad. NRSC has been awarded the work to prepare time series map by isothermal mapping. NRSC has carried out the work of Isothermal Mapping in 2014 and 2018. **Annexure 8– Last Time-series map of 2018**
2	The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIAIEMP report and with due approval of the concerned State/Go I Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.	The surface drainage plan is attached herewith. No diversion of natural water courses has been done . The construction of embankment to prevent any danger against inrush of surface water into the mine has been constructed. **Annexure- 9-** surface drainage plan

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3	The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be diverted. Further action will be treated as specified in the guidelines for preparation of Mine Closure Plan issued by the Ministry of Coal dated 2th August, 2009.	The final mine void depth will preferably be as per the approved Mine Closure Plan. At the end of mining all the remaining excavated area will be leveled and reclaimed physically as well as Biologically.
4	The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining"/"post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EMP submitted to this Ministry. Progressive compliance status vis-a-vis the post mining land use pattern shall be submitted to the MOEFCC/RO.	The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan is being in conformity. Land use pattern has been submitted to ministry. Green belt over an area of 192.20 Ha (27.11 Ha over OB dumps, 165.09 Ha social forestry & Avenue Plantation) can be observed within IV as per CMPDIL land reclamation monitoring Report-2018. **Annexure 10- land reclamation monitoring Report**
5	Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued vide S.O.2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling or stowing of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB.	There is no generation of fly ash in cluster IV.
6	It shall be ensured that as per the time schedule specified in mine closure plan it should remain live till the point of utilization. The top soil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry.	It is being Complied. Top soil is being stored. Top soil is being utilized as plantation site. Grassing after preparing of seed ball has been done over 25 Ha OB area till date. Backfilling of excavated area is being done as per mine closure guidelines. Green belt over an area of 192.20 Ha (27.11 Ha over OB dumps, 165.09 Ha social forestry & Avenue Plantation) can be observed within IV as per CMPDIL land reclamation monitoring Report-2018. **Annexure 10 A- Top soil storage plan** **Annexure 10 B- Plantation details (2014-15 to till date)**
7	Post-mining land shall be rendered usable for agricultural/forestry purposes and handed over to the respective State Government, as specified in the Ministry of Coal Guidelines dated 27th August, 2009 for Preparation of Mine Closure Plan.	It will be complied. **Annexure 11- Approval copy of Mine closer plan.**

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8	Regular monitoring of subsidence movement on the surface over and around the working areas and its impact on natural drainage pattern, water bodies, vegetation, structure, roads and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence beyond the limit prescribed, appropriate effective mitigation measures shall be taken to avoid loss of life and materials. Cracks should be effectively plugged in with ballast and clay soil/suitable material.	No depillaring in underground mine is going on hence no mining induced subsidence is taking place. Regular monitoring of subsidence is being done by subsidence monitoring committee of the area.
9	A separate team for subsidence monitoring and surface mitigation measures shall be constituted and continuous monitoring & implementation of mitigation measures be carried out.	It is being complied. A Certificate of Project Officers and General Manager of the Cluster IV, indicating no subsidence due to mining operation is being attached. **Annexure 12- Certificate Regarding no subsidence due to mining operation.**
10	Thorough inspection of the mine lease area for any cracks developed at the surface due to mining activities below ground shall be carried out to prevent inrush of water in the mine.	It is being complied.
11	Native tree species shall be selected and planted over areas affected by subsidence.	Plants like seesam, Gamhar, Aam, Peepal,Bargad, Sagwan, Kathal etc. has been planted over areas likely to be affected by subsidence.
	Emissions, effluents, and waste disposal	
1	Transportation of coal, to the extent permitted by road, shall becarried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc shall be carried out in critical areas prone to air pollution (with higher values of PM1Q/PM2.s)such as haul road, loading/unloading and transfer points. Fugitive dust emissionsfrom all sourcesshall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters confirm to the norms prescribed by the Central/State Pollution Control Board.	Vehicular emission is kept under control by proper maintenance of vehicles. Vehicular emissions are being monitored in every prescribed period. Only those vehicles are being allowed to run having PUC. In addition to the above coal transportation is done by tarpaulins covered and optimally loaded vehicles. The project authorities are regularly checking all the loaded trucks/dumpers coming inside the plant about their valid PUC. Total 40nos of fixed water sprinkler at haul road has been deployed for control to air pollution. In addition to that 45 no of fixed sprinkler installed along the siding/CHP, throwing approx 10-12m and distance between sprinkler is about 10-15m. **Annexure 13- PUC certificate**
2	Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area as soon as possible. The green belt comprising a mix of native species (endemic species should be given priority) shall be developed all along the major approach/ coal transportation roads.	For meeting the green belt development target we have assigned the work order to the DFO,Dhanbad in FY 2019-2020 & FY 2020-2021 for plantation over an area of 11 Ha& 13 Ha over Ob dump respectively. Plantation is

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		being carried out in available spaces for creation of thick green belt. It is being Complied. Green belt over an area of 192.20 Ha (27.11 Ha over OB dumps, 165.09 Ha social forestry & Avenue Plantation) can be observed within IV as per CMPDIL land reclamation monitoring Report 2018. Apart of block plantation, 600 nos of avenue plantation in form of bamboo gabion plantation has been done in the FY 19-20 by DFO, Dhanbad. Two nos of Sneh Smriti upwan (Fruit orchid) site have been developed in around 1.5 Ha areas. Grass seed have been broadcasted In around 15 Ha over OB dump. **Annexure 14 - 11 Ha& 13Ha plantation work order and plantation Pics.**
3	The transportation of coal shall be carried out as per the provisions and route envisaged in the approved Mining Plan or environment monitoring plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.	Presently, road transportation is being done by covering vehicle with tarpaulin.
4	Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.	Vehicular emissions are being monitored in every prescribed period. Only those vehicles are being allowed to run having PUC. In addition to the above coal transportation is done by tarpaulins covered and optimally loaded vehicles. The project authorities are regularly checking all the loaded trucks/dumpers coming inside the plant about their valid PUC.
5	Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.	It is being complied. Dust suppression arrangement has been made at crusher. Fixed type water sprinkler have been installed. Installation of Belt conveyor system may leads to fire Hazard as the existence of fiery coal seam in our command area. **Annexure 15- Dust suppression arrangement at coal loading point of CHP.**
6	Coal handling plant shall be operated with effective control measures w.r.t. various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.	It is being complied. Dust suppression arrangement has been made at coal Handling plants. 3 mobile water sprinkler have been deployed for control to air pollution in CHP. In addition to that 45 no of fixed sprinkler installed along the siding/CHP, throwing range approx 10-12m and distance between sprinkler is about 10-15m.

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7	Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.	It is being complied. Only mine water is used for industrial purposei.e fire dealing ,watering the mine area, roads, green belt development etc. Regular monitoring of ground water level and quality are being monitored by CMPDIL, Ranchi. Rain water Harvesting arrangement has been made. Roof top rain water harvesting system has also been developed at coal dump colony under cluster IV. **Annexure 16- Ground water monitoring report** **Annexure 17- Rain water harvesting arrangement.**
8	Catch and or garland drains and siltation ponds in adequate numbers and appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression and green belt development and other industrial use. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.	It is being complied. **Annexure 18- Pic of toe wall made along OB dump.** **Annexure 19- Pic of siltation pond.**
9	Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) after due treatment conforming to the specific requirement (standards).	Five nos of Rain water Harvesting pond has been created. Water is being supplying to nearby villages after treatment of mine water as per requirement.
10	Solid waste/hazardous waste generated in the mines shall be addressed in accordance to the MSW Rules, 2016.	It is being complied. Solid waste/hazardous waste generated in the mines is being addressed in accordance to the MSW Rules, 2016.
11	The water pumped out from the mine, after siltation, shall be utilized for industrial purpose viz. watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly.	It is being complied. Pumped out water are being utilized for water sprinkling on haul road, green belt development, fire dealing etc.
12	Major approach roads shall be black topped and properly maintained.	It is being complied.
13	The project proponent shall not alter major water channels around the site. Appropriate embankment shall beprovided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side,	The embankment constructed along the river boundary is of suitable dimension and critical patches has been strengthened by concreting and stone pitching as per design made by Central Mine Planning and Design Institute Limited (CMPDIL) on the river front side and

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	stabilized with plantation so as to withstand the peak water pressure preventing any chance of mine inundation.	stabilized with plantation to withstand the peak water flow and prevent mine inundation. Construction of concrete embankment at critical patch of nallah/Jore has been done. Total length of constructed embankment is 3000 m. **Annexure 20-Pic of embankment constructed.**
14	Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, shall be designed keeping at least 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine sites. The sump capacity shall also provide adequate retention period to allow proper settling of silt material of the surface runoff.	It is being complied. Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, has been designed.
15	Industrial waste water from coal handling plant and mine water shall be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluent. Sewage treatment plant of adequate capacity shall be installed for treatment of domestic waste water.	Mine water is being reused in mine for industrial purposes (sprinkling, fire control etc.) Oil and grease trap has been installed at the workshops. **Annexure 21- Pic of Oil & Grease trap**
	Illumination, noise & vibration	
1	Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & its RO on six-monthly basis.	It is being complied. Latest report of the same is being attached herewith. **Annexure 22- Illumination monitoring report.**
2	Adequate measures shall be taken for control of noise levels as per noise pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted.	Personnel operating near HEMMs, drilling machine comply with safety regulation and are equipped with Personal Protective Equipment. Awareness programmes are being given to all the personnel at Vocational training center and mine site.
3	Controlled blasting techniques shall be practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc. as per the guidelines prescribed by the DGMS.	It is being complied. Controlled blasting techniques are being practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc. as per the guidelines prescribed by the DGMS. **Annexure 23- Ground vibration report.**
4	The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.	It is being complied. Noise level is being monitored by CMPDIL. **Annexure 24- Noise level Monitoring Report**
	Occupational health & safety	

PLANS MAP

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1	The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.	IME/PME is done periodically for the workers to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. **Annexure 25- IME/PME report**
2	Personnel working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.	Training and awareness programmes are being given to all the personnel working in dusty areas. Total 2100 Nos of Dust masks have been provided to the personnel engaged in mining and working under cluster IV. **Annexure 26- training photograph**
	Ecosystem and biodiversity conservation	
1	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered/endemic flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.	Ecological restoration are being done in consultation with FRI, dehradun. Road Map of Ecological restoration has been made. **Annexure 27- Afforestation Programme of cluster-IV**
2	The project proponent shall take all precautionary measures to ensure riverine/riparian ecosystem in and around the coal mine upto a distance of 5 km. A riverine/riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation/water resource department in the State Government.	Monitoring of river water is being done regularly. Special affords has been made for cleaning of river water, drives like swachhta pakhwada are being organised regularly.
	Public Hearing, R&R and CSR	
1	Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.	It is being complied. Compliance report of public hearing has been sent to ministry. Land oustees are getting their compensation as per norms laid down in R&R policy of the company.
2	The project proponent shall ensure the expenditure towards socio-economic development in and around the mine every financial year in pursuance of the Corporate Social Responsibility Policy as per the provisions under Section 135 of the Companies Act, 2013.	It is being complied. Expenditure towards socio-economic development has been ensured. During the COVID-19 pandemic distribution of food packets, mask, sanitizer and other essentials has been provided to local peoples. **Annexure 28- List of activities undertaken in and around the mine in pursuance of CSR policy.**

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3	The project proponent shall follow the mitigation measures provided in this Ministry's OM NO.Z-11013/5712014-IA.11 (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.	It is being complied.
4	The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.	No grazing land is involved in core zone.
	Corporate environment responsibility	
1	The Company shall have a well laid down environment policy duly approved by Board of Directors. The environment policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. Also, the company shall have a defined system of reporting of non-compliances/violations of environmental norms to the Board of Directors and/or shareholders/stakeholders.	It is being complied. Corporate Environmental policy has been made, approved by CMD of M/s BCCL and it is being implemented. Environment management cell has also been made to ensure implementation of environmental management plan. A parasnath udhyan as an eco-park has been made under corporate environment responsibility. The said park was inaugurated by honorable home minister shri Amit Shah on dated 23-July-2020 in presence of honorable coal minister shri pralhad joshi. **Annexure 29- CER policy**
2	The project proponent shall comply with the provisions contained in this Ministry's OM dated 1st May, 2018, as applicable, regarding Corporate Environment Responsibility.	It is being complied. Corporate Environmental policy has been made, approved by CMD of M/s BCCL and it is being implemented.
3	A separate environmental management cell both at the project and company headquarter level, with suitable qualified personnel shall be set-up under the control of a Senior Executive, who will report directly to the Board level executive/Head of the Organization.	A full-fledged Environment Department, headed by a HoD (Environment) along with a suitable qualified multidisciplinary team of executives has been established at the Headquarters. At the area level, one Executive in each area has been nominated as Nodal Officer (Environment). Management Trainees/Asst. Managers (Environment) have also been deputed at area level. The activities are monitored on regular basis at Area and at Headquarters levels. DGM (Environment) at head quarter level, co-ordinates with all the Areas and reports to

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		the Director (Technical) and in turn he reports to the CMD of the company.
4	Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.	It is being complied. Action plan has been made, work is being done accordingly. Year wise funds earmarked for environmental protection measure has been kept separately. **Annexure 30- Environmental protection measure expenditure details**
5	Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.	It is being complied. CCO has been engaged for the audit of plantation done per year. IIEST, Shibpur is attached for auditing of Mine closure activity done in Katras Area.
6	Skill training as per safety norms specified by DGMS shall be provided to all workmen including the outsourcing employees to ensure high safety standards in mines.	Skill training as per safety norms specified by DGMS are being provided to all workmen including the outsourcing employees to ensure high safety standards in mines.
7	Effective arrangement shall be made to provide and maintain at suitable points conveniently situated, a sufficient supply of drinking water for all the persons employed.	It is being Complied.
	Statutory Obligations	
1	This environmental clearance shall be subject to obtaining Forest Clearance from the concerned regulatory authority, Wildlife clearance from the Standing Committee of National Board for Wildlife, as applicable to the project.	There is no forest land existing under the leasehold of Cluster IV.
2	The project proponent shall obtain the necessary permission from the Central Ground Water Authority (CGWA) if applicable.	It is being Complied. Application has been made to CGWA.
3	The Environmental clearance shall be subject to orders of Hon'ble Supreme Court of India, Hon'ble High Courts, NGT and any other Court of Law, from time to time, and as applicable to the project.	It is being complied.
4	The project proponent shall obtain Consent to Establish/Operate under the Air (Prevention &Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from concerned SPCB	It is being complied.

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	Monitoring of project	
1	Continuous ambient air quality monitoring stations as prescribed in the statue be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM1o, PM2.5, S02 and NOx. 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. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc to be carried out at least once in six months.	Location of Monitoring station in the Jharia Coal Field have been finalized with the Jharkhand State Pollution Control Board. Five ambient air quality monitoring station has been established two at core zone and three at buffer zone. At core zone station established at AARC (Ramkanali) & Katras Chotudih Mine office and at buffer zone station established at Mine office-Block-IV, Nichitpur and RudhiBasti respectively. Presently air quality monitoring is being done as per norms at each location. Monitoring data regularly submitted to the Ministry including its Regional Office at Ranchi. Monitoring of air quality is being done by Central Mining & Planning Design Institute (CMPDIL), Dhanbad. Administrative approval has been accorded for the installation of CoAAQMS and the location has been finalized by Regional Officer, JSPCB Dhanbad. Tendering for installation of Coaaqms has been done twice but no bidder qualified. Retendering will be done. **Annexure 31- Monitoring station location details and Coaaqms tender copy**
2	The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25.9.2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.	It is being complied. CMPDIL has been engaged for Air Quality monitoring as well as heavy metals. **Annexure 32- Ambient Air quality monitoring report**
3	The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated zs" September, 2000 and as amended from time to time by the Central Pollution Control Board.	Monitoring of River water are being done by CMPDIL regularly in Upstream and Downstream. **Annexure 33- Monitoring Report**
4	The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No. J-20012/1/2006-IA.11 (M) dated 27th May, 2009 issued by the Ministry shall also be referred in this regard for compliance.	It is being complied.

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5	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter and water quality once a year, and the data thus collected shall be sent regularly to MoEFCC/RO.	It is in progress. Tendering for establishing a network of existing wells and constructing new piezometers during the mining operations has been done, but no bidder qualified. Retendering is being done. **Annexure 34- E-Tendering copy**
6	Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.	It is being complied. Monitoring of water quality upstream and downstream of water bodies is being carried out once in six months and record of monitoring data has been maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office. **Annexure 35- Water quality Monitoring Report enclosed as an Annexure 33**
7	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental conditions to the MOEFCC/RO. For half yearly monitoring reports, the data should be monitored for the period of April to September and October to March of the financial years.	It is being Complied. Six monthly reports on the status of the implementation of the stipulated environmental conditions are being submitted to the MOEFCC/RO. **Annexure 36-Forwarding letter of last six monthly compliance report**
8	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.	It is being complied.
	Miscellaneous	
1	Efforts should be made to reduce energy consumption by conservation, efficiency improvements and use of renewable energy.	LED bulb has been distributed among employees. Training has also been provided regarding the same. Installation of 2 no of Solar tree of 5 KW capacity will be installed shorty, tender has been finalized for the same. Installation of Roof top solar system at cluster IV, head office is also in line, tender has been floated for the same.

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2	The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations.	Complied.
3	A copy of the environmental clearance shall be marked to concerned Panchayat. A copy of the same shall also be sent to the concerned State Pollution Control Board, Regional Office of the MOEFCC, District Industries Centre and Collector's Office/Tehsildar Office for information in public domain within 30 days.	complied.
4	The EC shall be uploaded on the company's website. The compliance status of the stipulated EC 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 in public domain.	It is being Complied. EC has uploaded on the company's website. Six monthly compliance status are also being uploaded on company's website.
5	The project authorities shall advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of this Ministry at www.environmentclearance.nic.in and a copy of the same shall be forwarded to the Regional Office.	Complied. **Annexure 37- Copy of newspaper advertisement.**
6	The environmental statement for each financial year ending 31st March in Form-V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on 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&CC by email.	Complied regularly on time
7	The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during their presentation to the EAC.	It is being Complied. EIA/EMP is being implemented.
8	Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in revocation of this EC and attract action under the provisions of Environment (Protection) Act, 1986.	Agreed.

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9	The above conditions will be enforced inter-alia, under the provrsrons of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India/High Courts and any other Court of Law relating to the subject matter.	Agreed.
10	Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely particulates, S02 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive receptors in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc. to be carried out at least once in six months. Online ambient air quality monitoring station/stations may also be installed in addition to the regular air monitoring stations as per the requirement and/or in consultation with the SPCB.	Location of Monitoring station in the Jharia Coal Field have been finalized with the Jharkhand State Pollution Control Board. Five ambient air quality monitoring station has been established two at core zone and three at buffer zone. At core zone station established at AARC (Ramkanali) & Katras Chotudih Mine office and at buffer zone station established at Mine office-Block-IV, Nichitpur and RudhiBasti respectively. Presently air quality monitoring is being done as per norms at each location. Monitoring data regularly submitted to the Ministry including its Regional Office at Ranchi. Monitoring of air quality is being done by Central Mining & Planning Design Institute (CMPDIL), Dhanbad.

29/5/2021

General Manager
Cluster IV, BCCL

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No.J-11015/372/2013-IA-II (M)
Government of India
Ministry of Environment, Forest and Climate Change
IA Division (Coal Mining)

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi-3
Dated: 23rd October, 2019

To,

The General Manager (E&F)
M/s Bharat Coking Coal Ltd,
Koyala Bhawan,
District **Dhanbad** (Jharkhand)
Email: envbccl@gmail.com

Sub: Expansion of Cluster-IV (5 mixed mines) Coal Mining Project from 3.706 MTPA (Peak) to 7.34 MTPA (Normative)/9.55 MTPA (Peak) in ML area of 1123.79 ha of M/s Bharat Coking Coal Ltd, District Dhanbad (Jharkhand) – Continuation of Environmental Clearance - reg.

Sir,

This has reference to your online proposal No. IA/JH/CMIN/109351/2019 dated 28th June, 2019 on the above-mentioned subject.

2. The Ministry of Environment, Forest and Climate Change vide letter dated 20th February, 2018, has granted environmental clearance to the Cluster-IV (Group of 5 mixed mines) Coal Mining Project from 3.706 MTPA to 9.55 MTPA of M/s Bharat Coking Coal Limited in Mine Lease area of 1123.79 ha in District Dhanbad, (Jharkhand), subject to compliance of certain terms and conditions, which *inter-alia* included the following:-

'The environmental clearance shall be valid for a period of one year from the issue of this letter. Further extension/continuance of the project shall be based on evaluation of the action taken on each of the observations of this Ministry's Regional Office during their site vist on 22nd August, 201€.

3. In line with the above condition, site inspection was carried out by Ministry's Regional Office at Ranchi on 17-18 May, 2019 to monitor compliance status of the conditions stipulated in the said environmental clearance. The report in this regard has been forwarded by the Regional Office vide letter dated 22nd June, 2019.

4. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in its meeting held on 22nd August, 2019 and recommended for continuance of the project beyond 16th July, 2019 and validity of environmental clearance dated 16th July, 2018 for a period of 30 years or life of the mine, whichever is earlier. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords approval for continuance of the Cluster-IV (Group of 5 mixed mines) Coal Mining Project from 3.706 MTPA to 9.55 MTPA of M/s Bharat Coking Coal Limited in Mine Lease area of 1123.79 ha in District Dhanbad, (Jharkhand), for a period of 30 years or life of the mine, whichever is earlier, under the provisions of the Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto,

5. The project proponent shall carryout source apportionment study and establishment of piezometers, within 3 years from the date of issue of this letter.

6. All other terms and conditions stipulated in the said environmental clearance dated 16th July, 2018 shall remain unchanged.

(Sharath Kumar Pallerla)
Scientist F

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The Secretary, Department of Environment & Forests, Government of Jharkhand, Secretariat, Ranchi
3. The Additional Principal Chief Conservator of Forests, Regional office (ECZ), Ministry of Environment Forests and Climate Change, Bungalow No. A-2, Shyamali Colony, Ranchi - 834002
4. The Member Secretary, Jharkhand State Pollution Control Board, TA Building, HEC Complex, PO Dhurwa, Ranchi
5. The Member Secretary, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
6. The Member Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi
7. The District Collector, **Dhanbad**, Government of Jharkhand
8. Monitoring File 10. Guard File 11. Record File. 12. Notice Board

(Sharath Kumar Pallerla)
Scientist F

No.J-11015/372/2013 -IA-II (M)
Government of India
Ministry of Environment, Forest and Climate Change
IA-II (Coal Mining) Division

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi-3
Dated: 16th July, 2018

To,

The General Manager (E&F)
M/s Bharat Coking Coal Ltd,
Koyala Bhawan,
District **Dhanbad** (Jharkhand) Email: envbccl@gmail.com

Sub: Expansion of Cluster-IV (Group of 5 mixed mines) Coal Mining Project from 3.706 MTPA to 9.55 MTPA of M/s Bharat Coking Coal Limited in Mine Lease area of 1123.79 ha in District Dhanbad (Jharkhand) - Environmental Clearance - reg.

Sir,

This has reference to your letter No. BCCL/GM (Katras) /F-EC/15 4709 dated 2nd December, 2015 along with online proposal No.IA/JH/CMIN/20227/2013 dated 8th December, 2014 and subsequent letters dated 13.1.2015, 15.1.2015, 17.8.2015, 1.12.2015, 1.1.2016, 8.1.2016, 15.2.2016, 3.8.2017, 20.8.2017, 23.8.2017, 31.8.2017, 12.2.2018, 15.2.2018 and 10.3.2018 on the above mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for environmental clearance to expansion of Cluster-IV (Group of 5 mixed mines) Coal Mining Project from 3.706 MTPA to 7.34 MTPA (Normative)/9.55 MTPA (Peak) of M/s Bharat Coking Coal Ltd in mine lease area of 1123.79 ha located in District Dhanbad (Jharkhand).

3. The proposal was considered by the Expert Appraisal Committee (EAC) in the Ministry for Thermal & Coal Mining Sector in its 29th meeting held on 15 -16 January, 2015, 49th meeting on 7-8 January, 2016, 17th meeting on 31st August, 2017, 26th meeting on 15-16 February, 2018 and 30th meeting held on 17-18 May, 2018. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are as under:-

(i) Earlier, Cluster-IV Coal Mining project for capacity of 3.706 MTPA in an area of 1123.79 ha was granted environmental clearance on 6th February, 2013. The present proposal is for expansion of the project to implement Jharia Master Plan to deal with the fire in the coal field.
(ii) The project was accorded ToR vide letter dated 10.02.2014 with exemption from fresh public hearing for preparation of EIA/EMP report.
(iii) The latitude and longitude of the project are 23°46'31.71" N to 23°49'1.87" N and 86°17'25.11" E to 86°20'13.13" E respectively.
(iv) Joint Venture: No Joint Venture.
(v) Employment Generated/To be generated: 5359 persons deployed.
(vi) Benefits of the project: Providing valuable coking coal to steel plant and coal to power plant; liquidating fire to conserve coal reserve and dovetailing EC condition with Jharia Master Plan; liquidating fire to prevent further spread of fire and safeguard population; Liquidating fire to improve environmental condition of the region.

(vii) Coal Linkage: The coal from the cluster is linked to power plants and steel plants via rail and road.

Mode	Railway Siding	Linkages	
		Power Plants	Steel Plants
Rail	KDS 2	Panipat, Paricha, Panki, Uchhahar, BGB, HGJ (Harduaganj), Farakka, PMRG, DTPS, DSTP, Roper, Koderma Pit, Kanti, CTPS BTPS, Budge-Budge, DGTP	Panipat, B.T.I., Nangal
Road		MPL, Moonidih, RGNTPR (Raghunathpur), RNPTS, CTPS	

(viii) The land usage of the project will be as follows:

Pre-Mining:

S.N.	LANDUSE	Within ML Area (ha)	Outside ML Area(ha)	TOTAL
1.	Agricultural land	21.22	0	21.22
2.	Forest land	0	0	0
3.	Wasteland	455.27	0	455.27
4.	Grazing land	0	0	0
5.	Surface water bodies	48.42	0	48.42
6.	Settlements	136.87	0	136.87
7.	Infrastructure	134.40	0	134.40
8.	Quarry	294.65	0	294.65
9.	OB Dump	28.89	0	28.89
10.	Plantation	4.07	0	4.07
	Total	1123.79	0	1123.79

Post- Mining & Core Area:

S.N.	Land use during Mining	Land Use (ha)				
		Plantation	Water Body	Public Use	Undisturbed	TOTAL
1	External OB Dump	28.89	0	0	0	28.89
2	Top soil Dump	-	-	-	-	0
3	Excavation	608.95	10.76	0	0	619.71
4	Roads& Rail	0	0	106.52	0	106.52
5	Built up area	18.52	0	0	72.5	91.02
6	Green Belt	0	0	0	4.07	4.07
7	Undisturbed Area	9.36	0	0	264.22	273.58
	TOTAL	665.72	10.76	106.52	340.79	1123.79

(ix) Total geological reserve, mineable reserve and extractable reserve are 228.5 MT, 201.67 MT and 99.607 MT respectively. Thus, percent of extraction would be 49.39 %.

(x) The coal grade is W-IV to ST-II. The stripping ratio in AKWMC is 1:2.54, in Gaslitand is 1:9, in Katras Choitudih **is** 1: 10.54 and in Salanpur colliery is 1:2.434. The average gradient of the seams is 1 in 5 and thickness of seams is worked to be 1.32 to 8 m.

(xi) Total estimated water requirement for the project is 9678 m^3/day. The level of ground water ranges from 0.85-9.65 m. A request in this regard has been made to the CGWB, New Delhi on 26th August, 2017.
(xii) The method of mining would be mixed i.e. with opencast and underground mining technologies.

	Salanpur Colliery	Katras Choitudih Colliery	Amalgamated Keshalpur West Mudidih Colliery	Angarpathra colliery & Ramkanali colliery	Gaslitand colliery
Method of mining	Bord & Pillar (UG) & Shovel- dumper Combination (OC)	Shovel-dumper Combination (OC)	Shovel-dumper in OC and Bord & Pillar in (UG)	Bord & Pillar (UG)	Shovel-dumper (OC)

(xiii) There are 6 external OB dumps with quantity of 9.903 Mcum in an area of 37.84 ha with height of 30 m above the surface level. There are 4 internal dumps with quantity of 174.38 Mcum in an area of 257.67 ha with height up to ground level.
(xiv) The final mine void would be in an area of 10.76 ha with depth of 20-30 m which is proposed to be converted into a water body. Out of the total quarry area of 603.4 ha, backfilled quarry area of 592.64 ha shall be reclaimed with plantation.
(xv) The seasonal data for ambient air quality has been documented and all results at all stations are within prescribed limits.
(xvi) The life of mines are:

	Salanpur Colliery	Katras Choitudih Colliery	Amalgamated Keshalpur West Mudidih Colliery	Angarpathra colliery & Ramkanali colliery	Gaslitand colliery
Life of mine (yrs)	10 years	4 years	20 years	Over 30 years	3 years

(xvii) There are 7012 project affected families. R&R cost for the project is Rs.299.22 Crore.
(xviii) Total capital cost of the project is Rs 346.36 Crores. CSR shall be done on actual production basis. An amount of Rs. 191.0 Lakhs will be used for the CSR works per year for the project at the peak production i.e. 9.55 Mt. The fund for CSR will be allocated 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. Environmental Management Cost shall be provided as per norm.
(xix) Katri Nallah flows within the cluster whereas Khudia Nallah, Jarian Nallah and Kumari Jore are on the west, east and north side respectively of the Cluster-IV and flow southwardly.
(xx) Almost all the mines of BCCL are taken over from the erstwhile private owners. Therefore, the mine does not have structured mining plans. The mining operations are being continued as amalgamated collieries in Cluster-IV. BCCL Board has approved the mining plans & Mine Closure Plans of Salanpur, AKWMC & AARC in 305th meeting held on 12.03.2014 and of Katras choitudih in its 312th meeting held on 13th December, 2014.
(xxi) There are no national park, wildlife sanctuary and biosphere reserves located in 10 km buffer zone.
(xxii) There is no forest area involved.
(xxiii) Total afforestation plan shall be implemented covering an area of 665.72 ha at the end of mining operations. Green belt shall be developed over an area of 105.55 ha having density of tree plantation as 2500 trees/ ha.

(xxiv) Jharkhand State Pollution Control Board had issued closure orders for all the mines of BCCL in August, 2011 and March 2012 stating that BCCL is operating all its mines without the environmental clearances. M/s BCCL filed Writ Petition in the Hon'ble High Court of Jharkhand, Ranchi for legal relief against closure of mines by JSPCB with the fact that M/s BCCL had already initiated the process of seeking environmental clearances in 2008 onwards with the approved cluster concept in 2009.
(xxv) Public hearing for the project was conducted on 21st January, 2012 at Katras Club, Sijua for 3.706 MTPA (Peak) in an area of 1123.79 ha. There being no change in lease hold area for the present project, urgency for controlling the mine fires and on the request of the project proponent, the EAC recommended the ToR providing exemption from fresh public hearing.
(xxvi) Regional office, MOEF&CC, Ranchi has sent the certified Compliance Report to the Ministry vide letter no.103-398/ROR-2015/189 dated 22.08.2016.
(xxvii) Mining Plan and Mine Closure Plan of Cluster-IV was approved by M/s BCCL Board, for a peak capacity of 9.55 MTPA on 3rd August, 2017 and 2nd February, 2018 respectively. The Final Mine Closure plan will be submitted 5 years before final closure.

4. The Expert Appraisal Committee in its 26th meeting held on 15-16 February, 2018 has recommended the project for grant of environmental clearance. Based on recommendations of the EAC and subsequent revision of minutes in its meeting held on 17-18 May, 2018, the Ministry of Environment, Forest and Climate Change hereby accords environmental clearance to the project for expansion of Cluster-IV (Group of 5 mixed mines) Coal Mining project from 3.706 MTPA to 9.55 MTPA (Peak) of M/s Bharat Coking Coal Ltd in mine lease area of 1123.79 ha located at Tehsil Baghmara, District Dhanbad (Jharkhand), under the provisions of the Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto subject to the compliance of the terms & conditions and environmental safeguards mentioned below:-

(i) The environmental clearance shall be valid for a period of one year from the issue of this letter. Further extension/continuance of the project shall be based on evaluation of the action taken on each of the observations of this Ministry's Regional Office during their site visit on 22nd August, 2016.
(ii) The project proponent shall obtain Consent to establish from the State Pollution Control Boards of Jharkhand for the proposed peak capacity of 9.55 MTPA prior to commencement of the increased production.
(iii) Transportation of coal from face to Coal heap shall be carried out by truck. Further, the coal transportation from Coal heap to Coal Handling Plant shall be carried out through covered trucks.
(iv) Mitigative measures to be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient numbers of water sprinklers.
(v) Sufficient coal pillars shall be left un-extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.
(vi) Solid barrier shall be left below the roads falling within the block to avoid any damage to the roads and no depillaring operation shall be carried out below the township/colony.
(vii) Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.
(viii) Sufficient number of pumps of adequate capacity shall be deployed to pump out mine water during peak rain fall.
(ix) The company shall obtain approval of CGWA for use of groundwater for mining operations at its enhanced capacity of 9.55 MTPA.
(x) Continuous monitoring of occupational safety and other health hazards, and the corrective actions need to be ensured.
(xi) The fire dealing operations by excavating out fire should be expedited.

4.1 The grant of EC is further subject to compliance of standard EC conditions are as under:

(a) Mining

(i) Mining shall be carried out under strict adherence to provisions of the Mines Act, 1952 and subordinate legislations made there-under as applicable.

(ii) Mining shall be carried out as per the approved mining plan(including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS).

(iii) No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980

(iv) No change in mining method *i.e.* UG to OC, calendar programme and scope of work shall be made without obtaining prior approval of the Ministry of Environment, Forests and Climate Change (MoEFCC).

(v) Underground work place environmental conditions shall be rendered ergonomic and air breathable with adequate illumination in conformance with DGMS standards.

(b) Land reclamation and water conservation

(i) Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by the Ministry of Environment, Forest and Climate Change from time to time shall be submitted to MoEFCC/Regional Office.

(ii) The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIA/EMP report and with due approval of the concerned State/GoI Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.

(iii) The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be diverted. Further action will be treated as specified in the guidelines for preparation of Mine Closure Plan issued by the Ministry of Coal dated 27th August, 2009.

(iv) The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining"/"post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EMP submitted to this Ministry. Progressive compliance status vis-a-vis the post mining land use pattern shall be submitted to the MOEFCC/RO.

(v) Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued

vide S.O.2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling or stowing of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB.

(vi) It shall be ensured that as per the time schedule specified in mine closure plan it should remain live till the point of utilization. The top soil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry.

(vii) Post-mining land shall be rendered usable for agricultural/forestry purposes and handed over to the respective State Government, as specified in the Ministry of Coal Guidelines dated 27th August, 2009 for Preparation of Mine Closure Plan.

(viii) Regular monitoring of subsidence movement on the surface over and around the working areas and its impact on natural drainage pattern, water bodies, vegetation, structure, roads and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence beyond the limit prescribed, appropriate effective mitigation measures shall be taken to avoid loss of life and materials. Cracks should be effectively plugged in with ballast and clay soil/suitable material.

(ix) A separate team for subsidence monitoring and surface mitigation measures shall be constituted and continuous monitoring & implementation of mitigation measures be carried out.

(x) Thorough inspection of the mine lease area for any cracks developed at the surface due to mining activities below ground shall be carried out to prevent inrush of water in the mine.

(xi) Native tree species shall be selected and planted over areas affected by subsidence.

(c) Emissions, effluents, and waste disposal

(i) Transportation of coal, to the extent permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc shall be carried out in critical areas prone to air pollution (with higher values of PM_{10}/$PM_{2.5}$) such as haul road, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board.

(ii) Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area as soon as possible. The green belt comprising a mix of native species (endemic species should be given priority) shall be developed all along the major approach/ coal transportation roads.

(iii) The transportation of coal shall be carried out as per the provisions and route envisaged in the approved Mining Plan or environment monitoring plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.

(iv) Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.

(v) Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belt-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.

(vi) Coal handling plant shall be operated with effective control measures w.r.t. various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.

(vii) Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.

(viii) Catch and or garland drains and siltation ponds in adequate numbers and appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression and green belt development and other industrial use. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.

(ix) Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) after due treatment conforming to the specific requirement (standards).

(x) Solid waste/hazardous waste generated in the mines shall be addressed in accordance to the MSW Rules, 2016.

(xi) The water pumped out from the mine, after siltation, shall be utilized for industrial purpose *viz.* watering the mine area, roads, green belt development *etc.* The drains shall be regularly desilted particularly after monsoon and maintained properly.

(xi) Major approach roads shall be black topped and properly maintained.

(xii) The project proponent shall not alter major water channels around the site. Appropriate embankment shall be provided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side, stabilized with plantation so as to withstand the peak water pressure preventing any chance of mine inundation.

(xiii) Garland drains (of suitable size, gradient and length) around the critical areas i.e. mine shaft and low lying areas, shall be designed keeping at least 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine sites. The

sump capacity shall also provide adequate retention period to allow proper settling of silt material of the surface runoff.

(xiv) Industrial waste water from coal handling plant and mine water shall be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made thereunder, and as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluent. Sewage treatment plant of adequate capacity shall be installed for treatment of domestic waste water.

(d) Illumination, noise & vibration

(i) Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & its RO on six-monthly basis.

(ii) Adequate measures shall be taken for control of noise levels as per noise pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted.

(iii) Controlled blasting techniques shall be practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc. as per the guidelines prescribed by the DGMS.

(iv) The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis.

(e) Occupational health & safety

(i) The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.
(ii) Personnel working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.

(f) Ecosystem and biodiversity conservation

(i) The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered/endemic flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.

(ii) The project proponent shall take all precautionary measures to ensure riverine/riparian ecosystem in and around the coal mine upto a distance of 5 km. A riverine/riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation/water resource department in the State Government.

(g) Public Hearing, R&R and CSR

(i) Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.

(ii) The project proponent shall ensure the expenditure towards socio-economic development in and around the mine every financial year in pursuance of the Corporate Social Responsibility Policy as per the provisions under Section 135 of the Companies Act, 2013.

(iii) The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z-11013/5712014-IA.I1 (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.

(iv) The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land.

(h) Corporate environment responsibility

(i) The Company shall have a well laid down environment policy duly approved by Board of Directors. The environment policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions. Also, the company shall have a defined system of reporting of non-compliances/violations of environmental norms to the Board of Directors and/or shareholders/stakeholders.

(ii) The project proponent shall comply with the provisions contained in this Ministry's OM dated 1st May, 2018, as applicable, regarding Corporate Environment Responsibility.

(iii) A separate environmental management cell both at the project and company headquarter level, with suitable qualified personnel shall be set-up under the control of a Senior Executive, who will report directly to the Board level executive/Head of the Organization.

(iv) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.

(v) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

(vi) Skill training as per safety norms specified by DGMS shall be provided to all workmen including the outsourcing employees to ensure high safety standards in mines.

(vii) Effective arrangement shall be made to provide and maintain at suitable points conveniently situated, a sufficient supply of drinking water for all the persons employed.

(i) Statutory Obligations

(i) This environmental clearance shall be subject to obtaining Forest Clearance from the concerned regulatory authority, Wildlife clearance from the Standing Committee of National Board for Wildlife, as applicable to the project.

(ii) The project proponent shall obtain the necessary permission from the Central Ground Water Authority (CGWA) if applicable.

(iii) The Environmental clearance shall be subject to orders of Hon'ble Supreme Court of India, Hon'ble High Courts, NGT and any other Court of Law, from time to time, and as applicable to the project.

(iv) The project proponent shall obtain Consent to Establish/Operate under the Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from concerned SPCB.

(j) Monitoring of project

(i) Continuous ambient air quality monitoring stations as prescribed in the statue be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM_{10}, $PM_{2.5}$, SO_2 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. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc to be carried out at least once in six months.

(ii) The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25.9.2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.

(iii) The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated 25th September, 2000 and as amended from time to time by the Central Pollution Control Board.

(iv) The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No. J-20012/1/2006-IA.11 (M) dated 27th May, 2009 issued by the Ministry shall also be referred in this regard for compliance.

(v) Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter and water quality once a year, and the data thus collected shall be sent regularly to MoEFCC/RO.

(vi) Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.

(vii) The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental conditions to the MOEFCC/RO. For half yearly monitoring reports, the data should be monitored for the period of April to September and October to March of the financial years.

(viii) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

(k) Miscellaneous

(i) Efforts should be made to reduce energy consumption by conservation, efficiency improvements and use of renewable energy.

(ii) The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations.

(iii) A copy of the environmental clearance shall be marked to concerned Panchayat. A copy of the same shall also be sent to the concerned State Pollution Control Board, Regional Office of the MOEFCC, District Industries Centre and Collector's Office/Tehsildar Office for information in public domain within 30 days.

(iv) The EC shall be uploaded on the company's website. The compliance status of the stipulated EC 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 in public domain.

(v) The project authorities shall advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of this Ministry at www.environmentclearance.nic.in and a copy of the same shall be forwarded to the Regional Office.

(vi) The environmental statement for each financial year ending 31st March in Form-V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on 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&CC by e-mail.

(vii) The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during their presentation to the EAC.

(viii) Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in revocation of this EC and attract action under the provisions of Environment (Protection) Act, 1986.

(ix) The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India/High Courts and any other Court of Law relating to the subject matter.

(x) Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely particulates, SO2 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive receptors in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc. to be carried out at least once in six months. Online ambient air quality monitoring station/stations may also be installed in addition to the regular air monitoring stations as per the requirement and/or in consultation with the SPCB.

5. The proponent shall obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection. The Ministry or any other competent authority may stipulate any further condition for environmental protection.

6. The coal company/project proponent shall be liable to pay the compensation against the illegal mining, if any, and as raised by the respective State Governments at any point of time, in terms of the orders dated 2nd August, 2017 of Hon'ble Supreme Court in WP (Civil) No.114/2014 in the matter of 'Common Cause Vs Union of India & othrs'.

7. The concerned State Government shall ensure that no mining operations shall be carried out till the entire compensation for illegal mining, if any, is paid by the project proponent through their respective Department of Mining & Geology, in strict compliance of the judgment of Hon'ble Supreme Court.

8. This environmental clearance shall not be operational till such time the project proponent complies with the above said judgment of Hon'ble Supreme Court, as applicable, and other statutory requirements.

9. This environmental clearance supersedes the earlier environmental clearance granted vide letter no. J-11015/212/2010-IA-II(M) dated 6th February, 2013.

16/7/2018

(S K Srivastava)
Scientist E

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The Secretary, Deptt of Environment & Forests, Govt of Jharkhand, Secretariat, Ranchi
3. The Additional PCCF, Regional office (ECZ), Ministry of Environment Forests and Climate Change, Bungalow No. A-2, Shyamali Colony, Ranchi - 834002
4. The Member Secretary, Jharkhand State Pollution Control Board, TA Building, HEC Complex, PO Dhurwa, Ranchi
5. The Member Secretary, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
6. The Member Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi
7. The Advisor, Coal India Ltd, SCOPE Minar, Core-I, 4th Floor, Vikas Marg, Laxmi Nagar, N Delhi
8. The District Collector, Dhanbad, Government of Jharkhand
9. Monitoring File 10. Guard File 11. Record File. 12. Notice Board

16/7/2018

(S K Srivastava)
Scientist E

A comparative representation of productions from mines in the cluster for which EC was granted and proposed productions are as given below:

Table1.1: Comparative representation of productions from nines in the cluster for which EC was granted and Proposed productions

Sl. No.	Name of Mine		Production Capacity (MTY) As per EC granted in Feb 2013		Production Capacity (MTY) Proposed		Lease Hold Area (Ha)	Remarks
			Normative	Peak	Normative	Peak		
1	Salanpur Colliery	UG	0.15	0.195	0.13	0.17	177.49	-
		OC	-	-	0.42	0.55		For curbing illegal mining
		Total	**0.15**	**0.195**	**0.55**	**0.72**		-
2	Katras Choitudih Colliery	UG	0.22	0.286	0.00	0.00	228.00	-
		OC	-	-	0.50	0.65		For fire dealing as per approved Master Plan
		Total	**0.22**	**0.286**	**0.50**	**0.65**		-
3	Amalgamated Keshalpur-West Mududih Colliery	UG	0.19	0.247	0.6	0.78	325.00	-
		OC	2.00	2.6	4.9	6.37		For fire dealing as per approved Master Plan
		Total	**2.19**	**2.847**	**5.5**	**7.15**		-
4	Amalgamated Angarpathra - Ramkanali colliery	UG	0.291	0.378	0.19	0.25	254.64	-
5	Gaslitand Colliery	UG (Closed)	0.00	0.00	0.00	0.00	138.66	-
		OC	-	-	0.60	0.78		For fire dealing as per approved Master Plan
		Total	**0.00**	**0.00**	**0.60**	**0.78**		-
		Total UG	**0.851**	**1.106**	**0.92**	**1.2**		
		Total OC	**2**	**2.6**	**6.42**	**8.35**		
		Grand Total	**2.851**	**3.706**	**7.34**	**9.55**	**1123.79**	

The proposed capacity of cluster IV group of mines is as under:

Name of Project		Normative Production (in MTY)	Peak Production (in MTY)	Leasehold (In Ha)
Cluster IV Group of Mines	UG	0.92	1.2	1123.79
	OC	6.42	8.35	
	Total	7.34	9.55	

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Water Sprinkling at Coal Dump
05 18 2019



Mist Sprinkler in Cluster-IV





PPE distribution details of FY 20-21 in respect of Cluster IV group of mine

Sl No.	ITEMS	Total distribution in nos
1	Mining Shoes	968
2	GUMBOOT	840
3	HELMET	275
4	DUST MASK	2100
5	Fluorescent Jackets	1001




L&T 9020


05-18-2019


05 18 2019


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732
05 18 2019

Annexure - I

NOTING SHEET

Deptt: Environment Deptt.

Ref: DyGM(Env.)/F-EMP /15/77/N Dated 19-01-2015

Sub.: Preparation of Mine Plan, based on Feasibility Reports prepared by CMPDI for obtaining environment Clearance under cluster concept, and approval thereof

The Expert Appraisal Committee (Coal & Thermal) of MOEFCC, in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines, observed that BCCL has not submitted Mining Plan approved by its Board of Directors.

It was submitted by BCCL that since almost all the collieries / mines of BCCL are taken over from the erstwhile private owners, the mine does not have structured mining plans. The mining operations are being continued as amalgamated collieries. However BCCL is submitting feasibility Reports for the purpose.

The committee agreed for granting EC enhancement to Cluster-IV but directed BCCL to submit Mine Plans of all the mines in this cluster as well as of mines of other clusters for which EC has been granted.

It is proposed to prepare Mine Plan through CMPDI, on the basis of Feasibility Reports, prepared by CMPDI and already submitted along with Form-I, while making application to MOEFCC. The Mine Plan shall be submitted to MOEFCC after approval by BCCL Board of Directors.

The committee, in the meeting, also directed BCCL to submit the Cluster concept duly approved by Company Board of Directors. The document has already been submitted to MOEFCC on 10-11-2009 and approved by MOEFCC on 2-12-2009 .It is proposed to obtain post facto approval of BCCL Board of Directors.

Competent authority is requested to direct RD CMPDI, RI-II for preparing Mine Plan for all the mines of Clusters for which EC has been granted/applied, based on Feasibility report already submitted to MOEFCC so that the same can be placed before Board of Directors of BCCL for approval. The list of Feasibility Reports prepared by CMPDI and submitted to MOEFCC is enclosed as Annexure-A.

Dy GM(Env) 19/1/15

Director (T)Op

For kind perusal and action.

20/1/15

RD, RI II

Copy - D.T. (Plan) - for information

HOD(Env) 20/1/15

This Space is not for use.

BCCL Press 04/25/13 - 14 - 300 Pads. x 100 Lvs.

Annexure-A

List of Feasibility Reports prepared by CMPDI and submitted to MOEFCC alongwith Form-I Application

Sl No	Cluster	Name of mine	Normative Capacity	Peak Capacity	LEASE HOLD AREA
	I	Damoda Colliery (Albion OCP)	0.20	0.26	
		Damoda Colliery (UG)	0.10	0.13	575.0 Ha
		Damoda Colliery (BJ Section OCP)	0.60	0.78	
	II	Block II Colliery(Mixed)	4.45	5.785	852.00
		Jamunia OCP	1.2	1.56	55.00
		Shatabdi OCP	1.4	1.82	181.30
		Muraidih Colliery (Mixed)	5.5	7.15	536.41
		Phularitand OCP	3.0	3.90	401.00
	III	Jogidih Colliery	0.244	0.317	167.00
		Maheshpur Colliery	0.070	0.091	292.68
		South Govindpur Colliery (Closed)	Nil	Nil	182.00
		Teturiya Colliery (Closed)	Nil	Nil	123.00
		Govindpur Colliery	0.140	0.182	159.55
		New Akashkinaree Mine Opencast Project UG Mine	 1.000 0.135	 1.300 0.176	347.38
		Block-IV/Kooridih Mixed Mine Opencast Project UG Mine	 1.100 0.080	 1.430 0.104	149.00
	IV	Salanpur Colliery UG	0.13	0.17	
		Salanpur Colliery OC	0.42	0.55	
		Katras Choitudih Colliery OC	0.5	0.65	228.00
		a) Amalgamated Keshalpur& West Mududih UG b) Amalgamated Keshalpur& West Mududih OC	0.60 4.9	0.78 6.37	325.00
		Amalgamated Angarpathra & Ramkanali colliery UG	0.190	0.25	254.64
	V	Nichitpur OC Mine	0.6	0.78	150
		Tetulmari Colliery (Mixed)	0.795	1.033	317
		Mudidih Colliery (Mixed)	1.553	2.019	378.05
		Sendra Bansjore Colliery (Mixed)	0.75	0.975	249.63
		Kankanee Colliery (Mixed)	0.48	0.624	258.12
		Bansdeopur Colliery (Mixed)	0.676	0.879	104.72
		Loyabad UG Mine (closed for coal production)	0	0	499.56

	X	Bhowrah North (Mixed)	0.53	0.689	208.83
		Bhowrah South (Mixed)	0.683	0.887	571.58
		Patherdih (Mixed)	0.274	0.356	244.34
		Sudamdih Incline mine(UG)	0.09	0.117	254.27
		Sudamdih Shaft mine(UG)	0.185	0.240	391.50
		Amlabad UG mine (Closed for coal production)	0	0	386.95
		Sudamdih Coal Washery	1.6	2.08	
	XI	Gopalichak UG Project	0.11	0.143	241.94
		Kachi Balihari 10/12 Pit UG Mine	0.09	0.117	60.00
		PB Project (UG Mine)	0.80	1.040	89.00
		Bhagabandh UG Mine	0.08	0.104	581.17
		Moonidih UG Mine	4.0	5.20	2063.45
		Kendwadih UG Mine (Closed for production)	Nil	Nil	217.54
		Pootkee UG Mine (Closed for production)	Nil	Nil	153.77
		Kachi Balihari 5/6 Pit UG Mine (Closed for production)	Nil	Nil	120.71
		Moonidih Washery	1.60	1.60	0.27*
	XIII	Murulidih 20/21 pits	0.18	0.234	571.32
		Bhurungiya colliery	nil	nil	170.44
		Muchraidih colliery	nil	nil	83.23
		Hantoodih colliery	nil	nil	193.41
		Padugora colliery	nil	nil	17.6
		Muruhidih colliery	nil	nil	547.0
		Bhatdee colliery	nil	nil	315.62
	XIV	Lohapatty UG Mine	0.03	0.039	1577.22
		Lohapatty OC Mine	0.375	0.487	
	XV	Kharkharee Colliery	0.092	0.12	584.00
		Madhuband Colliery	0.113	0.147	393.77
		Phularitand Colliery	0.120	0.156	340.88
		Dharmaband Colliery	0	0	377.90
	XVI	Dahibari Basantimata OCP	1.30	1.69	385.68
		Basantimata UG	0.21	0.273	417.00
		New Laikdih OCP-(Abandoned) -Includes prop. Dahibari Washery	0.00	0.00	305.1
		Laikdih Deep UG (Abandoned)	0.00	0.00	281.00
		Chanch UG	0.00	0.00	575.43
	XVII	Begunia UG	0	0	306.00
		Victoria West UG	0	0	310.00
		Victoria UG	0	0	223.00
		Damagoria Colliery	0	0	620.0
		Proposed Kalayaneshwari OCP	4	5.2	851.83
		Proposed Kalayaneshwari Washery	3.65	3.65	15.66

	VI	East Bassuriya Colliery	1.500	1.950	141.07
		Bassuriya Colliery	0.120	0.156	162.76
		Gondudih Khas kusunda Colliery	2.000	2.600	410
		Godhur Colliery	2.000	2.6	162.72
	VII	Dhansar UG	0.372	0.484	174.12
		Dhansar OC	0.800	1.040	
		Kusunda OC	2.000	2.600	247.7
		Industry UG (Closed)	-	-	137.20
		Alkusa UG	0.115	0.150	101.77
		Ena OC	0.170	0.221	181.3
		South Jharia/ Rajapur OCP	1.300	1.690	207.48
		Burragarh UG	0.170	0.221	147.83
		Simlabahal UG	0.250	0.325	178.13
		Hurriladih UG	0.090	0.117	127.17
		Bhutgoria UG (Re-opening Proposed)	0.360	0.468	131.67
		Kustor UG (Closed)	-	-	250.71
		East Bhuggatdih UG (Closed)	-	-	242.62
		Vishwakarma OC (Proposed)	0.700	0.910	43.5 (Within Dhansar & Industry LH
	VIII	Bastacolla OCP	0.10	0.130	239.45
		Bastacolla UG	0.33	0.429	
		Bera OCP	0.15	0.195	209.56
		Bera UG	0.19	0.247	
		Dobari Colliery (UG)	0.24	0.312	146.90
		Kuya OCP	0.60	0.780	340.50
		Kuya UG	0.10	0.130	
		Goluckdih (NC) OCP (Proposed)	1.2	1.560	
		Ghanoodih Colliery (OCP)	1.40	1.820	73.00
		Kujama Colliery (OCP)	0.60	0.780	191.00
	IX	Lodna (UG)	0.115	0.150	391.64
		North Tisra (UG)	0.15	0.195	246.24
		NT/ST (OCP)	1.65	2.145	256.15
		Jealgora (UG) Closed	NIL	NIL	138.00
		Bagdigi (UG)	0.11	0.143	61.00
		Joyrampur (UG)	0.153	0.199	98.04
		Jeenagora (OC)	0.7	0.91	276.05
		Bararee (UG)	0.17	0.221	475.00
		NT/ST EXPANSION (OCP)	6.0	7.8	755.15

Annexure - II

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/ मु० महाप्रबंधक (यो. ए. परि.)/फ-15/15/ 231 Dated-17.06.2015

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद

933
17.06.15

विषय: Draft **Mining Plan for AKWM Colliery (Cluster IV)**.

महोदय,

Please find enclosed herewith the comments of Project Manager, AKWMC on the above subject. The report has been found to be in order.

This is for your kind information and further needful action at your end.

Thanking you.

भवदीय

संलग्नक: यथोपरि

महाप्रबंधक (योजना एवं परियोजना)

प्रतिलिपि:
महाप्रबंधक, कतरास एरिया, बी सी सी एल, धनबाद

D:\BCCL\Letter-15

154

BHARAT COKING COAL LIMITED
"A Mini Ratna Company"
(A Subsidiary of Coal India Limited)
OFFICE OF THE PROJECT OFFICER/AGENT
Amalgamated Keshalpur West Modidih Colliery
KATRAS AREA, PO: Sijua, Dist: - Dhanbad (Jharkhand) – 828121

Ref.No. AKWM/ 1377 Dated: - 26/05/2015

To,
The General Manager(P&P)
Koyla Bhawan, Dhanbad

Subject:- Submission of draft Mining Plan of AKWM Colliery(Cluster-IV).

D/Sir,

After going through the draft Mining Plan, it is found OK as per our Draft Plan.

This is for your kind information and necessary action please.

Thanking you

26/05/15

PROJECT OFFICER
AKWMC

Annexure-III

A

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp.bccl@coalindia.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp.bccl@coalindia.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/महाप्रबंधक (यो. ए. परि.)/फ-76/17/ 63(H) **Dated**-02.01.2017

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद.

क्षेत्रीय संस्थान-II सीएमपीडीआई धनबाद स 3532 दिनांक 22/12/16

विषय: Preparation of Mining Plan of all the mines of Cluster IV alongwith modified Mine Closure Plan for those mines.

महोदय,

The Expert appraisal committee (Coal & Thermal) of MOEFCC in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines observed that BCCL has not submitted approved mining plan. The Project was accorded TOR vide letter no. J-11015/372/2013-IA.II(M) Dated 10.02.2014 exempting Public hearing for preparation of EIA/EMP report.

The proposal is for cluster IV Coal Mining Project (7.34 MTPA normative and 9.55 peak in an ML area of 1123.79 ha of Bharat Coking Coal Limited. The capacity enhancement is proposed from existing capacity of 2.851 MTPA normative & 3.706 MTPA peak.

The expansion of the project is required to implement the Master Plan to deal with the fire in Jharia Coalfield.

Empowered Sub Committee of BCCL Board pointed out during ESC meeting on 30.12.2016 that Mining Plans for all the mines of Cluster IV, alongwith modified Mine Closure Plan of all the mines of Cluster IV should be placed before the committee.

In the view of above you are requested to prepare and submit the above document on an urgent basis.

Matter most urgent.

भवदीय

2.1.2017

महाप्रबंधक (योजना एवं परियोजना)

Annexure-IV

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)
कोयला भवन,कोयला नगर,धनबाद – 826005
A Mini Ratna Company
पर्यावरण विभाग

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

पत्र संख्या: भाकोकोलि/उप महाप्रबंधक(पर्या)/फाईल- Cluster-IV /2016/251- 254(H) दिनांक : 16.01.2017

सेवा में,
महाप्रबंधक - योजना एवं परियोजना
भा0को0को0लि0 ,धनबाद ।

विषय :- Approved Mining Plan for EC Capacity enhancement of Cluster-IV

महोदय,

For EC capacity enhancement of Cluster-IV (Katras Area) from existing 3.706 MTPA peak to 9.55 MTPA peak, application was made to MoEFCC in 2013.

- TOR granted on 10th Feb 2014 with waiver of Baseline and recommendation of waiver of PH
- EMP considered in EAC meeting of 15.01.2015 and after submission of certified copy of compliance from RO, MoEFCC & Mining Plan approved by Director under delegated power, further considered on 08.01.2016.
- Expert appraisal Committee of MoEFCC desired Mining Plan approved by Board & Revised certified from R.O. MoEFCC, Ranchi for further consideration.
- R.O. MOEFCC made fresh inspection on 22.08.2016 & revised report is now uploaded

You are therefore requested to expedite Mining Plan preparation and approval for submission to MoEFCC for further consideration.

भवदीय,
16/1/17
उप महाप्रबंधक (पर्यावरण)

प्रतिलिपि:
1. क्षेत्रीय निदेशक, क्षेत्रीय संस्थान -2, सी.एम.पी.डी.आई.धनबाद ।
2. महाप्रबंधक, कतरास क्षेत्र ।

Annexure - I

NOTING SHEET

Deptt: Environment Deptt.

Ref: DyGM(Env.)/F-EMP /15/77/N Dated 19-01-2015

Sub.: Preparation of Mine Plan, based on Feasibility Reports prepared by CMPDI for obtaining environment Clearance under cluster concept, and approval thereof

The Expert Appraisal Committee (Coal & Thermal) of MOEFCC, in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines, observed that BCCL has not submitted Mining Plan approved by its Board of Directors.

It was submitted by BCCL that since almost all the collieries / mines of BCCL are taken over from the erstwhile private owners, the mine does not have structured mining plans. The mining operations are being continued as amalgamated collieries. However BCCL is submitting feasibility Reports for the purpose.

The committee agreed for granting EC enhancement to Cluster-IV but directed BCCL to submit Mine Plans of all the mines in this cluster as well as of mines of other clusters for which EC has been granted.

It is proposed to prepare Mine Plan through CMPDI, on the basis of Feasibility Reports, prepared by CMPDI and already submitted along with Form-I, while making application to MOEFCC. The Mine Plan shall be submitted to MOEFCC after approval by BCCL Board of Directors.

The committee, in the meeting, also directed BCCL to submit the Cluster concept duly approved by Company Board of Directors. The document has already been submitted to MOEFCC on 10-11-2009 and approved by MOEFCC on 2-12-2009 .It is proposed to obtain post facto approval of BCCL Board of Directors.

Competent authority is requested to direct RD CMPDI, RI-II for preparing Mine Plan for all the mines of Clusters for which EC has been granted/applied, based on Feasibility report already submitted to MOEFCC so that the same can be placed before Board of Directors of BCCL for approval. The list of Feasibility Reports prepared by CMPDI and submitted to MOEFCC is enclosed as Annexure-A.

Dy GM(Env) 19/1/15

Director (T)Op

For kind action.

20/1/15

RD, RI II

Copy - D.T. (P&T) - for information

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BCCL Press 04/28/13 - 14 - 300 Pads. x 100 Lvs.

Annexure-A

List of Feasibility Reports prepared by CMPDI and submitted to MOEFCC alongwith Form-I Application

Sl No	Cluster	Name of mine	Normative Capacity	Peak Capacity	LEASE HOLD AREA
	I	Damoda Colliery (Albion OCP)	0.20	0.26	575.0 Ha
		Damoda Colliery (UG)	0.10	0.13	
		Damoda Colliery (BJ Section OCP)	0.60	0.78	
	II	Block II Colliery(Mixed)	4.45	5.785	852.00
		Jamunia OCP	1.2	1.56	55.00
		Shatabdi OCP	1.4	1.82	181.30
		Muraidih Colliery (Mixed)	5.5	7.15	536.41
		Phularitand OCP	3.0	3.90	401.00
	III	Jogidih Colliery	0.244	0.317	167.00
		Maheshpur Colliery	0.070	0.091	292.68
		South Govindpur Colliery (Closed)	Nil	Nil	182.00
		Teturiya Colliery (Closed)	Nil	Nil	123.00
		Govindpur Colliery	0.140	0.182	159.55
		New Akashkinaree Mine Opencast Project UG Mine	 1.000 0.135	 1.300 0.176	347.38
		Block-IV/Kooridih Mixed Mine Opencast Project UG Mine	 1.100 0.080	 1.430 0.104	149.00
	IV	Salanpur Colliery UG	0.13	0.17	
		Salanpur Colliery OC	0.42	0.55	
		Katras Choitudih Colliery OC	0.5	0.65	228.00
		a) Amalgamated Keshalpur& West Mududih UG b) Amalgamated Keshalpur& West Mududih OC	0.60 4.9	0.78 6.37	325.00
		Amalgamated Angarpathra & Ramkanali colliery UG	0.190	0.25	254.64
	V	Nichitpur OC Mine	0.6	0.78	150
		Tetulmari Colliery (Mixed)	0.795	1.033	317
		Mudidih Colliery (Mixed)	1.553	2.019	378.05
		Sendra Bansjore Colliery (Mixed)	0.75	0.975	249.63
		Kankanee Colliery (Mixed)	0.48	0.624	258.12
		Bansdeopur Colliery (Mixed)	0.676	0.879	104.72
		Loyabad UG Mine (closed for coal production)	0	0	499.56

	X	Bhowrah North (Mixed)	0.53	0.689	208.83
		Bhowrah South (Mixed)	0.683	0.887	571.58
		Patherdih (Mixed)	0.274	0.356	244.34
		Sudamdih Incline mine(UG)	0.09	0.117	254.27
		Sudamdih Shaft mine(UG)	0.185	0.240	391.50
		Amlabad UG mine (Closed for coal production)	0	0	386.95
		Sudamdih Coal Washery	1.6	2.08	
	XI	Gopalichak UG Project	0.11	0.143	241.94
		Kachi Balihari 10/12 Pit UG Mine	0.09	0.117	60.00
		PB Project (UG Mine)	0.80	1.040	89.00
		Bhagabandh UG Mine	0.08	0.104	581.17
		Moonidih UG Mine	4.0	5.20	2063.45
		Kendwadih UG Mine (Closed for production)	Nil	Nil	217.54
		Pootkee UG Mine (Closed for production)	Nil	Nil	153.77
		Kachi Balihari 5/6 Pit UG Mine (Closed for production)	Nil	Nil	120.71
		Moonidih Washery	1.60	1.60	0.27*
	XIII	Murulidih 20/21 pits	0.18	0.234	571.32
		Bhurungiya colliery	nil	nil	170.44
		Muchraidih colliery	nil	nil	83.23
		Hantoodih colliery	nil	nil	193.41
		Padugora colliery	nil	nil	17.6
		Murulidih colliery	nil	nil	547.0
		Bhatdee colliery	nil	nil	315.62
	XIV	Lohapatty UG Mine	0.03	0.039	1577.22
		Lohapatty OC Mine	0.375	0.487	
	XV	Kharkharee Colliery	0.092	0.12	584.00
		Madhuband Colliery	0.113	0.147	393.77
		Phularitand Colliery	0.120	0.156	340.88
		Dharmaband Colliery	0	0	377.90
	XVI	Dahibari Basantimata OCP	1.30	1.69	385.68
		Basantimata UG	0.21	0.273	417.00
		New Laikdih OCP-(Abandoned) -Includes prop. Dahibari Washery	0.00	0.00	305.1
		Laikdih Deep UG (Abandoned)	0.00	0.00	281.00
		Chanch UG	0.00	0.00	575.43
	XVII	Begunia UG	0	0	306.00
		Victoria West UG	0	0	310.00
		Victoria UG	0	0	223.00
		Damagoria Colliery	0	0	620.0
		Proposed Kalayaneshwari OCP	4	5.2	851.83
		Proposed Kalayaneshwari Washery	3.65	3.65	15.66

	VI	East Bassuriya Colliery	1.500	1.950	141.07
		Bassuriya Colliery	0.120	0.156	162.76
		Gondudih Khas kusunda Colliery	2.000	2.600	410
		Godhur Colliery	2.000	2.6	162.72
	VII	Dhansar UG	0.372	0.484	174.12
		Dhansar OC	0.800	1.040	
		Kusunda OC	2.000	2.600	247.7
		Industry UG (Closed)	-	-	137.20
		Alkusa UG	0.115	0.150	101.77
		Ena OC	0.170	0.221	181.3
		South Jharia/ Rajapur OCP	1.300	1.690	207.48
		Burragarh UG	0.170	0.221	147.83
		Simlabahal UG	0.250	0.325	178.13
		Hurriladih UG	0.090	0.117	127.17
		Bhutgoria UG (Re-opening Proposed)	0.360	0.468	131.67
		Kustor UG (Closed)	-	-	250.71
		East Bhuggatdih UG (Closed)	-	-	242.62
		Vishwakarma OC (Proposed)	0.700	0.910	43.5 (Within Dhansar & Industry LH
	VIII	Bastacolla OCP	0.10	0.130	239.45
		Bastacolla UG	0.33	0.429	
		Bera OCP	0.15	0.195	209.56
		Bera UG	0.19	0.247	
		Dobari Colliery (UG)	0.24	0.312	146.90
		Kuya OCP	0.60	0.780	340.50
		Kuya UG	0.10	0.130	
		Goluckdih (NC) OCP (Proposed)	1.2	1.560	
		Ghanoodih Colliery (OCP)	1.40	1.820	73.00
		Kujama Colliery (OCP)	0.60	0.780	191.00
	IX	Lodna (UG)	0.115	0.150	391.64
		North Tisra (UG)	0.15	0.195	246.24
		NT/ST (OCP)	1.65	2.145	256.15
		Jealgora (UG) Closed	NIL	NIL	138.00
		Bagdigi (UG)	0.11	0.143	61.00
		Joyrampur (UG)	0.153	0.199	98.04
		Jeenagora (OC)	0.7	0.91	276.05
		Banaree (UG)	0.17	0.221	475.00
		NT/ST EXPANSION (OCP)	6.0	7.8	755.15

Annexure-II

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/महाप्रबंधक (यो. ए. परि.)/फ-76/16/ 194 **Dated-28.03.2016**

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई, क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद

विषय: Modification of Mining Plan of AARC Mine of Cluster-IV.

संदर्भ: Letter No. BCCL/KA-IV/GM/2016/1289 dated 09.03.2016.

महोदय,

As per the above referred letter of GM, Katras Area, a Mining Plan of AARC was prepared by CMPDI in April, 2015 which is yet to be approved by BCCL Board, the capacity as per the Mining Plan is 0.075 MTY however as per enclosed production plan of AARC the normative mine capacity of the said mine will be 0.19 MTY.

You are requested to take necessary action for modification of Mining Plan of AARC accordingly and submit the document at the earliest possible.

संलग्नक: यथोपरि

भवदीय
(सुबीर घोष)
महाप्रबंधक (योजना एवं परियोजना)

प्रतिलिपि: सूचनार्थ
महाप्रबंधक, कतरास, बी.सी.सी.एल.
विभागाध्यक्षक (पर्यावरण), बी.सी.सी.एल.

D:\BCCL\Letter-16 77

Annexure-III

A

भारत कोकिंग कोल लिमिटेड		Bharat Coking Coal Limited
(एक मिनी रत्न कंपनी)		(A Mini Ratna Company)
योजना एवं परियोजना विभाग		**Planning & Project Division**
कोयला भवन कोयला नगर		**Koyla Bhawan, Koyla Nagar**
धनबाद- 826005		**Dhanbad- 826 005**
दूरभाष-0326-2230276		Telephone-0326-2230276
ईमेल: gmpp.bccl@coalindia.in		Email- gmpp.bccl@coalindia.in
CIN: U10101JH1972GO1000918		CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/महाप्रबंधक (यो. ए. परि.)/फ-76/17/ 63(H) **Dated**-02.01.2017

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद.

क्षेत्रीय संस्थान-II सीएमपीडीआई स 3532 दिनांक 22/12/16 कोयला नगर धनबाद

विषय: Preparation of Mining Plan of all the mines of Cluster IV alongwith modified Mine Closure Plan for those mines.

महोदय,

The Expert appraisal committee (Coal & Thermal) of MOEFCC in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines observed that BCCL has not submitted approved mining plan. The Project was accorded TOR vide letter no. J-11015/372/2013-IA.II(M) Dated 10.02.2014 exempting Public hearing for preparation of EIA/EMP report.

The proposal is for cluster IV Coal Mining Project (7.34 MTPA normative and 9.55 peak in an ML area of 1123.79 ha of Bharat Coking Coal Limited. The capacity enhancement is proposed from existing capacity of 2.851 MTPA normative & 3.706 MTPA peak.

The expansion of the project is required to implement the Master Plan to deal with the fire in Jharia Coalfield.

Empowered Sub Committee of BCCL Board pointed out during ESC meeting on 30.12.2016 that Mining Plans for all the mines of Cluster IV, alongwith modified Mine Closure Plan of all the mines of Cluster IV should be placed before the committee.

In the view of above you are requested to prepare and submit the above document on an urgent basis.

Matter most urgent.

भवदीय

2.1.2017

महाप्रबंधक (योजना एवं परियोजना)

Annexure-IV

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)
कोयला भवन,कोयला नगर,धनबाद – 826005
A Mini Ratna Company
पर्यावरण विभाग

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

पत्र संख्या: भाकोकोलि/उप महाप्रबंधक(पर्या)/फाईल- Cluster-IV /2016/251- 254(H) दिनांक : 16.01.2017

सेवा में,
महाप्रबंधक - योजना एवं परियोजना
भा0को0को0लि0 ,धनबाद ।

विषय :- Approved Mining Plan for EC Capacity enhancement of Cluster-IV

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- Expert appraisal Committee of MoEFCC desired Mining Plan approved by Board & Revised certified from R.O. MoEFCC, Ranchi for further consideration.
- R.O. MOEFCC made fresh inspection on 22.08.2016 & revised report is now uploaded

You are therefore requested to expedite Mining Plan preparation and approval for submission to MoEFCC for further consideration.

भवदीय,
16/1/17
उप महाप्रबंधक (पर्यावरण)

प्रतिलिपि:
1. क्षेत्रीय निदेशक, क्षेत्रीय संस्थान -2, सी.एम.पी.डी.आई.धनबाद ।
2. महाप्रबंधक, कतरास क्षेत्र ।

Annexure-I

NOTING SHEET

Dept: Environment Deptt.

Ref: DyGM(Env.)/F-EMP /15/~~77/N~~ 77/N Dated 19-01-2015

Sub.: Preparation of Mine Plan, based on Feasibility Reports prepared by CMPDI for obtaining environment Clearance under cluster concept, and approval thereof

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The committee, in the meeting, also directed BCCL to submit the Cluster concept duly approved by Company Board of Directors. The document has already been submitted to MOEFCC on 10-11-2009 and approved by MOEFCC on 2-12-2009 .It is proposed to obtain post facto approval of BCCL Board of Directors.

Competent authority is requested to direct RD CMPDI, RI-II for preparing Mine Plan for all the mines of Clusters for which EC has been granted/applied, based on Feasibility report already submitted to MOEFCC so that the same can be placed before Board of Directors of BCCL for approval. The list of Feasibility Reports prepared by CMPDI and submitted to MOEFCC is enclosed as Annexure-A.

Dy GM(Env) 19/1/15

Director (T)Op

For nec. action. 20/1/15

RD, RI II

Copy - D.T. (P&P) - for information and

This Space is not for use.

BCCL Press 04/2013 - 14 - 200 Pads x 100 Leaves

Annexure-II

18

BCCL

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
(कोल इण्डिया लिमिटेड का एक उपक्रम)
महाप्रबंधक का कार्यालय, कतरास क्षेत्र
पोस्ट: सिजुआ, धनबाद पिन: 828121
CIN U10101JH1972GOI000918
www.bccl.gov.in

सन्दर्भ : भा०को०को०लि०/म०प्र०/क०क्षे०/15/A-2/1210 दिनांक : **11.04.2015**

सेवा में ,
The Chief General Manager (P&P)
BCCL/Koyla Bhawan
Dhanbad.

विषय : Draft Mining Plan for Gaslitand Colliery.

Ref: Your letter no. BCCL/CGM/(P&P)/F-15/15/46 Dated 31/03/1015.

महाशय,

The Draft Mining Plan sent by you, has been checked from our side. The relevant mining data with respect to Gaslitand mine seems to be in order.

You are requested to please do the needful from your end for finalization of plan by RI-II, CMPDI.

आपका विश्वासी

महाप्रबंधक
कतरास क्षेत्र

संलग्नक :

1. Draft Mining Plan

प्रतिलिपि :

(1) Project Officer, GTC – without enclosure.
(2) Office Copy

ANNEXURE-I

NOTING SHEET

Deptt: Environment Deptt.

Ref: DyGM(Env.)/F-EMP /15/~~77~~ 77/N Dated 19-01-2015

Sub.: Preparation of Mine Plan, based on Feasibility Reports prepared by CMPDI for obtaining environment Clearance under cluster concept, and approval thereof

The Expert Appraisal Committee (Coal & Thermal) of MOEFCC, in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines, observed that BCCL has not submitted Mining Plan approved by its Board of Directors.

It was submitted by BCCL that since almost all the collieries / mines of BCCL are taken over from the erstwhile private owners, the mine does not have structured mining plans. The mining operations are being continued as amalgamated collieries. However BCCL is submitting feasibility Reports for the purpose.

The committee agreed for granting EC enhancement to Cluster-IV but directed BCCL to submit Mine Plans of all the mines in this cluster as well as of mines of other clusters for which EC has been granted.

It is proposed to prepare Mine Plan through CMPDI, on the basis of Feasibility Reports, prepared by CMPDI and already submitted along with Form-I, while making application to MOEFCC. The Mine Plan shall be submitted to MOEFCC after approval by BCCL Board of Directors.

The committee, in the meeting, also directed BCCL to submit the Cluster concept duly approved by Company Board of Directors. The document has already been submitted to MOEFCC on 10-11-2009 and approved by MOEFCC on 2-12-2009 .It is proposed to obtain post facto approval of BCCL Board of Directors.

Competent authority is requested to direct RD CMPDI, RI-II for preparing Mine Plan for all the mines of Clusters for which EC has been granted/applied, based on Feasibility report already submitted to MOEFCC so that the same can be placed before Board of Directors of BCCL for approval. The list of Feasibility Reports prepared by CMPDI and submitted to MOEFCC is enclosed as Annexure-A.

Dy GM(Env) 19/1/15

Director (T)Op — For kind perusal and for approval. 20/1/15

RD, RI II

Copy - D.T. (P&T) - for information

This Space is not for use.

BCCL Press 64/25/13-14-200 Pads x 100 Lvs.

ANNEXURE - II (1/2)

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/ मु0 महाप्रबंधक (यो. ए. परि.)/फ-15/15/ 129 **Dated**-31.03.2015

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद

सी.एम.पी.डी.आई०, क्षेत्रीय सं०-2, धनबाद
Dy. No. 01
Date 01/04/15
C. M. P. D. I., R.I.-2, Dhanbad

विषय: Draft Mining Plan for Katras Choitodih Colliery.

महोदय,

Please find enclosed herewith the comments of General Manager, Katras Area on the above subject. The report has been found to be in order.

This is for your kind information and further needful action at your end.

Thanking you.

भवदीय

31/3/15

(आर एन प्रसाद)
मुख्य महाप्रबंधक (योजना एवं परियोजना)

संलग्नक: यथोपरि

प्रतिलिपि:
श्री एस के अग्रवाल, वरीय प्रबंधक(खनन), योजना एवं परियोजना.

D:\BCCL\Letter-15

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ANNEXURE-II (2/2)

(9)

BHARAT COKING COAL LIMITED

(A subsidiary of coal India limited)

Office of General Manager

Katras Area IV

PO: Sijua, Dhanbad – 828121

Ref : KA/GM/HQ(Mining Plan)/15/A-2/ 1197 Dated 30.03.015

To

The General Manager (P&P)

Koyla Bhawan, BCCL

Dhanbad

Sub : Draft Mining Plan for Katras Choitodih Colliery

Dear Sir,

The draft Mining Plan sent by you, has been checked from our side. The relevant mining data with respect to Katras Choitodih Mine seems to be in order.

You are requested to pl. do the needful from your end for finalization of plan by RI-II, CMPDI.

Yours Faithfully

General Manager

Katras Area

Scanned by CamScanner

Annexure - I

NOTING SHEET

Deptt: Environment Deptt.

Ref: DyGM(Env.)/F-EMP /15/77/N Dated 19-01-2015

Sub.: Preparation of Mine Plan, based on Feasibility Reports prepared by CMPDI for obtaining environment Clearance under cluster concept, and approval thereof

The Expert Appraisal Committee (Coal & Thermal) of MOEFCC, in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines, observed that BCCL has not submitted Mining Plan approved by its Board of Directors.

It was submitted by BCCL that since almost all the collieries / mines of BCCL are taken over from the erstwhile private owners, the mine does not have structured mining plans. The mining operations are being continued as amalgamated collieries. However BCCL is submitting feasibility Reports for the purpose.

The committee agreed for granting EC enhancement to Cluster-IV but directed BCCL to submit Mine Plans of all the mines in this cluster as well as of mines of other clusters for which EC has been granted.

It is proposed to prepare Mine Plan through CMPDI, on the basis of Feasibility Reports, prepared by CMPDI and already submitted along with Form-I, while making application to MOEFCC. The Mine Plan shall be submitted to MOEFCC after approval by BCCL Board of Directors.

The committee, in the meeting, also directed BCCL to submit the Cluster concept duly approved by Company Board of Directors. The document has already been submitted to MOEFCC on 10-11-2009 and approved by MOEFCC on 2-12-2009 .It is proposed to obtain post facto approval of BCCL Board of Directors.

Competent authority is requested to direct RD CMPDI, RI-II for preparing Mine Plan for all the mines of Clusters for which EC has been granted/applied, based on Feasibility report already submitted to MOEFCC so that the same can be placed before Board of Directors of BCCL for approval. The list of Feasibility Reports prepared by CMPDI and submitted to MOEFCC is enclosed as Annexure-A.

Dy GM(Env) 19/1/15

Director (T)Op

For kind action.

20/1/15

RD, RI II

Copy - D.T. (P&P) - for information

This Space is not for use.

BCCL Press 04/28/13 - 14 - 300 Pads. x 100 Lvs.

Annexure-A

List of Feasibility Reports prepared by CMPDI and submitted to MOEFCC alongwith Form-I Application

Sl No	Cluster	Name of mine	Normative Capacity	Peak Capacity	LEASE HOLD AREA
	I	Damoda Colliery (Albion OCP)	0.20	0.26	575.0 Ha
		Damoda Colliery (UG)	0.10	0.13	
		Damoda Colliery (BJ Section OCP)	0.60	0.78	
	II	Block II Colliery(Mixed)	4.45	5.785	852.00
		Jamunia OCP	1.2	1.56	55.00
		Shatabdi OCP	1.4	1.82	181.30
		Muraidih Colliery (Mixed)	5.5	7.15	536.41
		Phularitand OCP	3.0	3.90	401.00
	III	Jogidih Colliery	0.244	0.317	167.00
		Maheshpur Colliery	0.070	0.091	292.68
		South Govindpur Colliery (Closed)	Nil	Nil	182.00
		Teturiya Colliery (Closed)	Nil	Nil	123.00
		Govindpur Colliery	0.140	0.182	159.55
		New Akashkinaree Mine Opencast Project UG Mine	1.000 0.135	1.300 0.176	347.38
		Block-IV/Kooridih Mixed Mine Opencast Project UG Mine	1.100 0.080	1.430 0.104	149.00
	IV	Salanpur Colliery UG	0.13	0.17	
		Salanpur Colliery OC	0.42	0.55	
		Katras Choitudih Colliery OC	0.5	0.65	228.00
		a) Amalgamated Keshalpur& West Mududih UG b) Amalgamated Keshalpur& West Mududih OC	0.60 4.9	0.78 6.37	325.00
		Amalgamated Angarpathra & Ramkanali colliery UG	0.190	0.25	254.64
	V	Nichitpur OC Mine	0.6	0.78	150
		Tetulmari Colliery (Mixed)	0.795	1.033	317
		Mudidih Colliery (Mixed)	1.553	2.019	378.05
		Sendra Bansjore Colliery (Mixed)	0.75	0.975	249.63
		Kankanee Colliery (Mixed)	0.48	0.624	258.12
		Bansdeopur Colliery (Mixed)	0.676	0.879	104.72
		Loyabad UG Mine (closed for coal production)	0	0	499.56

	X	Bhowrah North (Mixed)	0.53	0.689	208.83
		Bhowrah South (Mixed)	0.683	0.887	571.58
		Patherdih (Mixed)	0.274	0.356	244.34
		Sudamdih Incline mine(UG)	0.09	0.117	254.27
		Sudamdih Shaft mine(UG)	0.185	0.240	391.50
		Amlabad UG mine (Closed for coal production)	0	0	386.95
		Sudamdih Coal Washery	1.6	2.08	
	XI	Gopalichak UG Project	0.11	0.143	241.94
		Kachi Balihari 10/12 Pit UG Mine	0.09	0.117	60.00
		PB Project (UG Mine)	0.80	1.040	89.00
		Bhagabandh UG Mine	0.08	0.104	581.17
		Moonidih UG Mine	4.0	5.20	2063.45
		Kendwadih UG Mine (Closed for production)	Nil	Nil	217.54
		Pootkee UG Mine (Closed for production)	Nil	Nil	153.77
		Kachi Balihari 5/6 Pit UG Mine (Closed for production)	Nil	Nil	120.71
		Moonidih Washery	1.60	1.60	0.27*
	XIII	Murulidih 20/21 pits	0.18	0.234	571.32
		Bhurungiya colliery	nil	nil	170.44
		Muchraidih colliery	nil	nil	83.23
		Hantoodih colliery	nil	nil	193.41
		Padugora colliery	nil	nil	17.6
		Murulidih colliery	nil	nil	547.0
		Bhatdee colliery	nil	nil	315.62
	XIV	Lohapatty UG Mine	0.03	0.039	1577.22
		Lohapatty OC Mine	0.375	0.487	
	XV	Kharkharee Colliery	0.092	0.12	584.00
		Madhuband Colliery	0.113	0.147	393.77
		Phularitand Colliery	0.120	0.156	340.88
		Dharmaband Colliery	0	0	377.90
	XVI	Dahibari Basantimata OCP	1.30	1.69	385.68
		Basantimata UG	0.21	0.273	417.00
		New Laikdih OCP-(Abandoned) -Includes prop. Dahibari Washery	0.00	0.00	305.1
		Laikdih Deep UG (Abandoned)	0.00	0.00	281.00
		Chanch UG	0.00	0.00	575.43
	XVII	Begunia UG	0	0	306.00
		Victoria West UG	0	0	310.00
		Victoria UG	0	0	223.00
		Damagoria Colliery	0	0	620.0
		Proposed Kalayaneshwari OCP	4	5.2	851.83
		Proposed Kalayaneshwari Washery	3.65	3.65	15.66

	VI	East Bassuriya Colliery	1.500	1.950	141.07
		Bassuriya Colliery	0.120	0.156	162.76
		Gondudih Khas kusunda Colliery	2.000	2.600	410
		Godhur Colliery	2.000	2.6	162.72
	VII	Dhansar UG	0.372	0.484	174.12
		Dhansar OC	0.800	1.040	
		Kusunda OC	2.000	2.600	247.7
		Industry UG (Closed)	-	-	137.20
		Alkusa UG	0.115	0.150	101.77
		Ena OC	0.170	0.221	181.3
		South Jharia/ Rajapur OCP	1.300	1.690	207.48
		Burragarh UG	0.170	0.221	147.83
		Sinlabahal UG	0.250	0.325	178.13
		Hurriladih UG	0.090	0.117	127.17
		Bhutgoria UG (Re-opening Proposed)	0.360	0.468	131.67
		Kustor UG (Closed)	-	-	250.71
		East Bhuggatdih UG (Closed)	-	-	242.62
		Vishwakarma OC (Proposed)	0.700	0.910	43.5 (Within Dhansar & Industry LH
	VIII	Bastacolla OCP	0.10	0.130	239.45
		Bastacolla UG	0.33	0.429	
		Bera OCP	0.15	0.195	209.56
		Bera UG	0.19	0.247	
		Dobari Colliery (UG)	0.24	0.312	146.90
		Kuya OCP	0.60	0.780	340.50
		Kuya UG	0.10	0.130	
		Goluckdih (NC) OCP (Proposed)	1.2	1.560	
		Ghanoodih Colliery (OCP)	1.40	1.820	73.00
		Kujama Colliery (OCP)	0.60	0.780	191.00
	IX	Lodna (UG)	0.115	0.150	391.64
		North Tisra (UG)	0.15	0.195	246.24
		NT/ST (OCP)	1.65	2.145	256.15
		Jealgora (UG) Closed	NIL	NIL	138.00
		Bagdigi (UG)	0.11	0.143	61.00
		Joyrampur (UG)	0.153	0.199	98.04
		Jeenagora (OC)	0.7	0.91	276.05
		Banaree (UG)	0.17	0.221	475.00
		NT/ST EXPANSION (OCP)	6.0	7.8	755.15

Annexure-II

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp@bccl.gov.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/ मु0 महाप्रबंधक (यो. ए. परि.)/फ-15/15/61 Dated-07.04.2015

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद

105
18/4/15

विषय: **Draft Mining Plan for Salanpur Colliery.**

महोदय,

Please find enclosed herewith the comments of General Manager, Katras Area on the above subject. The report has been found to be in order.

This is for your kind information and further needful action at your end.

Thanking you.

भवदीय

7/4/15

(आर एन प्रसाद)
मुख्य महाप्रबंधक (योजना एवं परियोजना)

संलग्नक: यथोपरि

प्रतिलिपि:
महाप्रबंधक, कतरास एरिया, बी सी सी एल, धनबाद
श्री एस के अग्रवाल, वरीय प्रबंधक(खनन), योजना एवं परियोजना

Annexure-III

A

भारत कोकिंग कोल लिमिटेड
(एक मिनी रत्न कंपनी)
योजना एवं परियोजना विभाग
कोयला भवन कोयला नगर
धनबाद- 826005
दूरभाष-0326-2230276
ईमेल: gmpp.bccl@coalindia.in
CIN: U10101JH1972GO1000918

Bharat Coking Coal Limited
(A Mini Ratna Company)
Planning & Project Division
Koyla Bhawan, Koyla Nagar
Dhanbad- 826 005
Telephone-0326-2230276
Email- gmpp.bccl@coalindia.in
CIN: U10101JH1972GO1000918

पत्रांक : बी.सी.सी.एल/महाप्रबंधक (यो. ए. परि.)/फ-76/17/ 63(H) **Dated**-02.01.2017

सेवा में
क्षेत्रीय निदेशक,
सी एम पी डी आई,
क्षेत्रीय संस्थान-II,
कोयला भवन परिसर , धनबाद.

क्षे.सं.-II सी.एम.पी.डी.आई. स 3532 दि-नांक. 22/01/17 कोयला नगर धनबाद

विषय: Preparation of Mining Plan of all the mines of Cluster IV alongwith modified Mine Closure Plan for those mines.

महोदय,

The Expert appraisal committee (Coal & Thermal) of MOEFCC in its meeting on 15.01.2015 while considering proposal for EC capacity enhancement of Cluster-IV group of mines observed that BCCL has not submitted approved mining plan. The Project was accorded TOR vide letter no. J-11015/372/2013-IA.II(M) Dated 10.02.2014 exempting Public hearing for preparation of EIA/EMP report.

The proposal is for cluster IV Coal Mining Project (7.34 MTPA normative and 9.55 peak in an ML area of 1123.79 ha of Bharat Coking Coal Limited. The capacity enhancement is proposed from existing capacity of 2.851 MTPA normative & 3.706 MTPA peak.

The expansion of the project is required to implement the Master Plan to deal with the fire in Jharia Coalfield.

Empowered Sub Committee of BCCL Board pointed out during ESC meeting on 30.12.2016 that Mining Plans for all the mines of Cluster IV, alongwith modified Mine Closure Plan of all the mines of Cluster IV should be placed before the committee.

In the view of above you are requested to prepare and submit the above document on an urgent basis.

Matter most urgent.

भवदीय

2.1.2017

महाप्रबंधक (योजना एवं परियोजना)

Annexure-IV

भारत कोकिंग कोल लिमिटेड
(कोल इंडिया लिमिटेड का एक अंग)
कोयला भवन,कोयला नगर,धनबाद – 826005
A Mini Ratna Company
पर्यावरण विभाग

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

पत्र संख्या: भाकोकोलि/उप महाप्रबंधक(पर्या)/फाईल- Cluster-IV /2016/251- 254(H) दिनांक : 16.01.2017

सेवा में,
महाप्रबंधक - योजना एवं परियोजना
भा0को0को0लि0 ,धनबाद ।

विषय :- Approved Mining Plan for EC Capacity enhancement of Cluster-IV

महोदय,

For EC capacity enhancement of Cluster-IV (Katras Area) from existing 3.706 MTPA peak to 9.55 MTPA peak, application was made to MoEFCC in 2013.

- TOR granted on 10th Feb 2014 with waiver of Baseline and recommendation of waiver of PH
- EMP considered in EAC meeting of 15.01.2015 and after submission of certified copy of compliance from RO, MoEFCC & Mining Plan approved by Director under delegated power, further considered on 08.01.2016.
- Expert appraisal Committee of MoEFCC desired Mining Plan approved by Board & Revised certified from R.O. MoEFCC, Ranchi for further consideration.
- R.O. MOEFCC made fresh inspection on 22.08.2016 & revised report is now uploaded

You are therefore requested to expedite Mining Plan preparation and approval for submission to MoEFCC for further consideration.

भवदीय,
16/1/17
उप महाप्रबंधक (पर्यावरण)

प्रतिलिपि:
1. क्षेत्रीय निदेशक, क्षेत्रीय संस्थान -2, सी.एम.पी.डी.आई.धनबाद ।
2. महाप्रबंधक, कतरास क्षेत्र ।

BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)
Office of the General Manager
Katras Area.
CIN U10101JH1972GOI000918

Ref.IV/GM/EST/Legal/17/8257 Dated 15.3.2017

To,

D.F.O
Combined Building
DHANBAD

Sub: Details of Jungle Jari under Katras Area of BCCL

Dear Sir,

Enclosed herewith please find details of Jungle Jari land under Baghmara Circle received from Circle Office, Baghmara. (Annex 1) .The record of Jungle Jhari land received from Circle Office, Baghmara shows that Jungle Jhari land exist only in Mouza Nagrikalan 230 which is partly under Katras Area after reorganization of the areas by DGMS . So, after reorganization of the areas of Katras & Sijua Areas by DGMS, plot No 1 & 3 in Mouza Nagrikalan 230 is under the jurisdiction of Sijua Area where Jungle Jhari exists as per the above record of Circle Office, Baghmara . Hence there is no Jungle Jhari land under the jurisdiction of Katras Area, BCCL .

The Mouzas of land under the jurisdiction of Katras Area, BCCL is also enclosed herewith for your reference please.

This is for your information please.

Yours faithfully,

15/3/17

Chief Manager (Env.)
Katras Area
BCCL

15/3/17

Encl. As above

General Manager
Katras Area,BCCL

Cc to: The General Manager, Katras Area
Cc to: The AM(Estate), Katras Area
Cc to: Office copy

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Annexure-1

(1)

गैरमजरुआ जंगल–झाड़ी (Deemed Forest) भूमि की विवरणी (प्रपत्र III)

अंचल का नाम – बाघमारा, जिला का नाम – धनबाद

क्रमांक	अंचल	मौजा	थाना नं0	खाता	प्लॉट	रकवा	किस्म	बंदोबस्त / हस्तांतरित / लीज भूमि की विवरणी			की विवरणी (7–9)			अभियुक्ति
								खाता	प्लॉट	रकवा	खाता	प्लॉट	रकवा	
1	2	3	4	5	6	7	8	9			10			11
1	बाघमारा	गोपालपुर	62	–	37,111,38,613,438 ,447,201,614,300,255,2	270.88								
2	सोहनडीह		63		15,34	23.84								
3	घोराठी		65		1,158	21.4								
4	तिलैया		69		87,7,18,29,725,747,699, 663,701,702,603,602	19.52								
5	नारायणपुर		70		2,53,191,184,202, 408,453,394,299, 309,314	60.98								
6	दग्घो		71		2,308,373,433,503, 521,500,452,31	283.5								
7	हुरसोडीह		72		123,127,156,179	47.68								
8	खानूडीह		73		20,23,212,238,236 ,237,67,68,673,672 ,671,889,898,1064 ,1061,983,1062,239	336.32								
9	माटीगढ़ा		74		5,6,113,114,115 ,118,119,32,33, 116,120,112	443.2								
10	डोमचलकरो		75		48,52,37,38,55,51,1,46	246.91								
11	मीमकनाली		76		2,6,248,355,261,262,273	195.03								
12	बक्सपुरा		80		3,11,219,28	80.7								

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क्रमांक	अंचल	मौजा	थाना नं0	खाता	प्लॉट	रकबा	किस्म	बंदोबस्त/हस्तांतरित/लीज भूमि की विवरणी			की विवरणी (7–9)			अभियुक्ति
								खाता	प्लॉट	रकबा	खाता	प्लॉट	रकबा	
1	2	3	4	5	6	7	8	9			10			11
13	लुत्तीपहाड़ी		81		2,1,3,148,160,5,14	73.44								
14	आमडीह		64		5,154	12.1								
15	टामंझलाडीह		66		1,3,75,82,201,203,85,246,288,130,99	131.55								
16	नावाडीह		102		327,328,331,389	61.2								
17	बेहराकुदर		117		1077	12.55								
18	झगराही		118		475	9.83								
19	बरमसिया		105		340,339,357,356,345,275,337,374,4	107.97								
20	महेशपुर		308		4	15.82								
21	जरमुनई		181		1	4.8								
22	महेशपुर		185		118	1.72								
23	कर्णपुरा		186		1,71	5.75								
24	लालचक		207		142,119,88,87,80,78,74,402	14.47								
25	बागदाहा		217		2183,2940,2970,2966,2967,2968,2960,2971,2975,2980,2935,2083,2331,2324,3452	80.12								
			217		3434,3433,3421,3231,3230,3227,3218,3208									

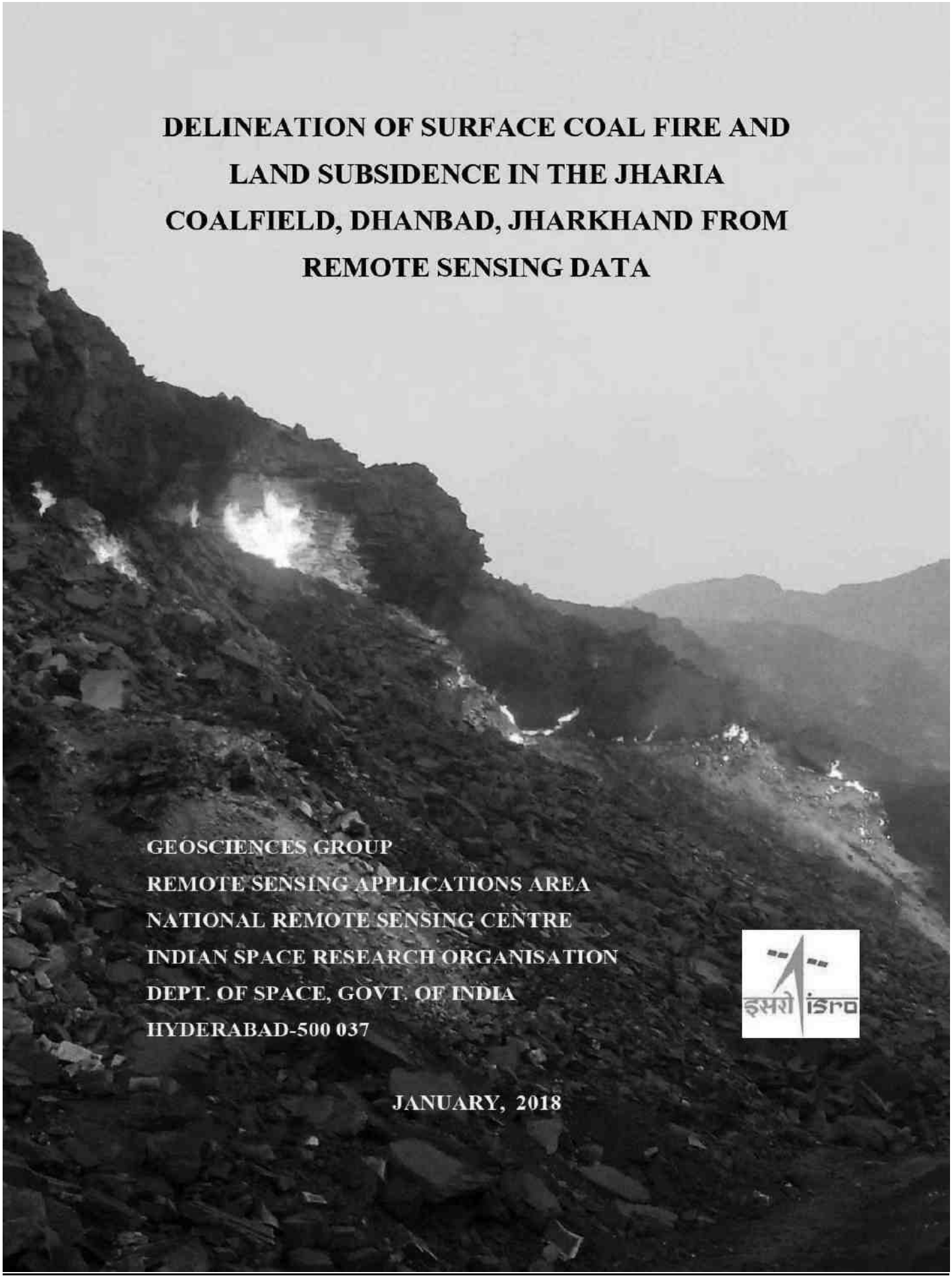
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क्रमांक	अंचल	मौजा	थाना नं0	खाता	प्लॉट	रकवा	किस्म	बंदोबस्त/हस्तांतरित/लीज भूमि की विवरणी			की विवरणी (7–9)			अभियुक्त
								खाता	प्लॉट	रकवा	खाता	प्लॉट	रकवा	
1	2	3	4	5	6	7	8	9			10			11
			217		3203,3436,3215,2972,2946 , 1482									
26	बौआकला		228		1,11,2326,2715,2400,2420, 2711,2712,2794,78,	85.34								
27	महतोटांड		180		3,40	18.8								
28	तिलाटांड		213		369,383,395,1387,1,2,3,4,7 , 65,77,78,89,80,81,82,132,1 38, 134,135,383,384,385	132.11								
29	फाटामाडुल		222		137,148,626,1833,1954	76.67								
30	गोविन्दाडीह		221		833,1,1362,2094	200.57								
31	घारजोरी		225		1,200,2421,2449,2641	21.92								
32	पंचरुखी		220		774	50								
33	नगरीकला		230		1,3	35.3								
34	हरिणा		101		225,226	34								
35	मधुगोड़ा		214		454,343	54.25								
36	चुगी		191		519,1232	8.81								
37	लोहपिट्टी		319		17,28,32,83,1604,2294, 2078,3278	59.96								

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क्रमांक	अंचल	मौजा	थाना नं0	खाता	प्लॉट	एकड़	किस्म	बंदोबस्त/हस्तांतरित/लीज भूमि की विवरणी			अभियुक्त की विवरणी (7–9)		
								खाता	प्लॉट	रकबा	खाता	प्लॉट	रकबा
1	2	3	4	5	6	7	8	9			10		11
38	तेलमच्चों		320		2782,2796,2755,2943,2962 2942,2754,2797,2807	102.9							
39	पुंजी		321		1,3,25,754,26,435,131,135, 142,436,434,650,614,612,7 01 ,800,801,751,695,794,255, 739,	167.48							
40	तारगा		305		1352,1676,1411,	68.96							
				कुल		3678.35							

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DELINEATION OF SURFACE COAL FIRE AND LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA

GEOSCIENCES GROUP
REMOTE SENSING APPLICATIONS AREA
NATIONAL REMOTE SENSING CENTRE
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HYDERABAD-500 037

JANUARY, 2018

NRSC/RSAA/GSG/BCCL/Project Report/JAN2018

DELINEATION OF SURFACE COAL FIRE **AND** LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA

Report for

BHARAT COKING COAL LIMITED (BCCL)

(A SUBSIDIARY OF COAL INDIA LTD.)

ENVIRONMENT DEPARTMENT, KOYLA BHAWAN

KOYLA NAGAR, DHANBAD – 826 005, JHARKHAND

GEOSCIENCES GROUP

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HYDERABAD-500 037

JANUARY, 2018

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ACKNOWLEDGEMENTS

The project team is grateful to Dr. Y.V.N. Krishnamurthy, Director, NRSC, for his support at various stages during execution of this project. We are extremely grateful to Dr. P.V.N. Rao, Deputy Director (RSAA), NRSC for his overall guidance and encouragement. We thank Shri D. Gangopadhyay (Director, P&P). BCCL, for this project initiative and for providing Geosciences group, NRSC, the opportunity to carry out the task. We are thankful to Shri A. K. Singh (GM, I/C), BCCL for taking keen interest in the project work and for the support during our fieldwork. We also thank Shri Dipankar Maity, Surveyor (Mining) and Shri Mithilesh Kumar, Sr. Manager (Mining) for their support and fruitful discussion during the fieldwork. The support of all the BCCL officials in the various collieries visited during the course of the ground truth verification is duly acknowledged.

EXECUTIVE SUMMARY

Coal fire is a serious problem in Jharia coal field, where high ranking coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has endangered the environmental stability of Jharia coal field. Coupled with the ecological changes instigated by open cast mining, the landscape in and around Jharia have changed drastically over the years. In the present study, delineation of coal fire and mining related land subsidence have been addressed. Thermal band of Landsat-8 (100m resolution) have been used to demarcate the coal mine fire areas from non fire areas. For this study, Landsat-8 data of May, 2017 have been used. The band 10 (10.60-11.19 μm) of Landsat-8 data is used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data has been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2012, the eastern flanks (Lodna and Tisra) show a larger fire area. The western flank (Nadkhurkee and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as OB dumps. Among all the colliery areas, Kusunda and Lodna area is most affected by coal mine fire. The current fire area mapped is 3.28 sq.km. Apart from this, five distinctive areas of land subsidence have been identified using interferometric method. These are primarily caused by older or active underground mining. The Moonidih Project is most affected by subsidence. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence map of Jharia coal field is prepared by using remote sensing data analysis with field validation.

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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. Subsurface and surface coal fires are a serious problem in many coal-producing countries. 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 dioxides, which are the result of coal burning processes, 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 date 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

Remote sensing technique in thermal band offers a cost-effective and time-saving technology for mapping various geoenvironmental / hazardous features such as coal fires, forest fires, oil well fires, volcanic eruptions etc. 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 Landsat-5 TM data for 2001 over Raniganj coalfield, West Bengal. Further, projects were executed in 2006 and 2012 in which coal fires of the JCF were mapped using Landsat-7 ETM+ and ASTER data, respectively. Additionally, a R&D study was taken up in 2013 to delineate subsidence areas using differential interferomteric (DInSAR) technique. In view of the past experiences, based on the letter (Ref. no. NRSC/16/76) from Director (Tech.), Operations, BCCL addressed to Director, NRSC on 01 February 2016. a project was formulated to take up Coal fire and Land Subsidence study of the Jharia Coal Field using space-borne remote sensing technique. The formal Memorandum of Understanding between BCCL and NRSC was signed on 23rd of Dec, 2016.

1.2 Objectives

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

I. To map Coal fire in the study area based on pixel integrated relative radiant temperature derived from latest available Landsat-8 data of 2016-17 time period.

II. To compare the change in the coal fire distribution in the Jharia coalfield within the period of 2012 and 2016-17.

III. To delineate probable subsidence areas in the region using differential interferometry method.

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 roughly within latitudes 23° 42' N and 23° 50'N and longitudes 86° 09'E and 86° 30'E.

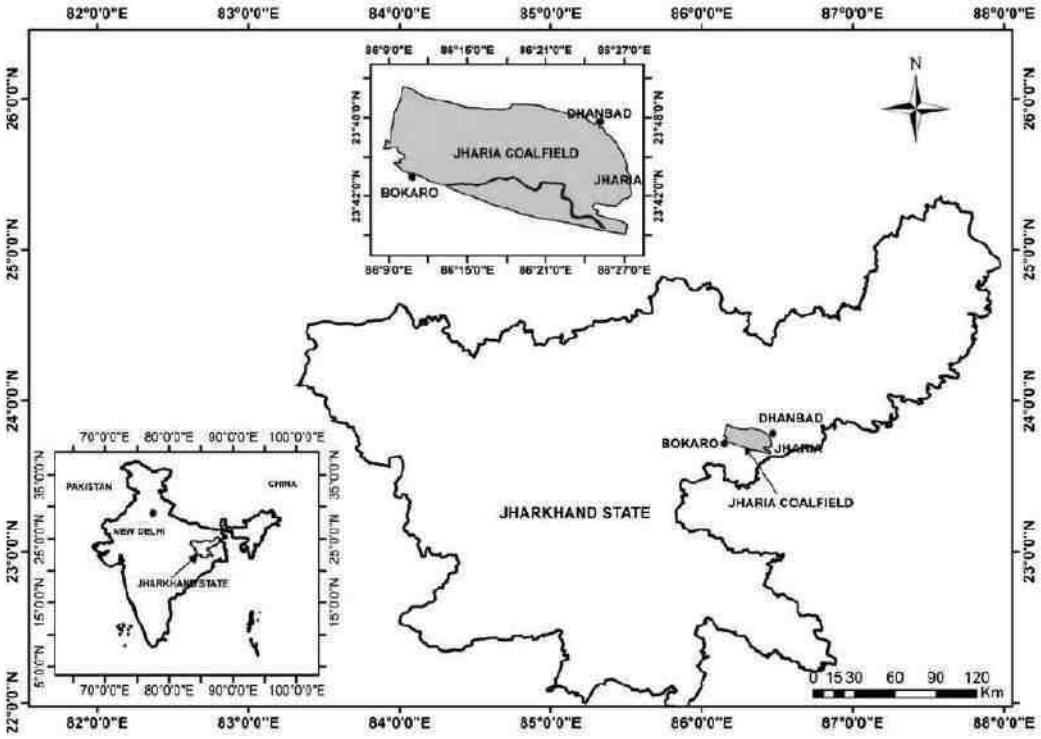


Figure 1: Study area map of Jharia Coalfied, Jharkhand

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 <10° C in the month of December – January and maximum temperature is >50° C in the month of May – June.

2.3 General Geology

Gondwana Super Groups 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 north to Jharia. 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.

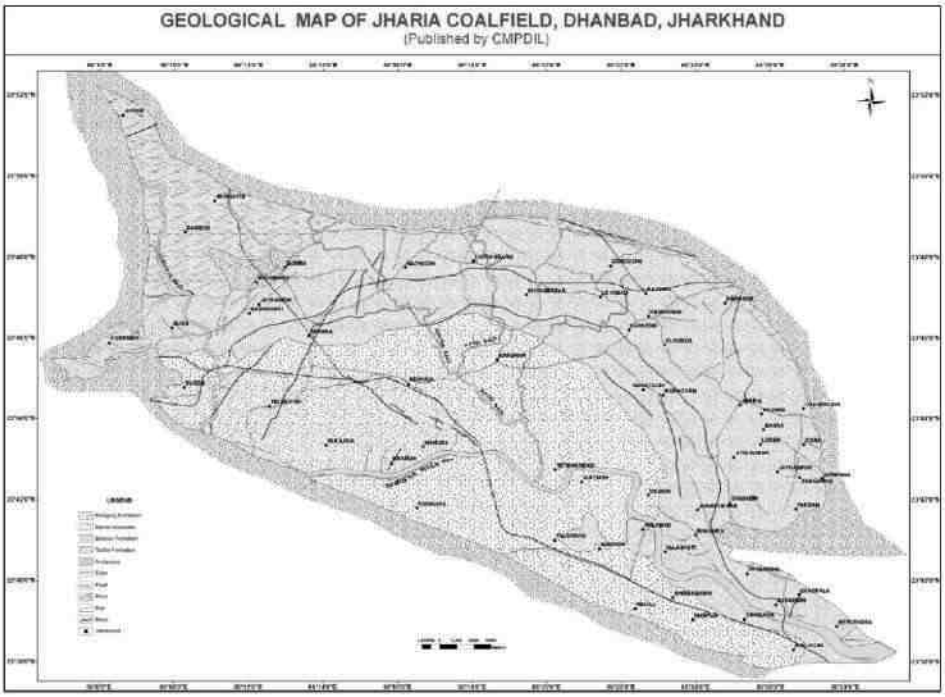


Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPIDL)

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

The most recent available thermal satellite data was used in conjunction with the fieldwork for mapping coal fire in JCF. A coal fire map generated from the same, would serve as a reference for the fieldwork, as the observations can be verified in the field. For this purpose, a coal fire map was created from LANDSAT 8 TIRS data of 14-May 2017 .

Further, the coal fire map of 2012 prepared by NRSC (NRSC, 2012) from ASTER data was used as a reference to identify the changes that has occurred in the extent and disposition of the fires from 2012 to 2017.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Five scenes of "Fine mode" SLC data were taken from PALSAR-2 archives over a period from October, 2014 to February, 2017. 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.

Sl. No	Satellite	Sensor	Time	Date	Data source
1	LANDSAT-8	TIRS	Daytime	14 May 2017	USGS, USA
2	ALOS-PALSAR-2 (Fine mode)	PALSAR-2	-	4 October. 2014	JAXA, Japan
3				3 October, 2015	
4				20 February. 2016	
5				01 October, 2016	
6				18 February. 2017	

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

4.1.1 Processing of Landsat 8 Data

With the launch of the LANDSAT-8 mission in February, 2013; thermal space borne data is available from its thermal infrared sensor (TIRS). 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 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. In present study, band 10 of TIRS sensor (acquired on 14 May, 2017) has been used coal fire mapping (Gangopadhyay et al. 2012). 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 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.

$$L_\lambda = M_L Q_{cal} + A_L \ldots\ldots\ldots (1)$$

Where:

L_λ = Spectral radiance (Watts/ (m2 * 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 (Lλ) for ASTER Band 13 and Landsat-8 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 literatures (Gupta, 2003).

$$T_R = K_2 / \ln ((K_1 / L_\lambda) + 1) \ldots\ldots\ldots (2)$$

T_R = Radiant (brightness) temperature,

K_1 = Calibration constant (1260.56 K),

K_2 = Calibration constant (666.09 watts/ (m2 *ster*μm)),

L_λ = Spectral radiance

4.1.2 Thresholding of radiant temperature image

Once the Landsat-8 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, 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 data used in this study, the cut-off temperature was determined around 39°C (Figure 4). Based on this cut-offs, regional coal fire map was prepared (Figure 5).

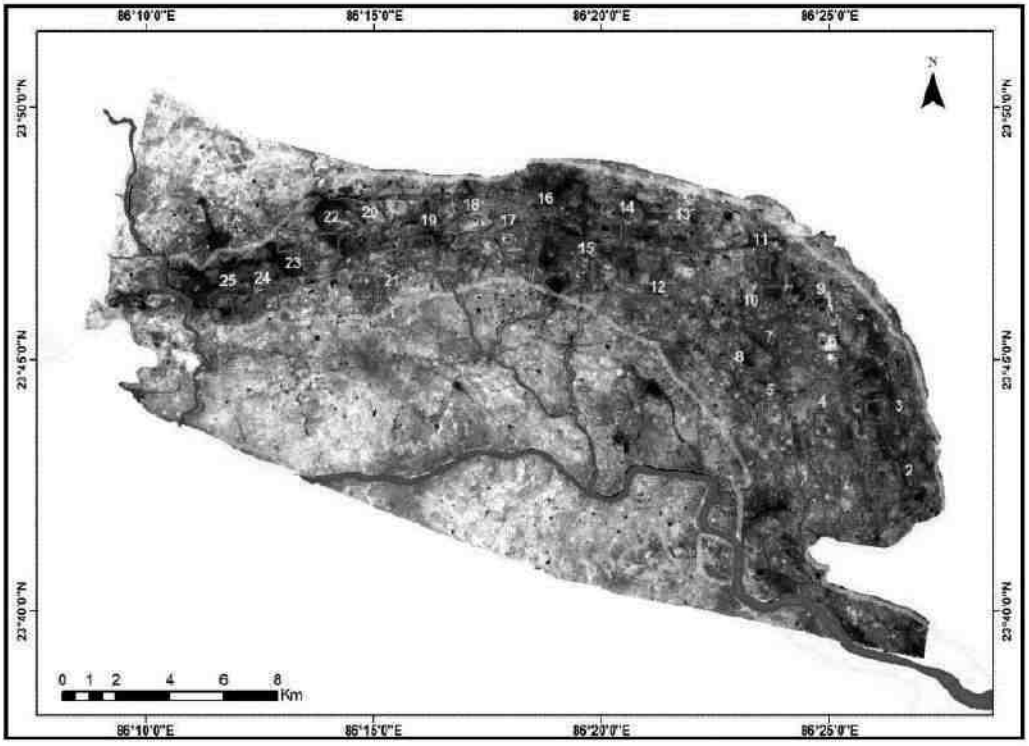


Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

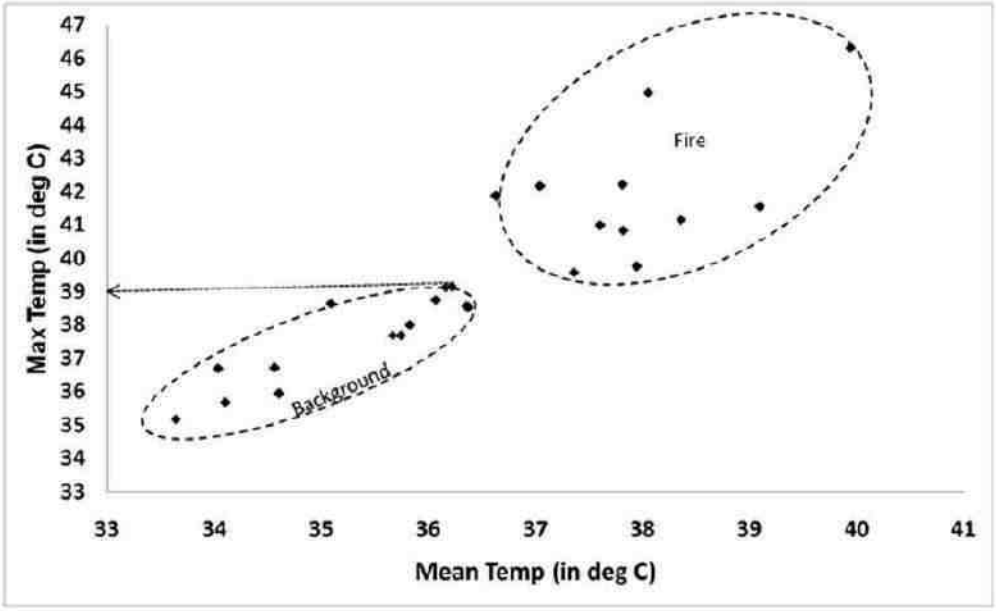


Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 39 °C (marked with arrow)

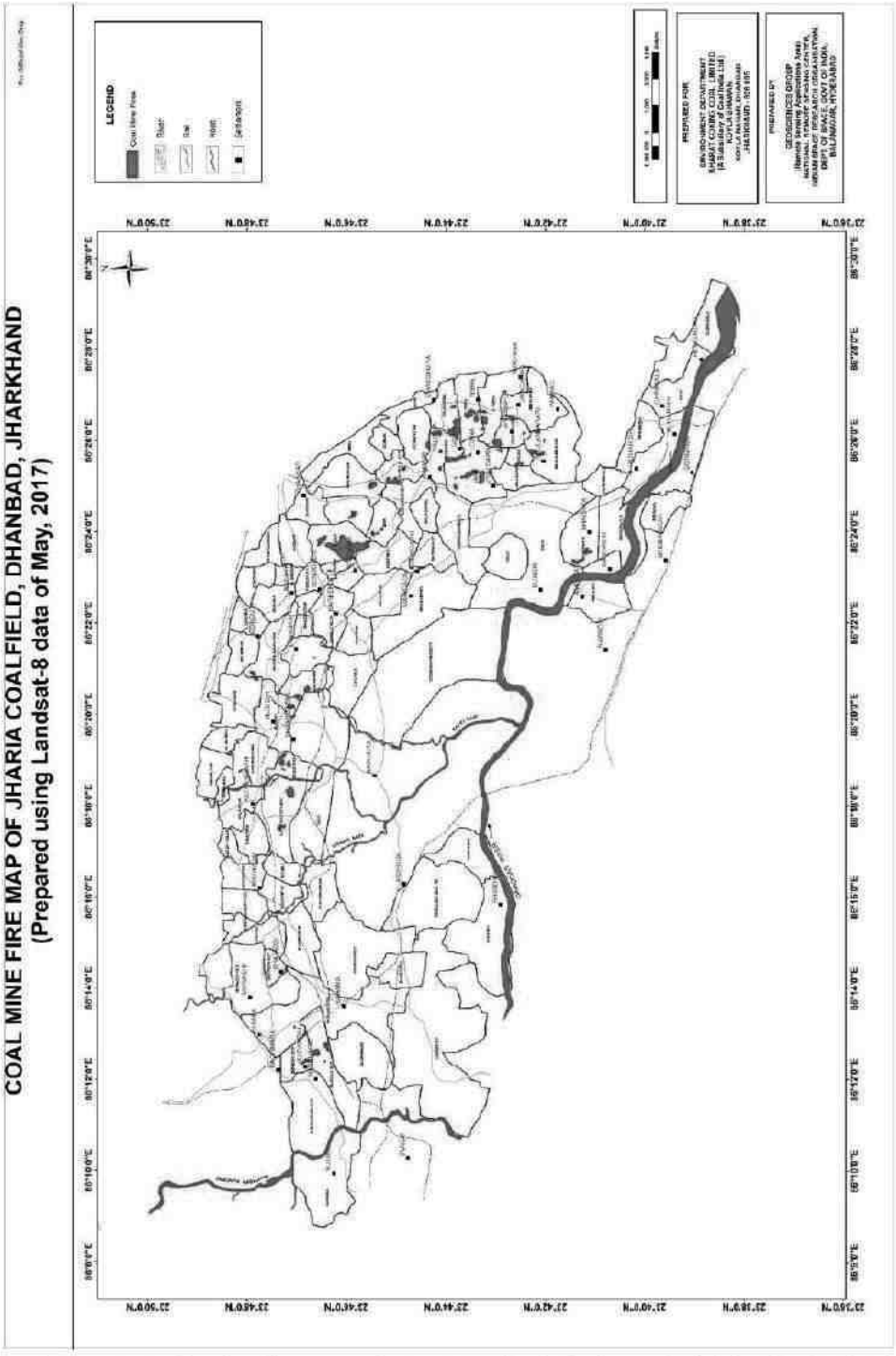


Figure 5: Coal mine fire map (May, 2017) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 13.

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).

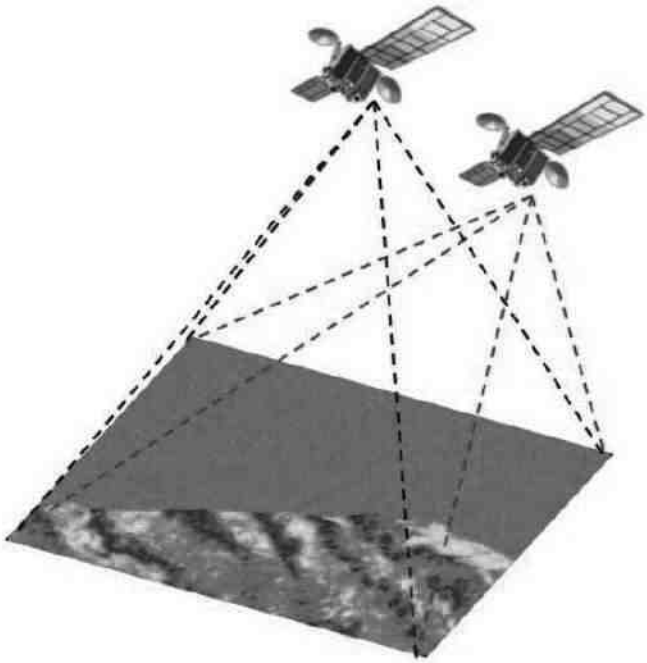


Figure 6. DInSAR acquisition scheme.

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.

$$\Delta\Phi dif = \Phi ErrorTopo + \Phi Mov + \Phi Atm + \Phi Noise \qquad (ii)$$

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 improvements 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 (Ferretti et al 2001; Hooper et al 2004; Kampes, 2006; Lanari et al 2004; Mora et al 2003;Werner et al 2003).

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

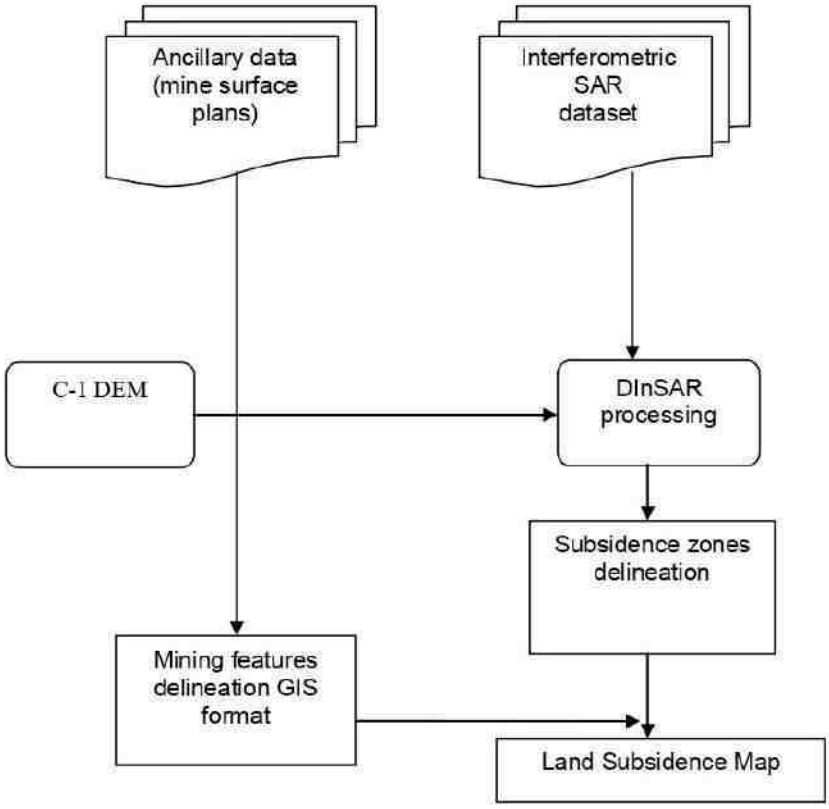


Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

In the present study, 5 sets of ALOS-PALSAR L-band microwave data (as mentioned in table 1) were procured. The datasets were paired into master-slave pairs as per short and long temporal baselines. The short temporal baseslines include master slave pairs of time difference of six months or less, whereas long temporal baselines include data pairs of time difference of one year or more. This has been illustrated in figure 8.

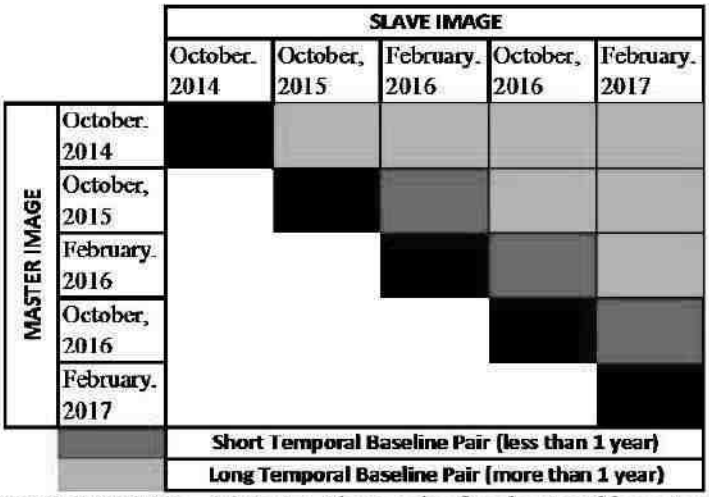


Figure 8. ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal base line processing

The interferometric fringes generating from short baseline pairs will generally indicate terrain changes due to mining activity happening over a short period of time. This will include mining excavations and creation of new OB dumps adjacent to the mining area. Any incidences of slow land subsidence will not be demarcated in the results (figure 9).

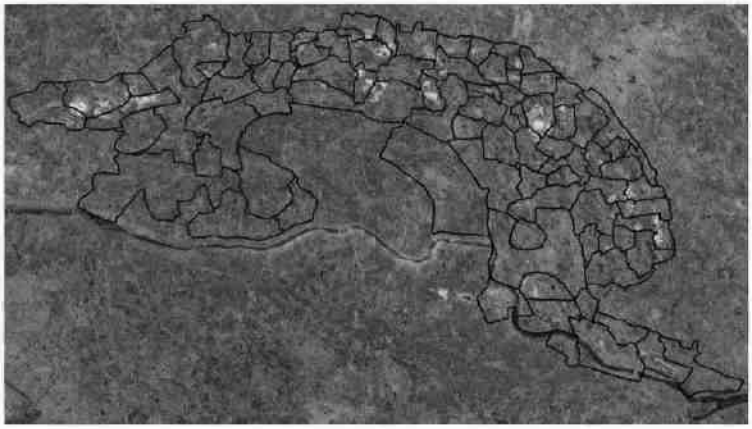


Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 16, Slave: Feb, 17).

On the other hand, master-slave pairs of long temporal baseline (one year or more, as shown in figure 8) will incorporate terrain changes due to mining activities as well, as long term ground subsidence from underground mining where ever present (figure 10).

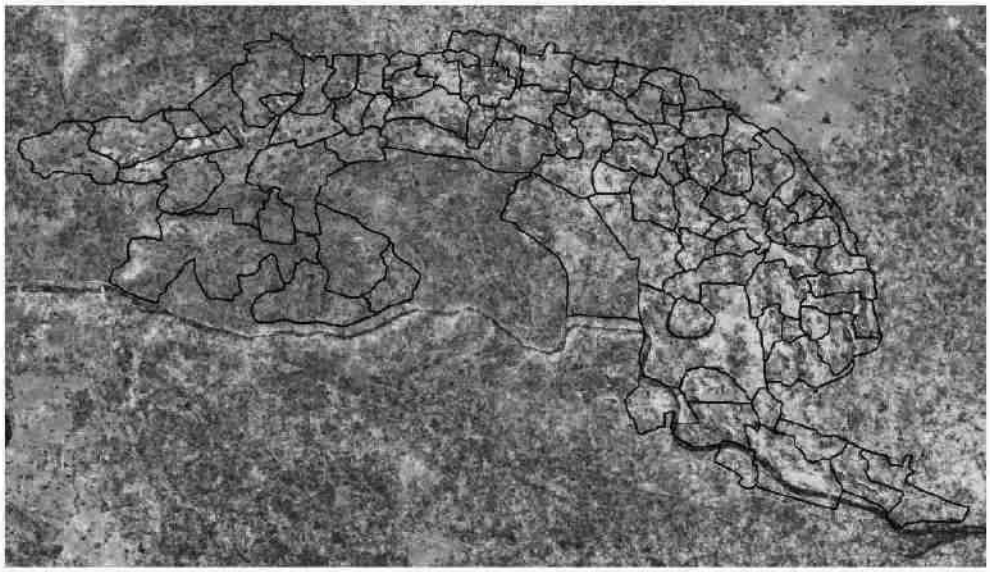


Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Oct, 15, Slave: Feb, 17).

The results from the long and short 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 due to underground mining. Using this, a terrain change

map of the Jharia Coalfield was generated demarcating terrain changes due to mining activities and subsidence areas (Figure 11).

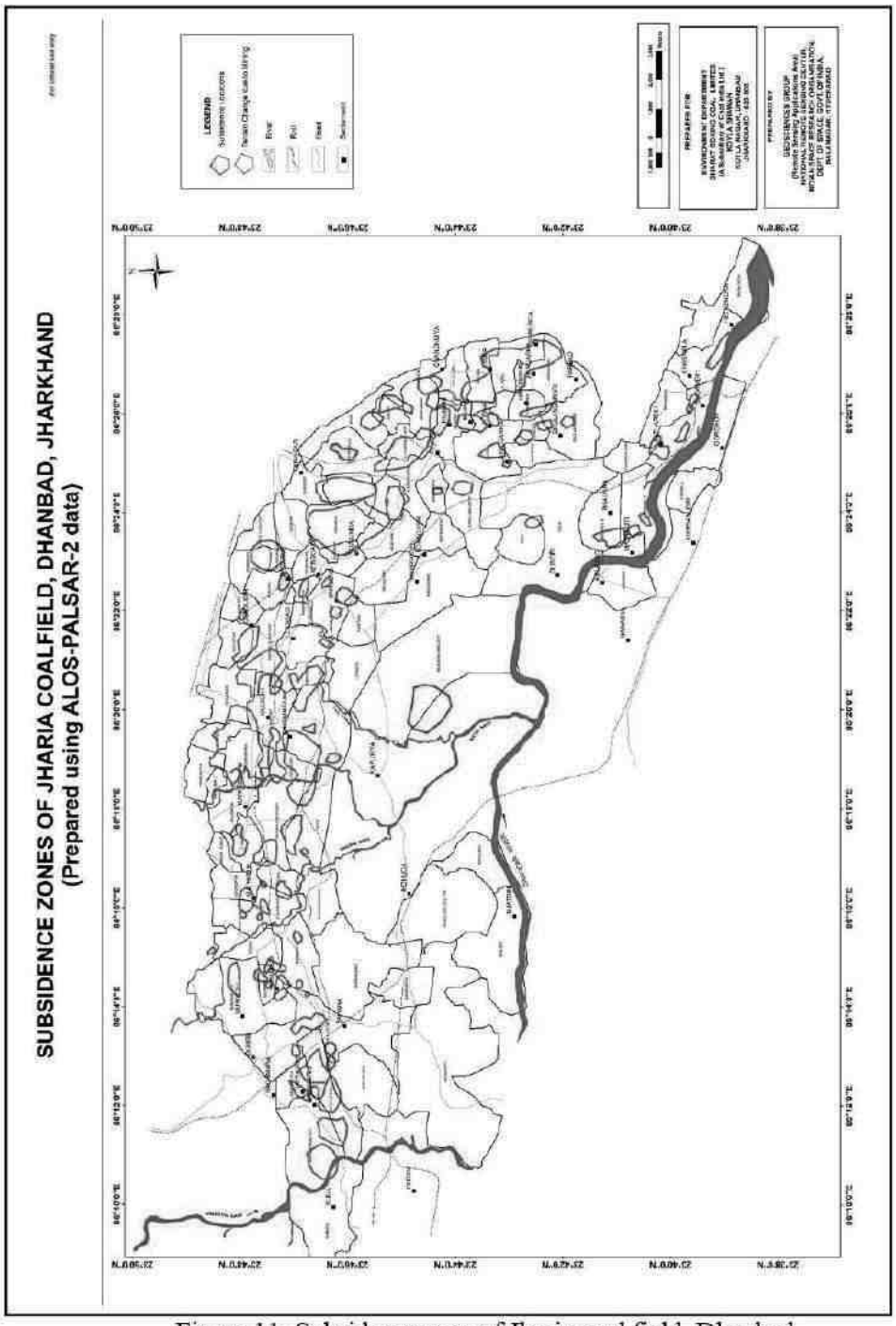


Figure 11: Subsidence map of Jharia coal field, Dhanbad.

CHAPTER V

FIELD WORK

A field work for verification of the coal fire locations and the subsidence zones as identified by the satellite data were taken up in December, 2017. A total of 53 coal fire points and 37 land subsidence locations were identified from the satellite data analysis. The locations of these points along with geographic coordinates were given to BCCL prior to the December, 2017 field work for their feedback on the status of these points. Out of the 53 coal fire locations identified, 52 points were confirmed to be fire bearing as per the present masterplan of the Jharia coalfield created by BCCL Both the coal fire and the subsidence locations were further independently verified by NRSC during the fieldwork in December, 2017. The locations and the observations are coal fire and subsidence are provided in annexure 1 and annexure 2 of this report respectively.

The salient overview of the field observations are as follows:

Coal-fire observations:

1. The coal fires as observed identified by the Landsat-8 data are mostly accurately delineated. Fires have been identified in the western, northern and eastern flank of the coalfield with considerable accuracy in the spatial locations.
2. In the eastern flank, the main fire affected mines are Kusunda, Lodna and Tisra. Active fires area present in the mines and fumes can be seen from the OB dumps. The Bhowra and Bhulanbarari mines also show presence of fire, however, the extent of the fire area appears to be underestimated in the data. Similarly, the extent of fires in Lodna and Tisra appears to have been overestimated in the data. The largest extent of fire in the single mine block is that in Kusunda.
3. In the northern flank, the main fire bearing mines are Katras, Gaslitand and Mudidih, However, it is seen that in these areas, the fires appears in pockets and are not pervasively present. The spatial extent of the fires on the ground and as estimated in the data can be correlated.

4. In the western flank, the Block II OCP is the primary fire affected region. However, it is seen that the Shatabdi OCP also bears fire pockets along semi-vertical mine walls, This is not identified in the data.

Subsidence location observations:

1. Subsidence locations as identified by the data area difficult to verify in the field, unless there are tell-tale signatures like large cracks or fissures on the ground or damage to anthropogenic constructions like vertical cracks on building cracks etc.
2. Out of the 37 identified subsidence locations from the microwave data, it is seen that 32 are due to terrain changes resulting from mining activities like ongoing excavations or formation of new mining dump. These decrease or increase in elevations has resulted in forming of interferometric fringes in the data thus creating false positives.
3. Five areas were firmly established as subsidence zones. Out of these, the main area where subsidence is occurring in a pervasive scale, is that in the Moonidih Underground Project. The Moonidih Project is an underground long wall mine where excavations are going on for over decades. This may have resulted in pervasive subsidence in the region. The signatures of subsidence such as ground cracks are observed in the area.
4. Two adjacent locations are observed south of the Block II OCP and in Phularitand mining block. This may be resulted due to older underground mining in the area. Signatures such as sagging of ground is seen.
5. Another minor subsidence region was identified around the Simlabahal underground mining project. This is again due to active underground mining in the area. A similar region was also observed in the northern part of the Bastacolla mines where active underground mining is ongoing.

In lieu of the observations in field on the fire and subsidence locations, few post field work correction in the coal fire and subsidence maps was necessitated and has been discussed in the next chapter.

CHAPTER VI

POST FIELDWORK ANALYSIS

As observed in the fieldwork, there were certain mine areas where the presence of fire was not detected by the satellite data. For example in Shatabdi and Bhulanbarari mine areas, the fire appears in small pockets on mine faces and was possibly not detected by the threshold temperature calculated for the entire mine area. On the other hand, in the Bhowra, Lodna and Tisra mine areas, the spatial extent of fire appears to have been overestimated by the regional threshold temperature use to separate the fire and the background areas.

Therefore, mine specific threshold temperature analysis was carried out for Shatabdi, Bhulanbarari, Bhowra, Lodna and Tisra mine areas to correctly depict the fire areas on the ground. The threshold temperature selected from each of these mine areas are given in Table 3.

Table 3: Threshold temperature for fire area estimation of individual mines.

Name of the Mine Block	Threshold Temperature (in °C)
Bhowra	38.5
Tisra (north and south)	North : 41; South : 40.5
Lodna	41
Bhulanbarari	38.5
Shatabdi	38

Using the threshold temperatures as mentioned in the table 3, the previously undetected fire areas in the Shatabdi and Bhulanbarari mines were detected. Further the spatial extent of the fire areas in Bhowra, Lodna and Tisra mines were changed to adequately represent the actual extent of the fire on the ground. These were incorporated in the coalfire map shown in figure 5.

CHAPTER VII

DISCUSSIONS AND CONCLUSIONS

7.1 Discussions

7.1.1 Coal fire analysis

The present study is aimed to provide the status of coal fire in the Jharia coal field for the period of 2017. Landsat-8 data of May, 2012 was used to prepare the coal mine fire map (Figure 5) for the year 2017. The data have 100 m spatial resolution in the thermal bands and is as on study date, the best thermal satellite data available. The Coal fire maps of 2017 when compared to map of 2012 (NRSC, 2014) depicts the dynamics of coal fire. Coal fire is difficult to mitigate because of its dynamic nature. But the understanding the trend in the shift of coal fire zones and over all distribution of coal fire will help in environmental and risk management related to coal mining activities.

The coal mine fire map for the year 2017 (Figure 5 illustrates the overall fire distribution in the area). The maps reveal that the coal fires are distributed across the Jharia coal field in pockets associated with major open cast mining activities. All most all the coal mine fires are restricted to the Barakar Formation where coal seams are exposed. In the eastern flank of the arcuate shaped mining extent, the collieries in Lodna and Tisra (North and South) is the highest fire affected mining blocks and Bhowra, Bhulanbarari, Kujama and Jharia are also affected by multiple smaller fire pockets. The fire in the areas is mostly manifested by high temperature fume cracks with occasional presence of active flames especially the the Lodna-Tisra area. Further, towards the north east, in Ena and Kusunda active fires are more prevalent and the area is extensively affected. The highest radiant temperatures (in order of ~50°C) are recorded by the satellite sensors in these areas. In the north, a large number of moderate to small fire pockets are seen in the areas around Shyambazar (Figure 5 & 6). These are related to the mining areas of Katras, Gaslitand, Mudidih and Kankanee. Mining activity, over the last few of years has exposed new, isolated and discontinuous fires in these regions.

In the western flank, three distinguishable fire affected zones are seen. Toward the western end of the mining area, the Benedih and Block II OCP are affected by smaller fires from isolated coal seams. These again are surfacialy manifested in the

form of fume cracks with smoke emanating from them. The Shatabdi OCP are also affected but fire is manifested in the along vertical mining wall sections.

Comparison of the 2017 coal fire map with that of 2012 (NRSC, 2014) indicated the dynamism in the spatial extent and distribution of the coal fires. The changes are highlighted as follows:

i. In reference to the map generated in 2012, the 2017 map shows that the emergence/re-emergence of fires in the eastern flank, namely Kujama, Tisra, Lodna and Jharia etc. The entire zone has been affected by multiple fire occurrences. The spatial disposition of fires in Bastacolla, Jharia and Bhulanbarari appear to have a minor increase.
ii. The areal extent of major fire zone around Kusunda/Kenduadih and Ena appears to remain the same, though here again the spatial location of the anomalies has changed. This is probably due to the mitigation and active mining in this region.
iii. The fire zones in Benedih/Block II OCP and Shatabdi OCP have also changed/diminished in areal extent with presence of isolated smaller anomalies. There has been a considerable reduction in fire areas in and around the Shatabdi OCP.
iv. The spatial disposition of fire areas around Katras, Gaslitand and Mudidih show minor change. In 2012, a number of small fire pockets were seen, however presently those fire pockets have given away to a few fire zones of moderate disposition.
v. It needs to be noted that the 2012 study was carried out using ASTER data whereas the present study is carried out using Landsat-8 data. Therefore, the difference of sensor sensitivities will have a influence on the way the fires are sensed on the ground. Difference of sensor sensitivities will influence the number of fires identified as well as the areal extent of the fires in the data.

In summary, there is a change in the areal disposition of the fires from 2012 to 2017. Observations suggest the emergence/re-emergence of new areas in the eastern flanks in areas around Lodna and Tisra. Concurrently, there is a decrease in extent of fire areas Shatabdi, Nadkhurkee area in the western flank from 2012 to 2017. A quantitative comparison of the 2012 and 2017 data was carried out. As compared

2012, when the total fire affected extent of about 2.18 km^2; in 2017 total fire affected extent is about 3.28 km^2. The colliery wise break-up of change in fire area from 2012 to 2017 is given in Annexure III.

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 differential interferometric technique. 5 scenes of PALSAR-2 data spanning over a period of 2014 to 2017 were used to delineate the subsidence if any in the region and separately identify them from the terrain changes due to mining. Verification of 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 identification is 5 prominent subsidence areas. Of these, the major area where considerable ground subsidence is occurring is the Moonidih UG project. Long term underground mining has resulted in continuous subsidence in the area. Apart from this, the other four areas are south of Block II OCP, Simlabahal and Bastacolla. No quantitative estimates of the subsidence has been carried out in the study.

7.2 Conclusions

The following conclusions can be made:

1. As of the date of study in the year 2017 and in comparison with the previous study done in 2012, there has been a change in areal extent and disposition of the fire affected areas.
2. Compared to 2012, the eastern flanks (Lodna, Tisra areas) show considerable increase in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The major new fire areas are observed in the northern flank in the areas around Lodna and Tisra etc. These areas were not mapped as fire in the 2012 study.
4. The mines in Kenduadih and Lodna remain to be the worst affected with maximum presence of active fires.
5. There is a increase in areal extent of the fire (Figure 12) from 2012 to 2017.

Note: *Estimations of fire extent (in terms of sq.km.) both in 2012 and in the present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.*

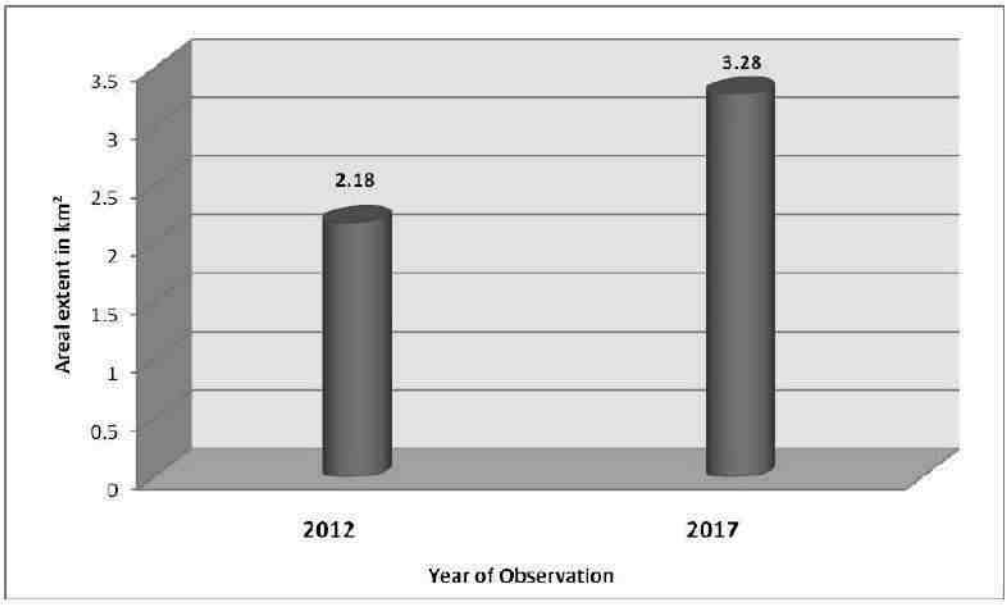


Figure 12: Total fire area statistics

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 (resampled from spatial resolution of 100m) 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 (see cover page). 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 4.2.1, 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 is 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.

5) Generally, a constant threshold temperature is estimated over the entire study area, and the same is applied to delineate the fire areas from those of non-fire. However, it is seen that the application of such global thresholding may mask fires which are in turn seen in the field and that the threshold temperature value may vary locally. In the current scenario, it is seen that the fire locations as verified in the fieldwork at Bhulanbarari and Shatabdi were not identified in the data on application of a global threshold of 39°C. However, a subset of the data within the Bulanbarari area only, is analyzed with a lower threshold of 38.5°C, the fire pixels are manifested in the data. Hence, the appropriateness of a singular thresholding temperature value may need to be relooked upon. Future studies can be carried out using colliery wise statistical local thresholding to create a composite coal fire map.

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) 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 needs 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.

References

1. Gangopadhyay, P.K., Lahiri-dutt, K., Saha, K. (2005): "Application of remote Sensing to identify coal fires in the Raniganj coal belt, India." *Int. Jour of Applied Earth Observation and Geoinformation.*
2. Gangopadhyay, P.K., Malthuis.B, Van Dink (2005): "Aster Derived emissivity and coal-fire related surface temperature anomaly a case study in Wuda, North China," *Int. Jour. of Remote Sensing*, vol-26, No.-24, pp-5555-5571.
3. Schmugge, T., French, Ritchie, J.C., Rango, A., Pelgrum, H. (2002): "Temperature and emissivity separation from multispectral thermal infrared observation," *Remote Sensing of Environment*, 79, pp-189-198.
4. Saraf A.K., Prakash A., Sengupta, S., Gupta, R.P (1995): "Landsat-TM data for estimating ground temperature and depth of sub-surface coal fire in the Jharia coalfiled, India," *Int. Jour. Remote sensing vol-16, no-12*, 2111-2124.
5. Gangopadhyay P.K., (2003): "Coalfire detection and monitoring in Wuda, North China, A multispectral and multi-sensor approach:-Ph.D. Thesis, ITC Netherland.
6. Gupta, R.P. (2003): "Remote Sensing Geology", *Springer-Verlag.Third ed.*pp-183-216.
7. Kealey, P.S and Hook S.J(1993): "Separating temperature and emissivity in thermal infrared Multispectral Scanner Data: Implication for recovering land surface temperatures", *IEE Transaction on Geoscience and Remote Sensing,vol,31,no-6*,pp-1155-1164
8. Zhang, J., Wagner, W., Prakash, A., Mehl,H. and Voigt,S.(2004): "Detecting coal fires using remote sensing techniques," *Int. Jour. Remote sensing, vol-25, no-6,* pp3193-3220.
9. Bhattacharya, A. and Reddy, C.S.S. (1995): Inventory and monitoring of underground and surface coal mine fire in Jharia coalfield, Bihar using thematic mapper thermal IR data: *Geosciences Group, Official report, NRSA.*
10. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geology and Geophysics division. *Official report, NRSA, 2006*
11. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geosciences Group. *Official report, NRSC, 2014*

Annexure –I

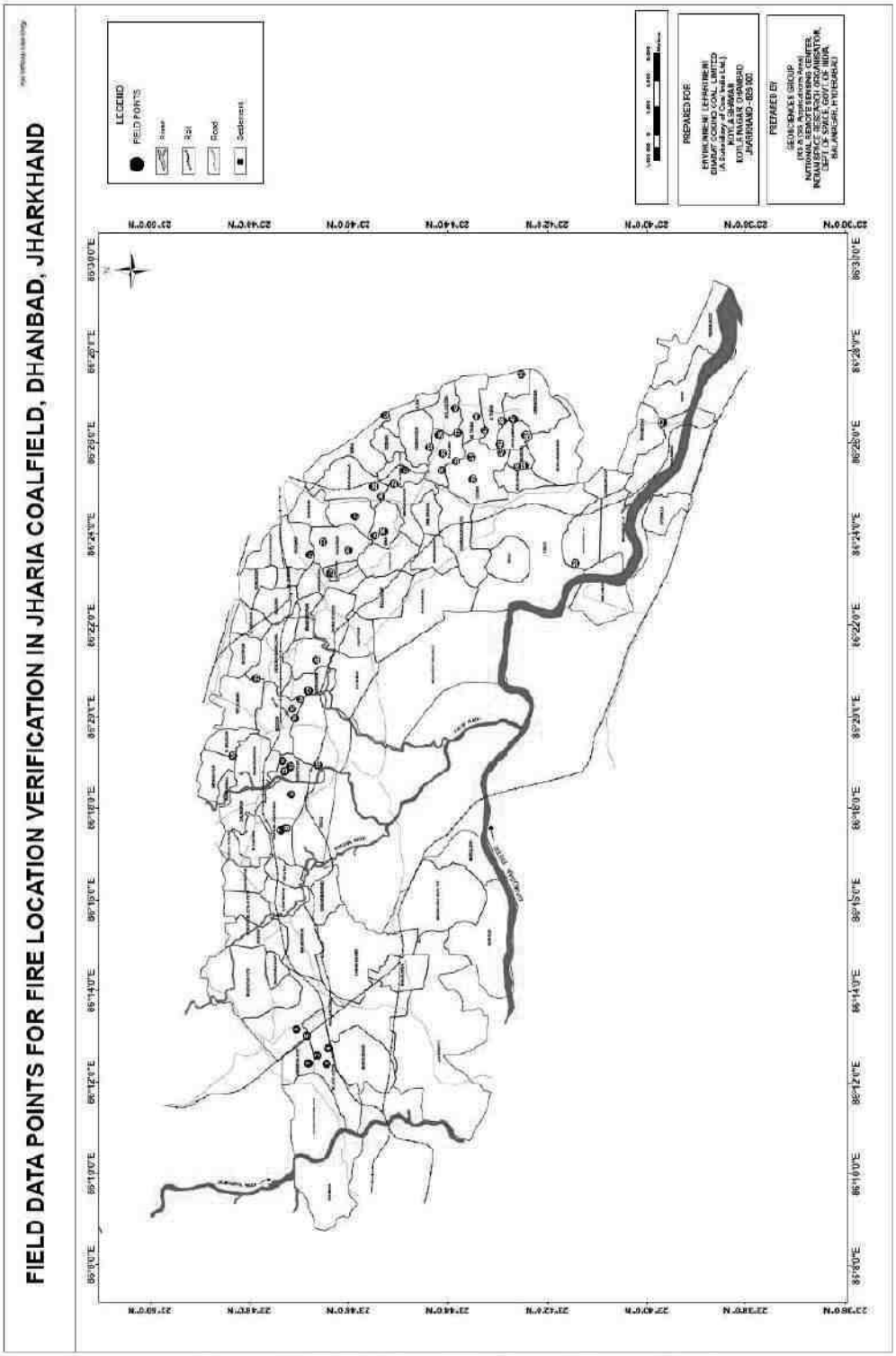


Figure 13. Field data points for coal fire verification

Table – 4: Coal Fire observations during fieldwork (see figure 13 for reference)

SL. No.	Point of Observations		Comments		
	Latitude	Longitude	Type of Mining Activity	Presence of Coal Fire	Mine name and Any other Comments
1	23.7801	86.2068	OB Dump	Fire	ABOCP
2	23.7771	86.2097	Active Mine	Fire	ABOCP
3	23.7739	86.2066	Active Mine	Fire	ABOCP
4	23.7733	86.2124	OB Dump	Fire	ABOCP
5	23.7806	86.2168	No Working	Fire	ABOCP
6	23.7841	86.2192	No Working	Fire	Phularitand
7	23.7893	86.2919	No Working	Fire	Katras Chatudih
8	23.7875	86.2926	No Working	Fire	Katras Chatudih
9	23.7857	86.3049	Working	Fire	Gaslitand
10	23.7768	86.3157	Outside Jharia Mines		Tata
11	23.7887	86.3170	OB Dump	Fire	Gaslitand
12	23.7862	86.3151	OB Dump	Fire	Gaslitand
13	23.7880	86.3133	OB Dump	Fire	Gaslitand
14	23.8054	86.3191	Working	Fire	AKWMC
15	23.7855	86.3363	OB Dump	Fire	Mudidh
16	23.7826	86.3397	Working	Fire	Kankanee
17	23.7800	86.3427	Working	Fire	Kankanee
18	23.7848	86.3327	OB Dump	Fire	Mudidih
19	23.7977	86.3473	OB Dump	Fire	Sendra Bansjora
20	23.7775	86.3540	OB Dump	Fire	Loyabad
21	23.7793	86.3924	No Working	No fire	Kusunda (Domestic coal burning)
22	23.7753	86.3970	Working	Fire	Kusunda
23	23.7724	86.3858	Working	Fire	Kusunda
24	23.7669	86.3940	OB Dump	Fire	Kusunda
25	23.7578	86.3993	OB Dump	Fire	Ena
26	23.7550	86.4009	OB Dump	Fire	Ena
27	23.7645	86.4065	Working	Fire	ADIC
28	23.7580	86.4172	Old Quarry	Fire	ROCP
29	23.7515	86.4184	OB Dump	Fire	ROCP
30	23.7559	86.4137	OB Dump	Fire	ROCP
31	23.7476	86.4232	Working	Fire	ROCP
32	23.7543	86.4431	Outside Jharia Mines		Unknown site (Out side of Kuya)
33	23.7394	86.4317	Active Mine	Fire	Ghanoodih
34	23.7360	86.4362	OB dump	Fire	Goluckdih
35	23.7349	86.4293	OB Dump	Fire	Kujama
36	23.7354	86.4232	No Working	Fire	Kujama
37	23.7301	86.4369	Working	Fire	NT-ST
38	23.7305	86.4265	OB dump	Fire	Kujama
39	23.7249	86.4200	No Working	Fire	Lodna
40	23.7159	86.4327	Working	Fire	Joyrampur
41	23.7254	86.4280	No Working	No fire	Lodna
42	23.7209	86.4376	Working	Fire	NT-ST
43	23.7154	86.4296	Working	Fire	Lodna
44	23.7238	86.4427	Working	Fire	NT-ST
45	23.7309	86.4457	OB dump	Fire	NT-ST
46	23.7151	86.4412	Active Mine	Yes	NT-ST
47	23.7114	86.4419	OB Dump	Fire	NT-ST
48	23.7073	86.4360	Active Mine	Fire	Joyrampur
49	23.7097	86.4243	Working	Fire	Bagdigi/Joyrampur
50	23.7079	86.4249	Active Mine	Fire	Bagdigi/Joyrampur
51	23.7086	86.4582	Outside Jharia Mines		Unknown site (Out side of NT-ST)
52	23.6614	86.4404	Outside Jharia Mines		Chasnala
53	23.6906	86.3892	OB dump	Fire	Bhowrah (North)

Annexure –II

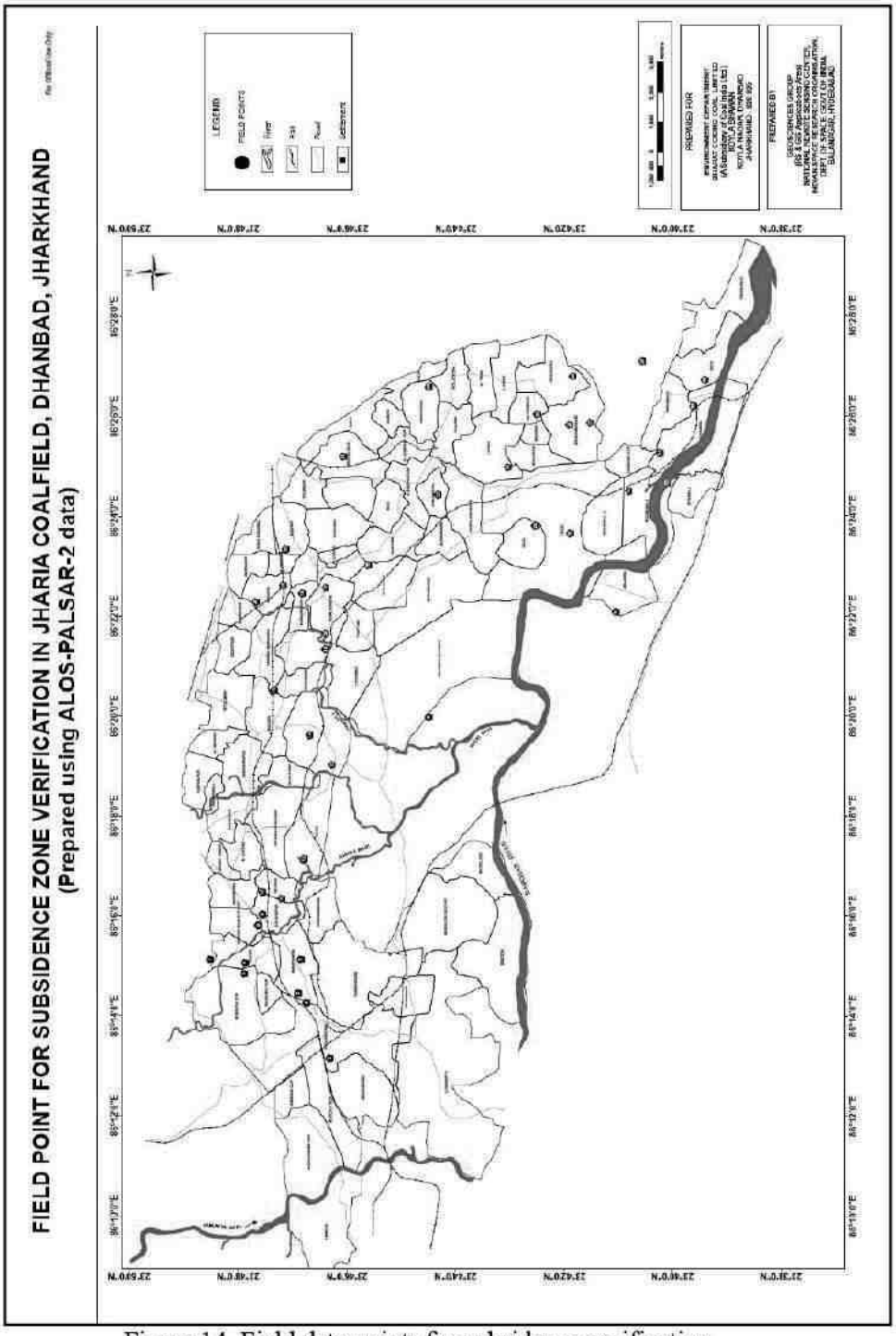


Figure 14. Field data points for subsidence verification

Table – 5: Coal Fire observations during fieldwork (see figure 14 for reference)

	Point of Observations		Comments	
Sr. no.	Latitude	Longitude	Mine name and Any other Comments	Signs of Subsidence (crack on building/ground crack etc.)
0	23.7416	86.3338	Moonidih UG Project	Sagged area, Building damage
1	23.7722	86.2192	South of Block II (2 areas)	Cracks on the ground
2	23.7817	86.2409	Terrain Change due to mining	
3	23.7811	86.2521	Terrain Change due to mining	
4	23.7792	86.2376	Terrain Change due to mining	
5	23.7983	86.2473	Terrain Change due to mining	
6	23.7981	86.2510	Terrain Change due to mining	
7	23.8088	86.2521	Terrain Change due to mining	
8	23.7941	86.2636	Terrain Change due to mining	
9	23.7926	86.2671	Terrain Change due to mining	
10	23.7868	86.2724	Terrain Change due to mining	
11	23.7928	86.2746	Terrain Change due to mining	
12	23.7800	86.2857	Terrain Change due to mining	
13	23.7713	86.3171	Terrain Change due to mining	
14	23.7783	86.3270	Terrain Change due to mining	
15	23.7893	86.3419	Terrain Change due to mining	
16	23.7734	86.3556	Terrain Change due to mining	
17	23.7734	86.3762	Terrain Change due to mining	
18	23.7804	86.3742	Terrain Change due to mining	
19	23.7865	86.3769	Terrain Change due to mining	
20	23.7855	86.3890	Terrain Change due to mining	
21	23.7679	86.4199	Bastacolla	Sagged areas
22	23.7390	86.4071	Simlabahal UG	Sagged areas
23	23.7417	86.4431	Terrain Change due to mining	
24	23.7176	86.4163	Terrain Change due to mining	
25	23.7085	86.4339	Terrain Change due to mining	
26	23.6986	86.4304	Terrain Change due to mining	
27	23.6923	86.4312	Terrain Change due to mining	
28	23.6977	86.4466	Terrain Change due to mining	
29	23.7092	86.3967	Terrain Change due to mining	
30	23.6985	86.3942	Terrain Change due to mining	
31	23.6845	86.3681	Terrain Change due to mining	
32	23.6804	86.4083	Terrain Change due to mining	
33	23.6685	86.4110	Terrain Change due to mining	
34	23.6706	86.4211	Terrain Change due to mining	
35	23.6603	86.4366	Terrain Change due to mining	
36	23.6568	86.4454	Terrain Change due to mining	
37	23.6760	86.4516	Terrain Change due to mining	
38	23.7603	86.3836	Terrain Change due to mining	
39	23.7734	86.3609	Terrain Change due to mining	
40	23.7948	86.3715	Terrain Change due to mining	

Annexure –III

SL. NO.	COLLIERY AREA NAME	FIRE AREA 2012 (SQ. KM.)	FIRE AREA 2017 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
1	DAMODA	0.0000	0.0000	0.000	NO FIRE
2	TISCO (west)	0.0000	0.0000	0.000	NO FIRE
3	IISCO	0.0000	0.0000	0.000	NO FIRE
4	TISCO (north)	0.0885	0.0153	-0.073	DECREASE
5	NUDKHURKEE OCP	0.0000	0.0000	0.000	NO FIRE
6	BENEDIH OCP	0.0530	0.0453	-0.008	DECREASE
7	BLOCK-II OCP	0.0530	0.1353	0.082	INCREASE
8	MURAIDIH OCP	0.1478	0.0022	-0.146	DECREASE
9	SHATABDI OCP	0.0378	0.0361	-0.002	DECREASE
10	TETURIA	0.0000	0.0000	0.000	NO FIRE
11	S.GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
12	KORIDIH BLOCK-IV OCP	0.0000	0.0000	0.000	NO FIRE
13	JOGIDIH	0.0000	0.0000	0.000	NO FIRE
14	DHARAMABAND	0.0000	0.0000	0.000	NO FIRE
15	MAHESHPUR	0.0000	0.0000	0.000	NO FIRE
16	PHULARITAND	0.0133	0.0205	0.007	INCREASE
17	MADHUBAND	0.0000	0.0000	0.000	NO FIRE
18	AKASH KINARI	0.0000	0.0000	0.000	NO FIRE
19	GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
20	E. KATRAS	0.0133	0.0000	-0.013	DECREASE
21	KATRAS-CHOITUDIH	0.1021	0.1368	0.035	INCREASE
22	KESHALPUR	0.0000	0.0013	0.001	INCREASE
23	RAMKANALI	0.0000	0.0000	0.000	NO FIRE
24	NICHITPUR	0.0000	0.0000	0.000	NO FIRE
25	E. BASURIA	0.0000	0.0000	0.000	NO FIRE
26	KHAS KUSUNDA	0.0000	0.0000	0.000	NO FIRE
27	GONDUDIH	0.0000	0.0000	0.000	NO FIRE
28	W. GODHAR	0.0012	0.0000	-0.001	DECREASE
29	BASURIA	0.0000	0.0000	0.000	NO FIRE
30	TETULMARI	0.0223	0.0220	0.000	DECREASE
31	DHANSAR	0.0000	0.0000	0.000	NO FIRE
32	GODHAR	0.1073	0.0000	-0.107	DECREASE
33	INDUSTRY	0.0119	0.0513	0.039	INCREASE
34	KUSUNDA	0.4243	0.7398	0.315	INCREASE
35	SENDRA-BANSJORA	0.0796	0.0275	-0.052	DECREASE
36	BASTACOLLA	0.0663	0.0810	0.015	INCREASE
37	BERA	0.0000	0.0000	0.000	NO FIRE
38	KUYA	0.0000	0.0000	0.000	NO FIRE
39	GOLUCKDIH	0.0301	0.1122	0.082	INCREASE
40	KUJAMA	0.0398	0.2404	0.201	INCREASE

41	S. JHARIA-R. OCP	0.0244	0.1118	0.087	INCREASE
42	DOBARI	0.0000	0.0000	0.000	NO FIRE
43	GONHOODIH	0.0398	0.0322	-0.008	DECREASE
44	SIMLABAHAL	0.0000	0.0000	0.000	NO FIRE
45	HURRILADIH&STD	0.0000	0.0000	0.000	NO FIRE
46	ENA	0.0918	0.0432	-0.049	DECREASE
47	BURRAGARH	0.0000	0.0000	0.000	NO FIRE
48	N. TISRA	0.0098	0.1802	0.170	INCREASE
49	LODNA	0.0000	0.3527	0.353	INCREASE
50	S. TISRA	0.0000	0.1015	0.102	INCREASE
51	BARAREE	0.1037	0.1074	0.004	INCREASE
52	AMLABAD	0.0000	0.0000	0.000	NO FIRE
53	PATHERDIH	0.0000	0.0000	0.000	NO FIRE
54	SUDAMDIH	0.0000	0.0000	0.000	NO FIRE
55	SITANALA	0.0000	0.0000	0.000	NO FIRE
56	MURULIDIH 20/21 PIT	0.0000	0.0000	0.000	NO FIRE
57	MURULIDIH	0.0000	0.0000	0.000	NO FIRE
58	BHATDIH	0.0000	0.0000	0.000	NO FIRE
59	LOHAPATTY	0.0000	0.0000	0.000	NO FIRE
60	IISCO	0.0000	0.0000	0.000	NO FIRE
61	TASRA-IISCO	0.0000	0.0000	0.000	NO FIRE
62	KENDUADIH	0.0610	0.0000	-0.061	DECREASE
63	BULLIHARY	0.0000	0.0000	0.000	NO FIRE
64	GOPALICHUCK	0.0000	0.0000	0.000	NO FIRE
65	POOTKEE	0.0000	0.0000	0.000	NO FIRE
66	BHURUNGIA	0.0000	0.0000	0.000	NO FIRE
67	KHARKHAREE	0.0000	0.0000	0.000	NO FIRE
68	GASLITAND	0.1194	0.1215	0.002	INCREASE
69	KANKANEE	0.0530	0.0525	-0.001	DECREASE
70	MUDIDIH	0.1141	0.1104	-0.004	DECREASE
71	W. MUDIDIH	0.0171	0.0000	-0.017	DECREASE
72	LOYABAD	0.0133	0.0063	-0.007	DECREASE
73	BHAGABAND	0.0000	0.0000	0.000	NO FIRE
74	MOONIDIH PROJECT	0.0000	0.0000	0.000	NO FIRE
75	E.BHUGGATDIH	0.0022	0.0214	0.019	INCREASE
76	ALKUSHA	0.0326	0.0294	-0.003	DECREASE
77	KUSTORE	0.0524	0.0463	-0.006	DECREASE
78	ANGARAPATRA	0.1331	0.0149	-0.118	DECREASE
79	SALANPUR	0.0000	0.0000	0.000	NO FIRE
80	BHOWRAH. N	0.0133	0.0980	0.085	INCREASE
81	BHOWRAH. S	0.0000	0.0000	0.000	NO FIRE
82	BAGDIGI	0.0000	0.0209	0.021	INCREASE
83	JEALGORA	0.0000	0.0067	0.007	INCREASE
84	JEENAGORA	0.0000	0.0470	0.047	NO FIRE

85	JOYRAMPUR	0.0099	0.1042	0.094	INCREASE
86	CHANDAN OCP	0.0000	0.0000	0.000	NO FIRE
87	BANSDEOPUR	0.0000	0.0000	0.000	NO FIRE
	TOTAL AREA	**2.18**	**3.28**	**1.10**	INCREASE

Table 6: Colliery wise break-up of change in fire area from 2012 to 2017

Note:
1) "**NO FIRE**" implicates that the fire has not been identified satellite data *(either absent or below sensor resolution)*
2) "**INCREASE**" implies, increase in fire area OR emergence of fire areas not identified in 2012 study.
3) "**DECREASE**" implies, decrease in fire area OR fire areas of 2012, which are not identified in present study *(either absent or below sensor resolution)*.
4) Estimations of fire extent (in terms of sq.km.) both 2012 and in present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.

Annexure –IV



Figure 15: Fume cracks in Lodna-Tisra Area. (point 39 in figure 13 and table 4)



Figure 16: Burnt area near OB dump in Lodna area (point 41 in figure 13 and table 4)



Figure 17: Coalfries in active seams in Kusunda (point 23 in figure 13 and table 4)



Figure 18: Sagged area due to subsidence, south of Block II OCP. (point 1 in figure 14 and table 5)

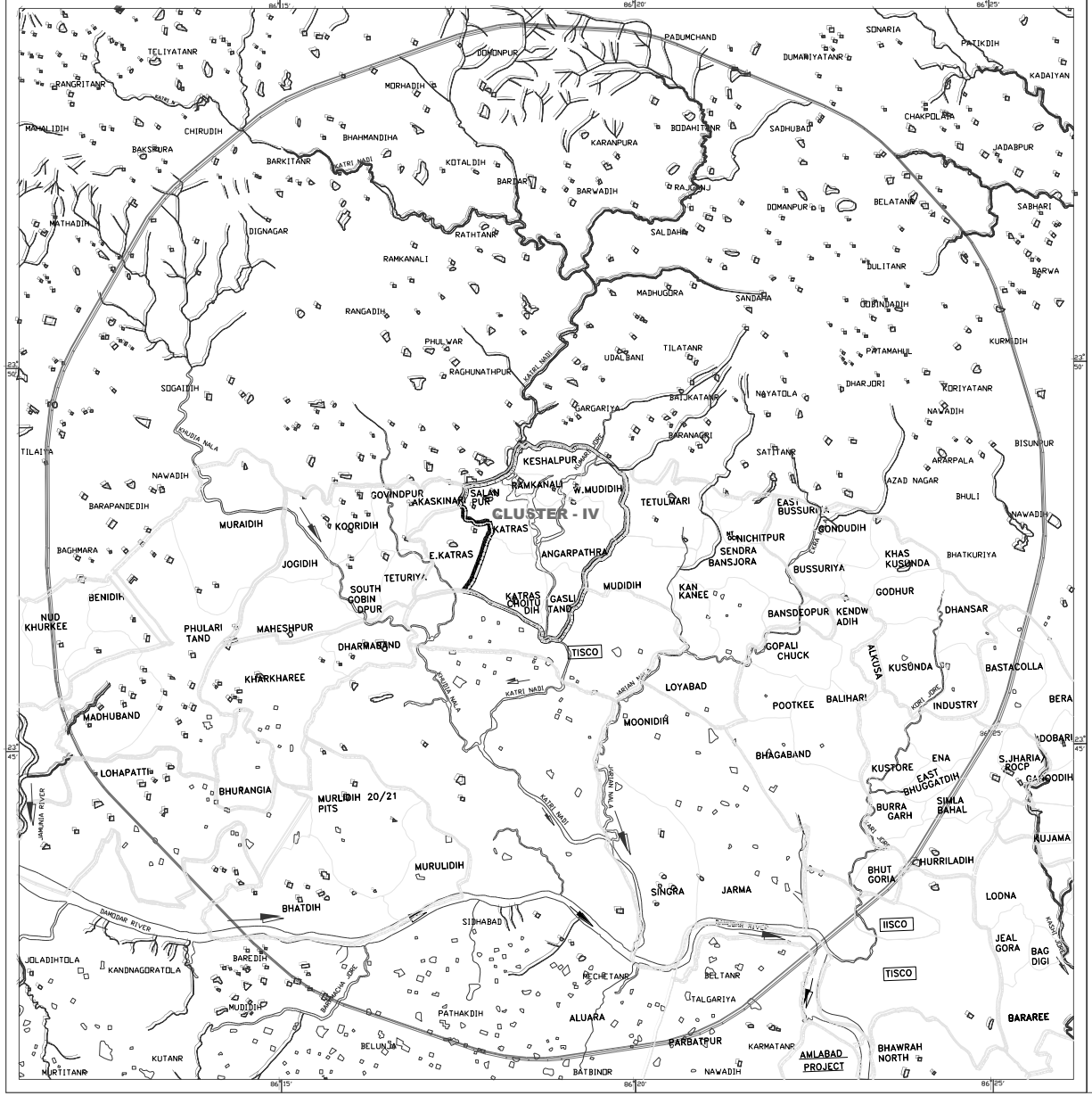


Figure 19: Fire in OB dumps in Kusunda area. (point 24 in figure 13 and table 4)



Figure 20: Fume cracks in the Bhulanbarari area.

STUDY AREA MAP OF CLUSTER - IV
SHOWING HYDROLOGICAL FEATURES



INDEX

POND

RIVER

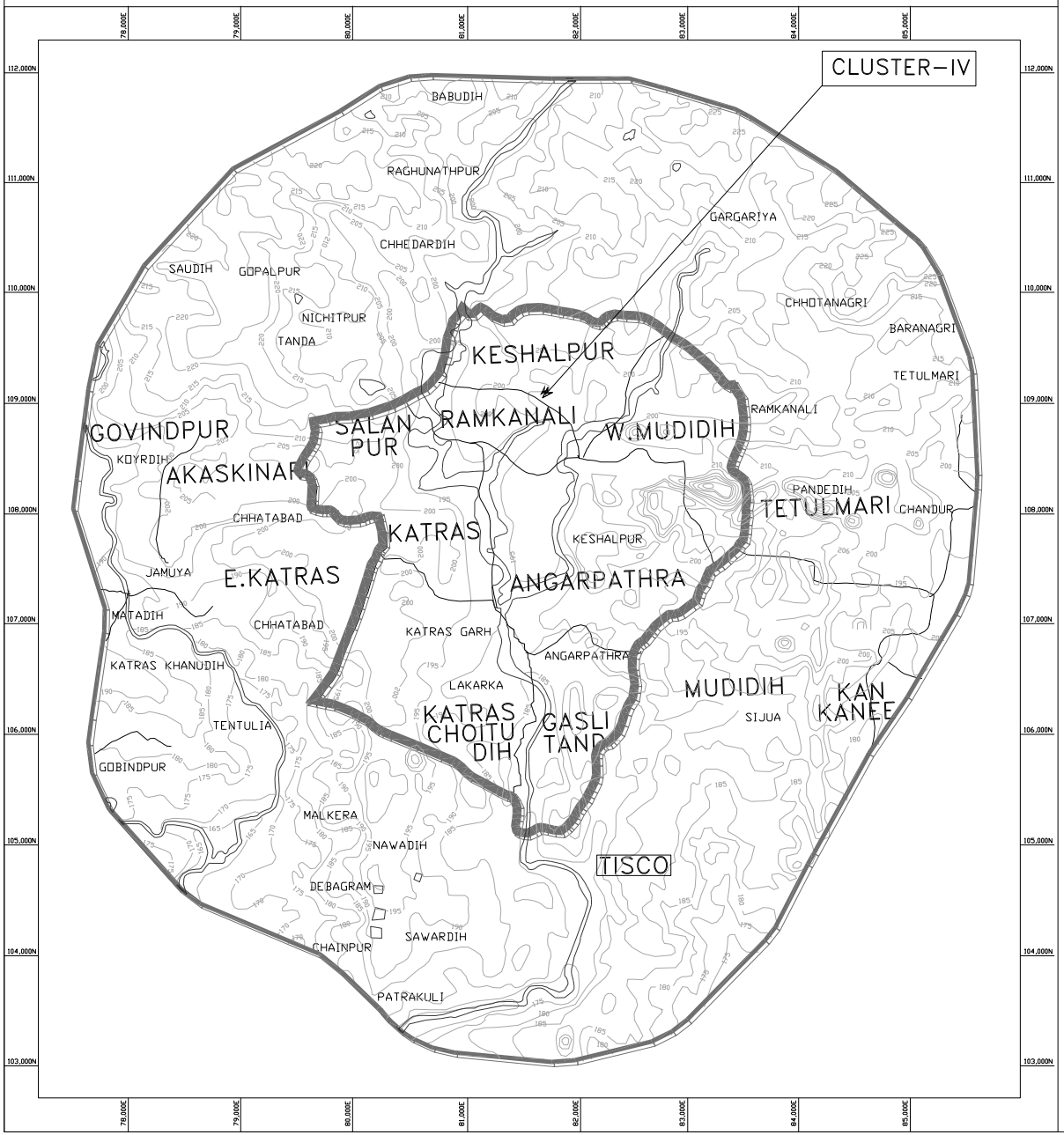
PROPOSED PROJECT (CORE ZONE)

BUFFER ZONE

PLATE NO-10

A/C NO. D\CLUSTER_IV/\HYDROLOGICAL PLAN

STUDY AREA OF CLUSTER - IV SHOWING DRAINAGE CONTOUR



INDEX

POND

RIVER

PROPOSED PROJECT (CORE ZONE)

2 KM. ZONE

CONTOUR(m)

PLATE NO -11

A/C No.:- D\CLUSTER_IV\
\CLUSTER_IV DRAINAGE CONTOUR

WATER TABLE CONTOUR MAP OF CLUSTER-IV

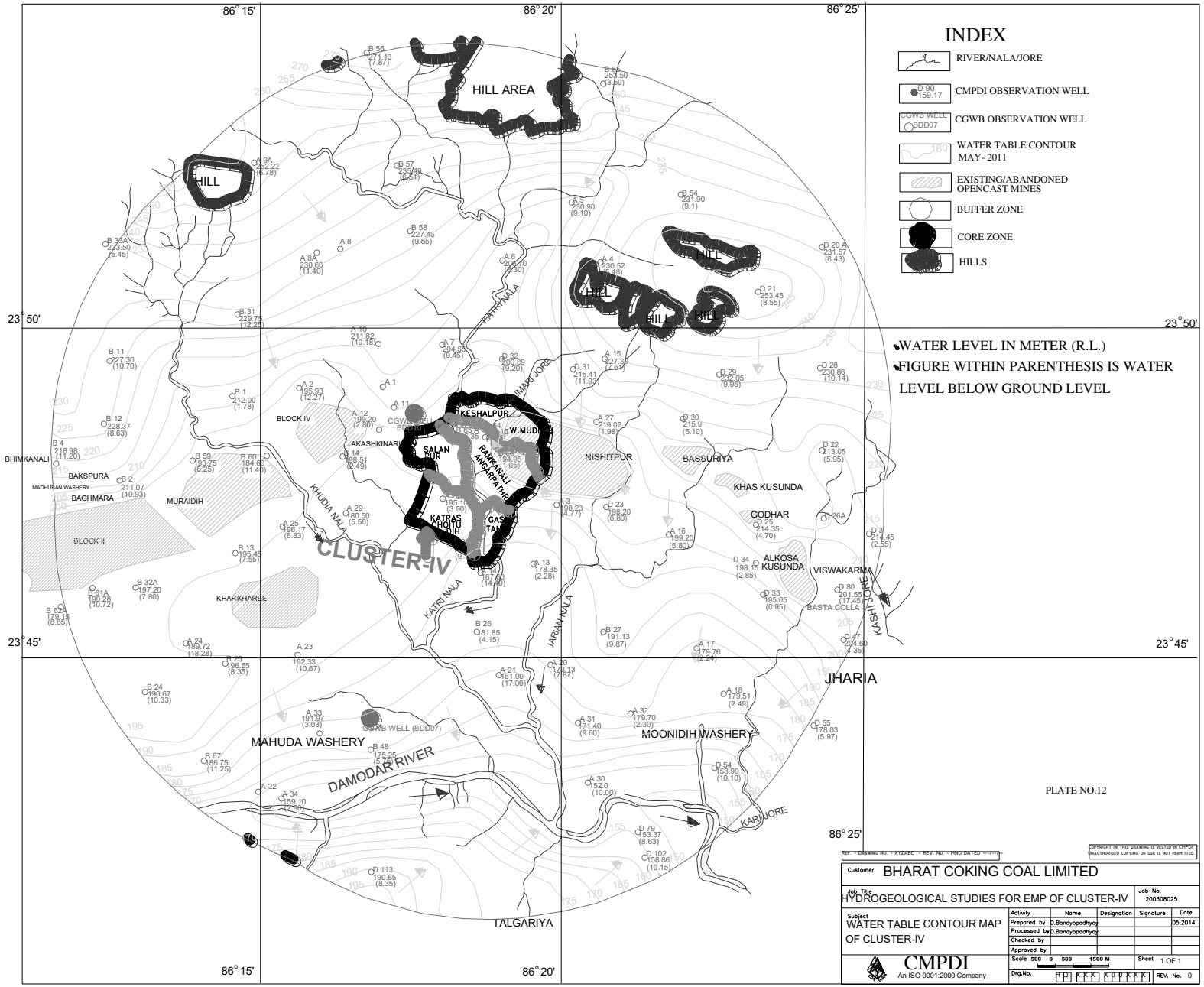


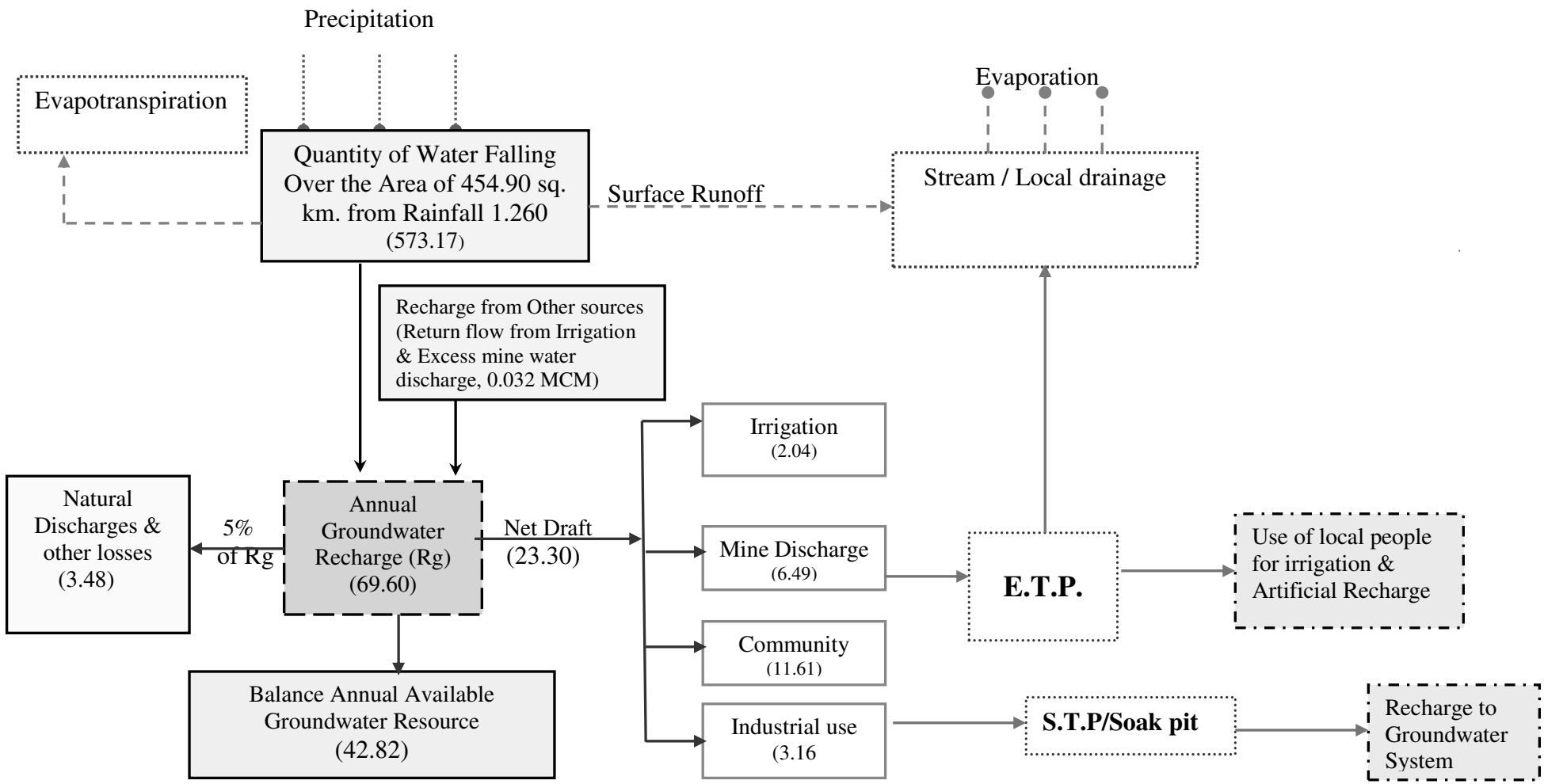
PLATE NO.12

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Customer: BHARAT COKING COAL LIMITED				
Job Title: HYDROGEOLOGICAL STUDIES FOR EMP OF CLUSTER-IV				Job No. 200308025
Subject: WATER TABLE CONTOUR MAP OF CLUSTER-IV	Activity	Name	Designation	Signature	Date
	Prepared by	D.Bandyopadhyay			05.2014
	Processed by	D.Bandyopadhyay			
	Checked by				
	Approved by				
CMPDI An ISO 9001:2000 Company	Scale 500 0 500 1000 M			Sheet	1 OF 1
	Drg.No.			REV. No.	0

GROUNDWATER BALANCE FLOW DIAGRAM, BUFFER ZONE OF CLUSTER-IV

(All Values are in M.Cu.m)



Job No - 200308025

PLATE NO: 13

CMPDI

WATER USAGE DIAGRAM OF CLUSTER-IV MINES

(All Values are in m^3 / day)

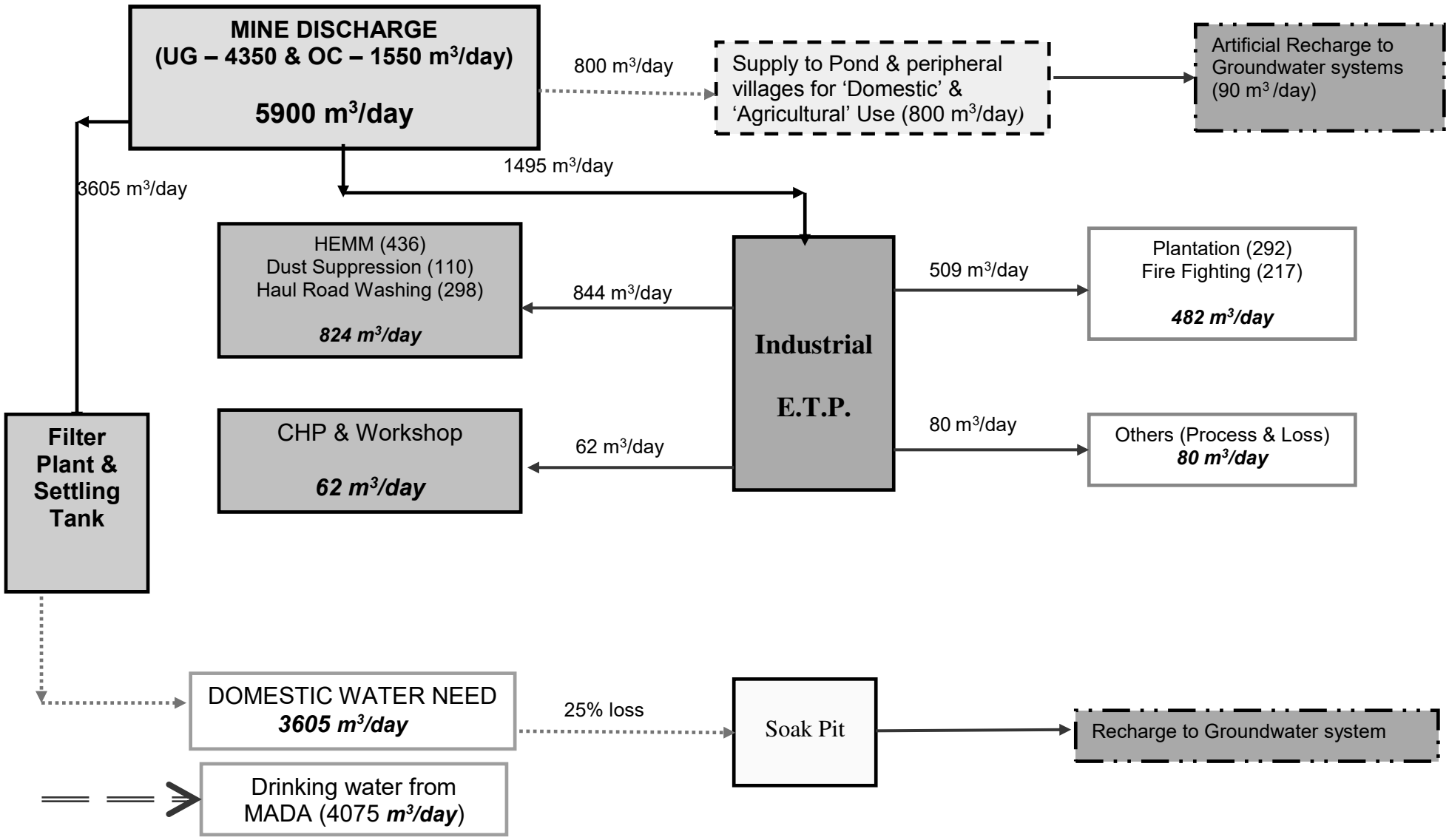


PLATE NO: 14

JOB NO - 200308025

GROUND WATER RECHARGE BALANCE - BUFFER ZONE OF Cluster IV
(Mcum &%)

Net ground water Recharge 66.12

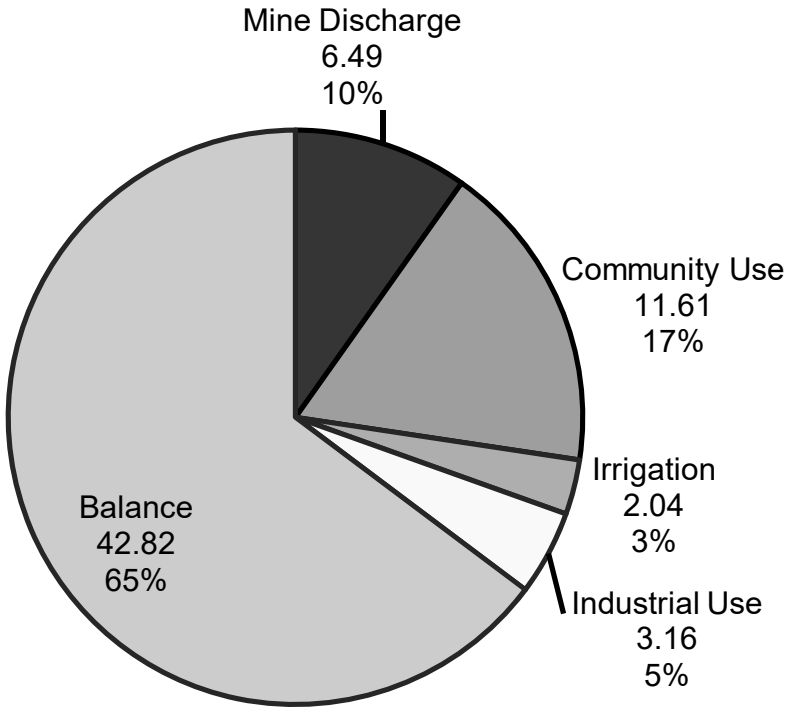
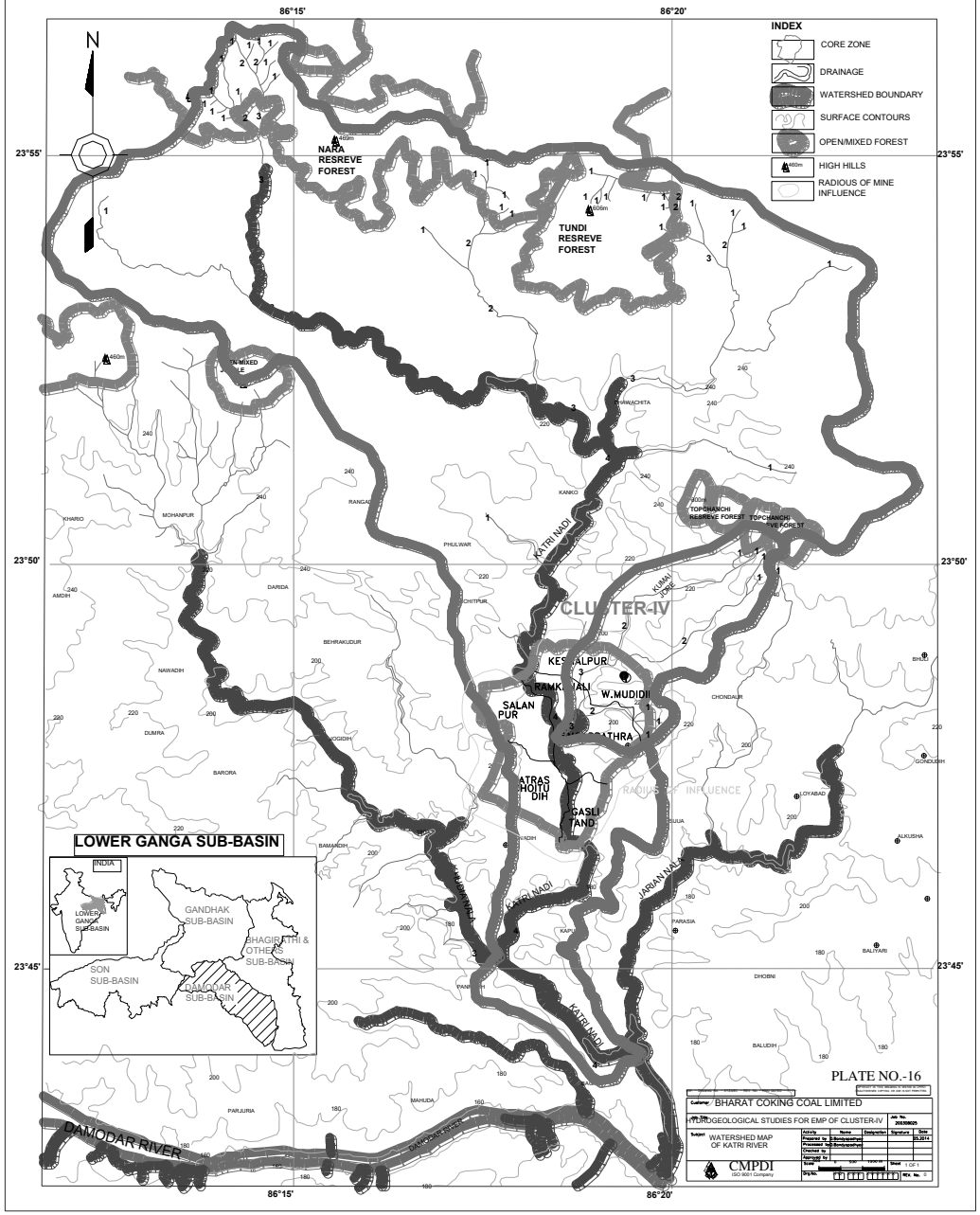


PLATE NO-15

WATERSHED MAP OF CLUSTER IV



DRAINAGE MAP OF THE CLUSTER-IV

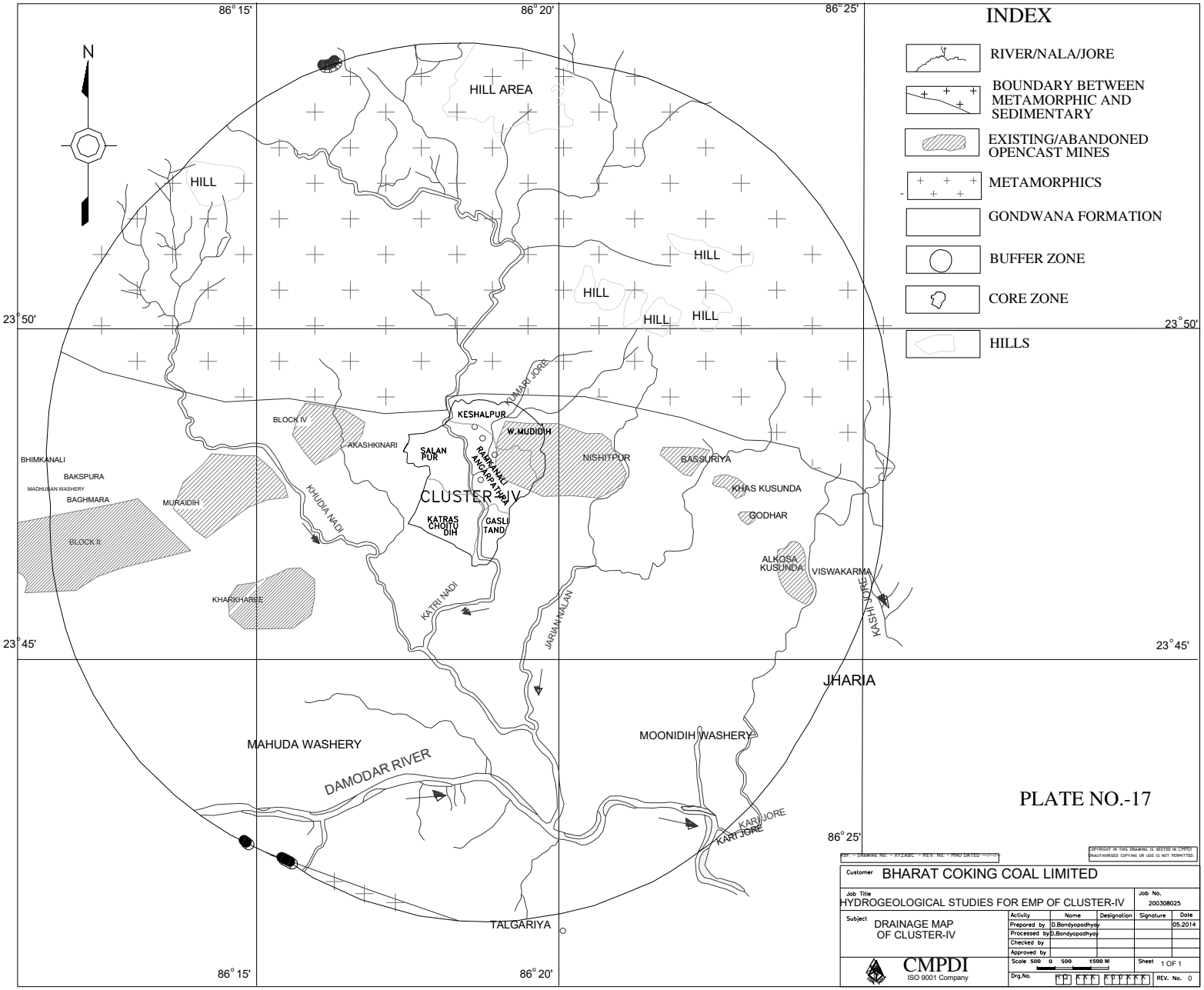


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Job Title: HYDROGEOLOGICAL STUDIES FOR EMP OF CLUSTER-IV

Job No.: 200308025

Subject: DRAINAGE MAP OF CLUSTER-IV

Activity	Name	Designation	Signature	Date
Prepared by	D.Bandyopadhyay			05.2014
Processed by	D.Bandyopadhyay			
Checked by				
Approved by				

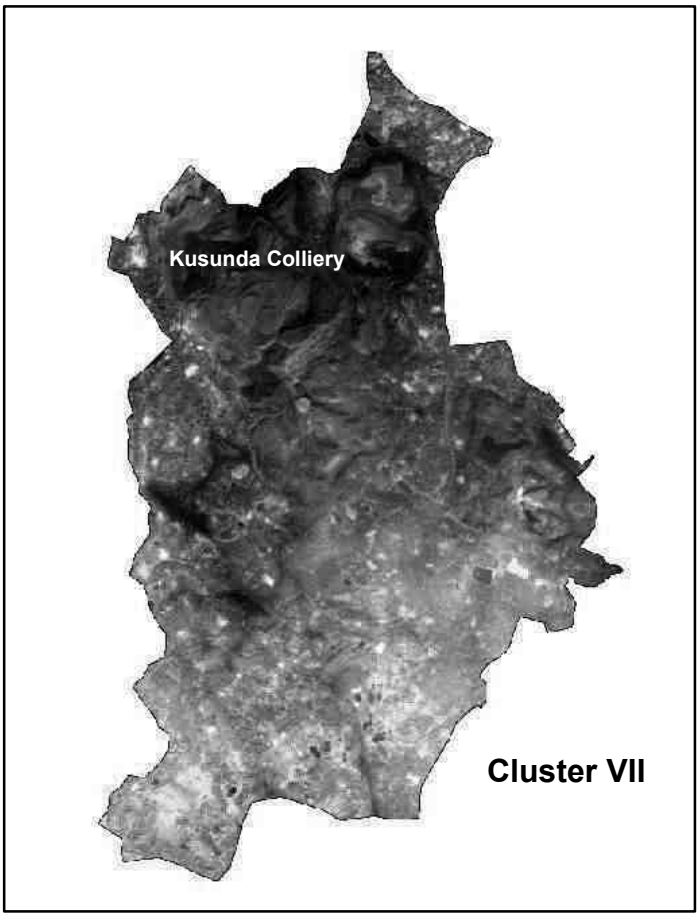
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Sheet 1 OF 1

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Land Restoration / Reclamation Monitoring of Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data for the Year 2018



Submitted to

Bharat Coking Coal Limited

cmpdi
A Mini-Ratna Company

Land Restoration / Reclamation Monitoring of Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data for the Year 2018

March-2019

Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

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Executive Summary

1. Project

Land restoration / reclamation monitoring of 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 the land restoration / reclamation monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, and 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

- Four Clusters viz. I, IV, VII, X were selected in 2018-19 for land reclamation/restoration monitoring. These clusters consist of mainly opencast mines.

- Out of the total leasehold area of 5883.96 Ha., total mined out area is only 1075.76 Ha., belonging to the OC mines.

- It is evident from the analysis that 58.11% of excavated area is under technical reclamation and 35.02% of the excavated area is under active mining. Cluster wise details are given in Table-1 & Fig-1.

- 13.61% of total leasehold area has come under plantation (% green cover)

- Study reveals that out of total mine leasehold area of 5883.96 Ha. of the above mentioned 04 nos. clusters of BCCL taken up for the land reclamation monitoring during the year 2018-19; total excavated area is 1075.76 Ha. (18.28%) out of which 73.92 Ha. (6.87%) has been planted *(Biologically Reclaimed)*, 625.15 Ha. (58.11%) is under backfilling *(Technical Reclamation)* and

balance 376.69 Ha. (35.02%) is under active mining

- This report and the findings will act as the basis for further monitoring and reclamation related activities.

- Out of the four clusters of BCCL, maximum land reclamation has been done in Cluster VII (76.09%) followed by Cluster X (71.00%).

Table 1

Land Reclamation Status in Clusters of (Underground + Opencast) Projects of BCCL based on Satellite Data of the Year 2018

(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	Total Area under Reclamation
				Biological Reclamation	Other Plantations					
			Area under Backfilling	Plantation on Excavated / Backfilled Area	Plantation on External Over Burden 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)*
1	Cluster I	575.00	10.11	7.29	47.99	25.53	28.39	45.78	80.80	17.40
			22.08%	15.91%			62.00%		14.05%	38.00%
2	Cluster IV	1123.79	147.22	0.00	27.11	165.09	166.67	313.88	192.20	147.22
			46.90%	0.00%			53.10%		17.10%	46.90%
3	Cluster VII	2127.70	351.54	37.47	15.52	238.67	122.23	511.24	291.67	389.01
			68.76%	7.33%			23.91%		13.71%	76.09%
4	Cluster X	2057.47	116.28	29.16	66.09	140.75	59.41	204.86	236.00	145.44
			56.76%	14.23%			29.00%		11.47%	71.00%
	TOTAL	**5883.96**	**625.15**	**73.92**	**156.71**	**570.04**	**376.69**	**1075.76**	**800.66**	**699.07**
			58.11%	**6.87%**			**35.02%**	**18.28%**	**13.61%**	**64.98%**

(% 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”’.

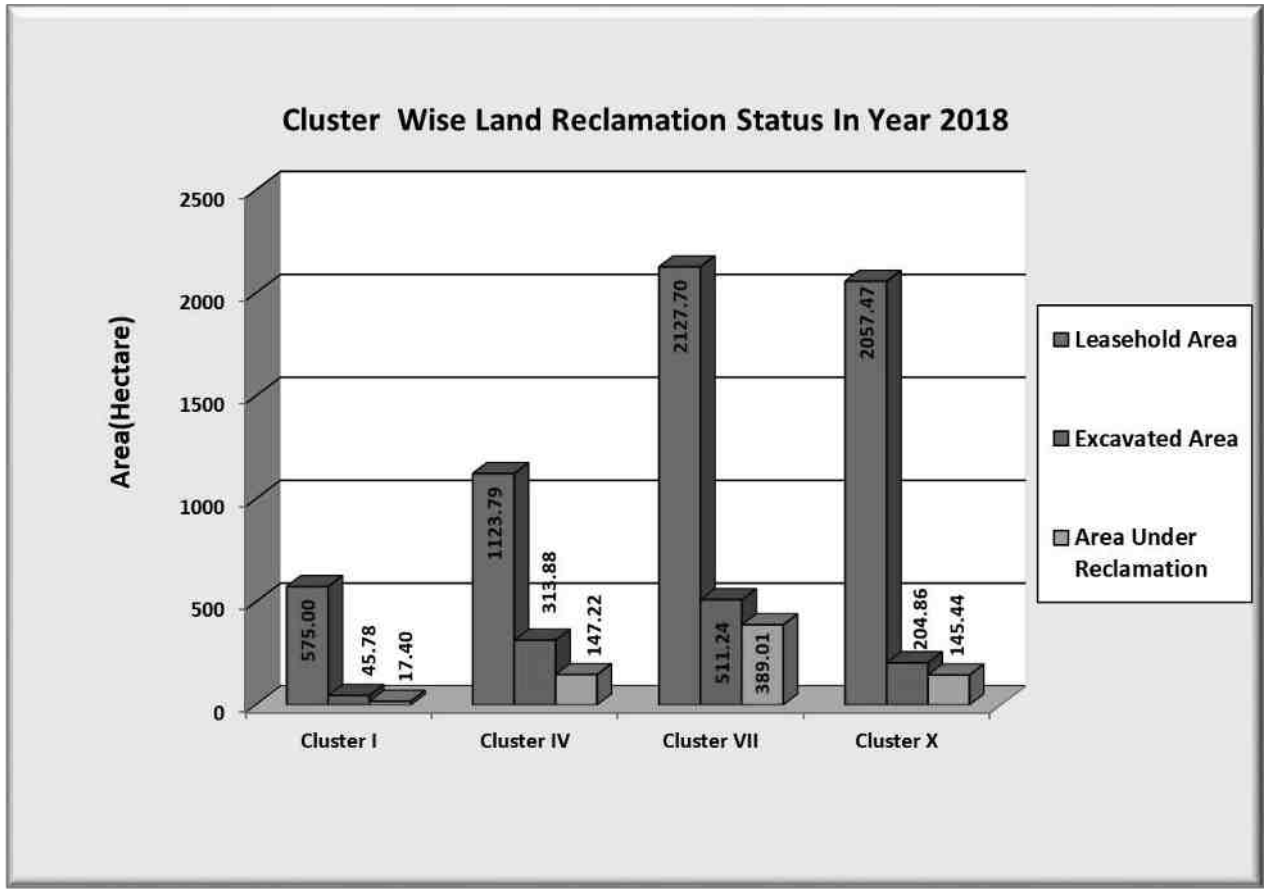


Fig. 1: Cluster wise Land Reclamation Status-2018 (BCCL)

1. 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 capacity, but from 2018 the same will be carried out cluster wise for mines of ECL & BCCL. For operational reasons and convenience, underground and opencast mines (often with multiple overlapping seams), have now been clustered together. 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 cluster coal mining projects would also comply the statutory requirements of Ministry of Environment & Forest (MoEF). 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 2018 carried out for four clusters of mines comprising both underground and OC projects for Bharat Coking Coal Ltd.

2. Objective

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and 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. Methodology

There are number of steps involved between raw 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 only raw digital satellite data, 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:

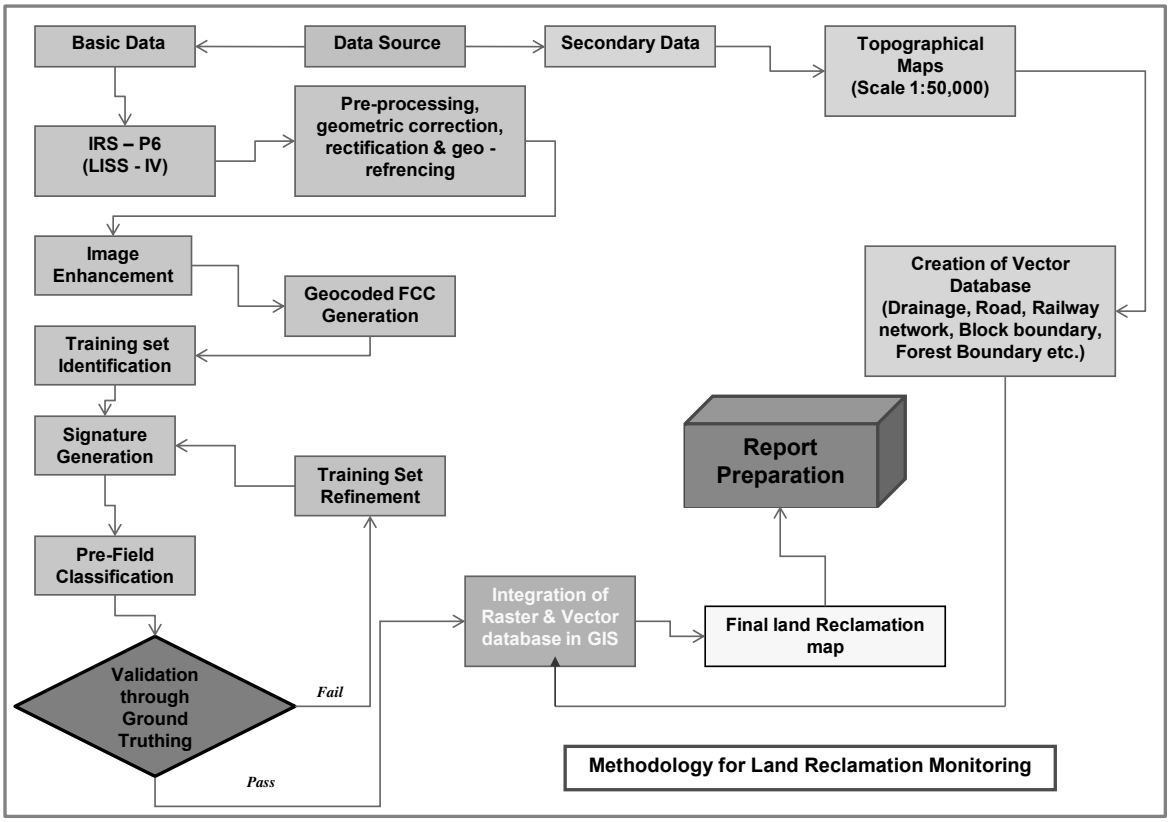


Fig. 2: Methodology of Land Reclamation Monitoring

3.1 **Data Procurement:** After browsing the data quality and date of pass on internet, supply order for data is placed to NRSC. 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 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 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 to 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 14.0 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. 14.0 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 are 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.

4. Land Reclamation Status in Bharat Coking Coal Ltd.

4.1 In BCCL, a total of twelve clusters of mines are selected for land reclamation monitoring. Following four clusters of mines comprising both underground and OC projects of Bharat Coking Coal Ltd. have been taken up for land reclamation monitoring in 2018.

- Cluster I (Damoda OCP)
- Cluster IV (Salanpur Colliery, Katras Choitudih Colliery, Gaslitand Colliery, Amalgamated Keshalpur West Mudidih Colliery, Angarpathra Colliery & Ramkanali Colliery)
- Cluster VII (Amalgamated East Bhuggatdih Simlabahal Colliery, Ena OC, Vishwakarma OCP, Kustore OCP)
- Cluster X (Bhowrah North, Bhowrah South, Patherdih)

4.2 All the four above clusters, have been mapped during the year 2018 for assessing the progress of land reclamation.

4.3 Area statistics of different land use classes present in OC projects till the year 2018 is given in Table 2. Land use maps derived from the satellite data are given in Plate nos.1, 2, 3 & 4. The land use status are shown in Fig. 3, 4, 5 & 6.

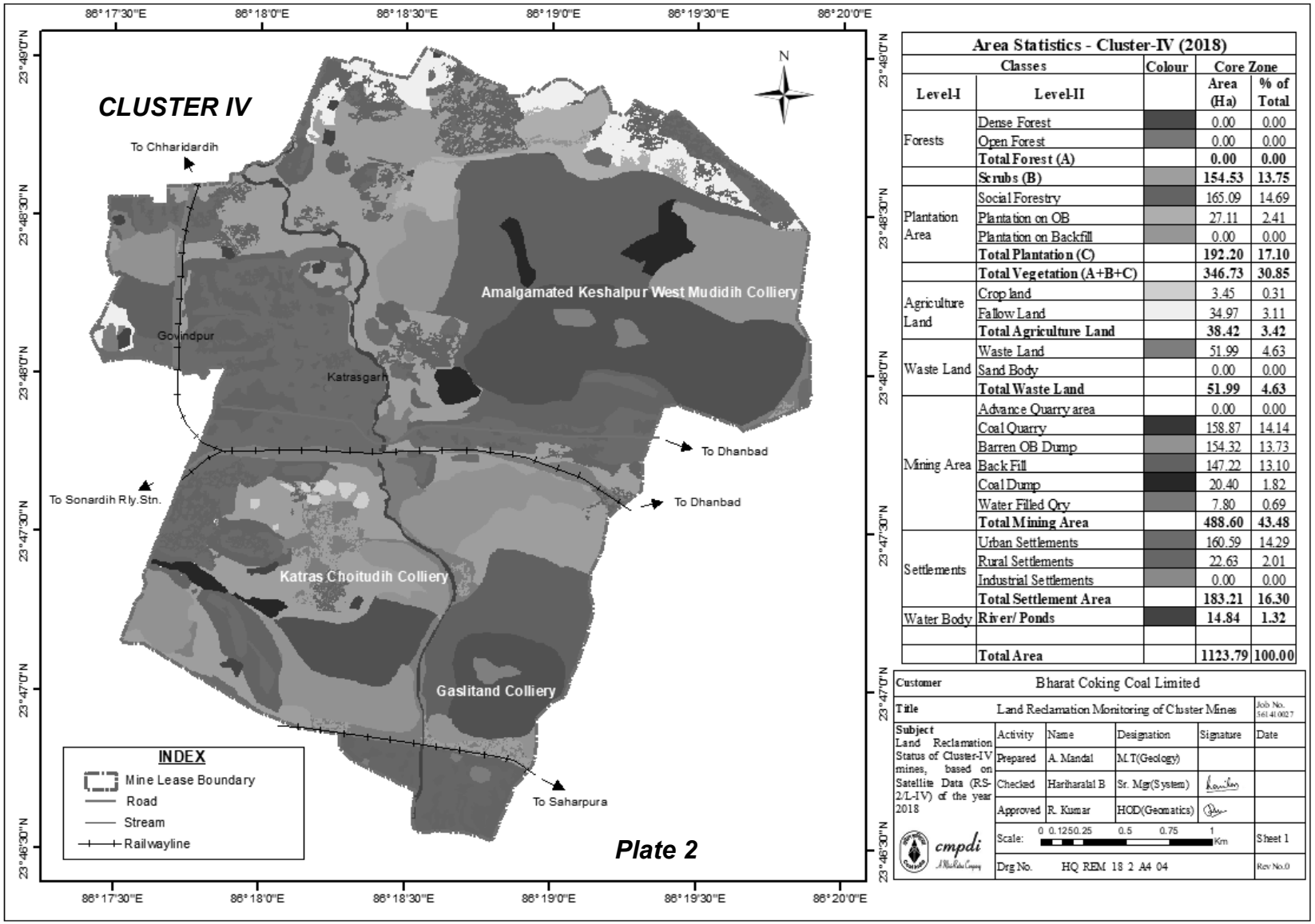
4.4 Study reveals that majority of the mines under the clusters considered for monitoring are of opencast type. 35.02% of excavated area is under active mining in the opencast mines. 58.11% of the excavated area have come under technical reclamation till 2018

Table 2

Status of Land Use/Reclamation Status in Clusters of (OC + Underground) mines of Bharat Coking Coal Limited based on Satellite Data of the year 2018

(Area in Hectare)

		CLUSTER I		CLUSTER IV		CLUSTER VII		CLUSTER X		TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	5.36	0.93	0.00	0.00	0.00	0.00	0.00	0.00	5.36	0.09
	Open Forest	29.81	5.18	0.00	0.00	0.00	0.00	180.80	8.79	210.61	3.58
	Total Forest	35.17	6.12	0.00	0.00	0.00	0.00	180.80	8.79	215.97	3.67
SCRUBS	Scrubs	194.77	33.87	154.53	13.75	618.49	29.07	559.57	27.20	1527.35	25.96
PLANTATION	Social Forestry/Avenue Plantation	25.53	4.44	165.09	14.69	238.67	11.22	140.75	6.84	570.04	9.69
	Plantation on OB Dump	47.99	8.35	27.11	2.41	15.52	0.73	66.09	3.21	156.71	2.66
	Plantation on Backfill (Biological Reclamation)	7.29	1.27	0.00	0.00	37.47	1.76	29.16	1.42	73.92	1.26
	Total Plantation	80.80	14.05	192.20	17.10	291.67	13.71	236.00	11.47	800.66	13.61
	Total Vegetation	**310.75**	**54.04**	**346.73**	**30.85**	**910.15**	**42.78**	**976.37**	**47.45**	**2543.99**	**43.24**
	Coal Dump	5.26	0.91	20.40	1.82	16.03	0.75	2.84	0.14	44.53	0.76
ACTIVE MINING	Coal Quarry	8.79	1.53	158.87	14.14	119.18	5.60	46.10	2.24	332.94	5.66
	Advance Quarry Site	3.24	0.56	0.00	0.00	0.00	0.00	0.00	0.00	3.24	0.06
	Quarry Filled With Water	16.36	2.84	7.80	0.69	3.05	0.14	13.31	0.65	40.52	0.69
	Total Area under *Active Mining*	**28.39**	**4.93**	**166.67**	**14.83**	**122.23**	**5.74**	**59.41**	**2.89**	**376.69**	**6.40**
	Barren OB Dump	20.58	3.58	154.32	13.73	75.79	3.56	89.57	4.35	340.25	5.78
RECLAIMED	Area Under Backfilling (Technical Reclamation)	10.11	1.76	147.22	13.10	351.54	16.52	116.28	5.65	625.15	10.62
	Total Area under *Technical Reclamation*	**10.11**	**1.76**	**147.22**	**13.10**	**351.54**	**16.52**	**116.28**	**5.65**	**625.15**	**10.62**
	Total Area under Mine Operation	**64.33**	**11.19**	**488.60**	**43.48**	**565.59**	**26.58**	**268.10**	**13.03**	**1386.62**	**23.57**
WASTELAND	Waste Lands	69.03	12.00	51.99	4.63	162.76	7.65	153.62	7.47	437.40	7.43
	Fly Ash Pond / Sand Body	9.94	1.73	0.00	0.00	0.00	0.00	44.69	2.17	54.63	0.93
	Total Wasteland	**78.97**	**13.73**	**51.99**	**4.63**	**162.76**	**7.65**	**198.30**	**9.64**	**492.02**	**8.36**
WATERBODIES	Reservoir, nallah, ponds	14.43	2.51	14.84	1.32	18.39	0.86	194.65	9.46	242.30	4.12
	Total Waterbodies	**14.43**	**2.51**	**14.84**	**1.32**	**18.39**	**0.86**	**194.65**	**9.46**	**242.30**	**4.12**
AGRICULTURE	Crop Lands	3.52	0.61	3.45	0.31	37.65	1.77	18.29	0.89	62.91	1.07
	Fallow Lands	79.43	13.81	34.97	3.11	20.73	0.97	91.05	4.43	226.18	3.84
	Total Agriculture	**82.95**	**14.43**	**38.42**	**3.42**	**58.37**	**2.74**	**109.35**	**5.31**	**289.09**	**4.91**
SETTLEMENTS	Urban Settlement	7.17	1.25	160.59	14.29	380.73	17.89	228.39	11.10	776.88	13.20
	Rural Settlement	13.83	2.41	22.63	2.01	9.93	0.47	57.90	2.81	104.29	1.77
	Industrial Settlement	2.58	0.45	0.00	0.00	21.79	1.02	24.42	1.19	48.80	0.83
	Total Settlement	**23.58**	**4.10**	**183.21**	**16.30**	**412.45**	**19.38**	**310.71**	**15.10**	**929.96**	**15.80**
	Grand Total	**575.00**	**100.00**	**1123.79**	**100.00**	**2127.70**	**100.00**	**2057.47**	**100.00**	**5883.96**	**100.00**



Area Statistics - Cluster-IV (2018)

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)		**154.53**	**13.75**
Plantation Area	Social Forestry		165.09	14.69
	Plantation on OB		27.11	2.41
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		**192.20**	**17.10**
	Total Vegetation (A+B+C)		**346.73**	**30.85**
Agriculture Land	Crop land		3.45	0.31
	Fallow Land		34.97	3.11
	Total Agriculture Land		**38.42**	**3.42**
Waste Land	Waste Land		51.99	4.63
	Sand Body		0.00	0.00
	Total Waste Land		**51.99**	**4.63**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		158.87	14.14
	Barren OB Dump		154.32	13.73
	Back Fill		147.22	13.10
	Coal Dump		20.40	1.82
	Water Filled Qry		7.80	0.69
	Total Mining Area		**488.60**	**43.48**
Settlements	Urban Settlements		160.59	14.29
	Rural Settlements		22.63	2.01
	Industrial Settlements		0.00	0.00
	Total Settlement Area		**183.21**	**16.30**
Water Body	**River/ Ponds**		**14.84**	**1.32**
	Total Area		**1123.79**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 561410027
Subject: Land Reclamation Status of Cluster-IV mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Activity	Name	Designation	Signature	Date
	Prepared	A. Mandal	M.T(Geology)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	HOD(Geomatics)		
	Scale: 0 0.125 0.25 0.5 0.75 1 Km				Sheet 1
	Drg No. HQ REM 18 2 A4 04				Rev No.0

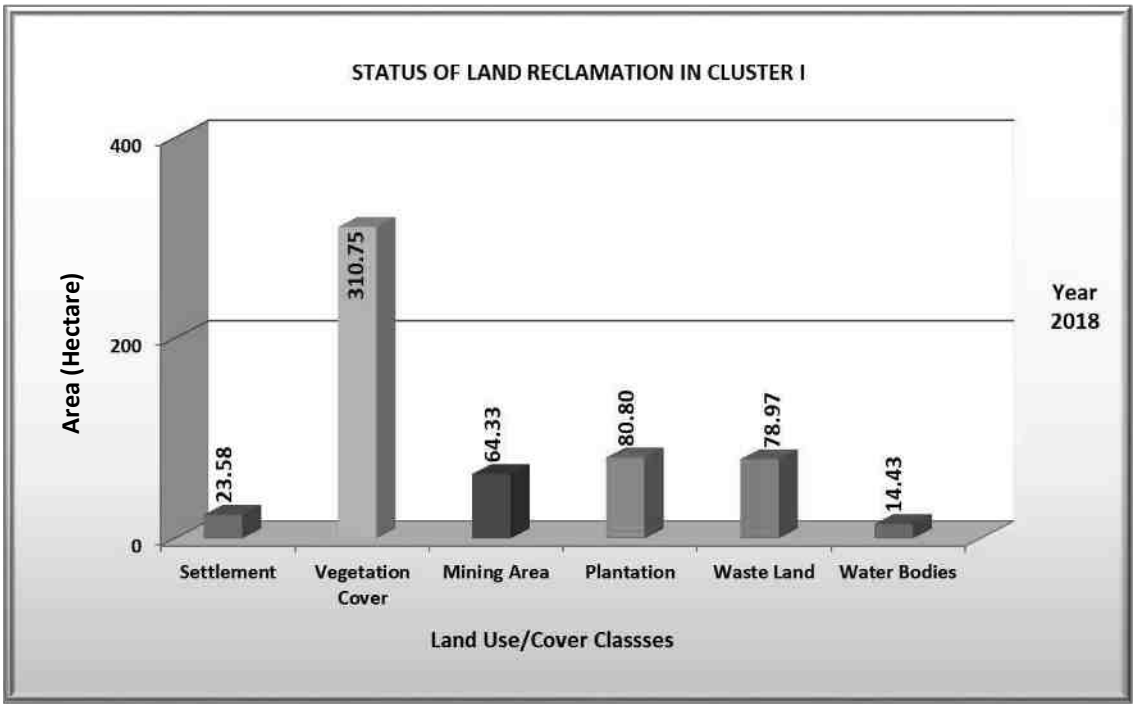


Fig. 3: Land Reclamation status of Cluster I

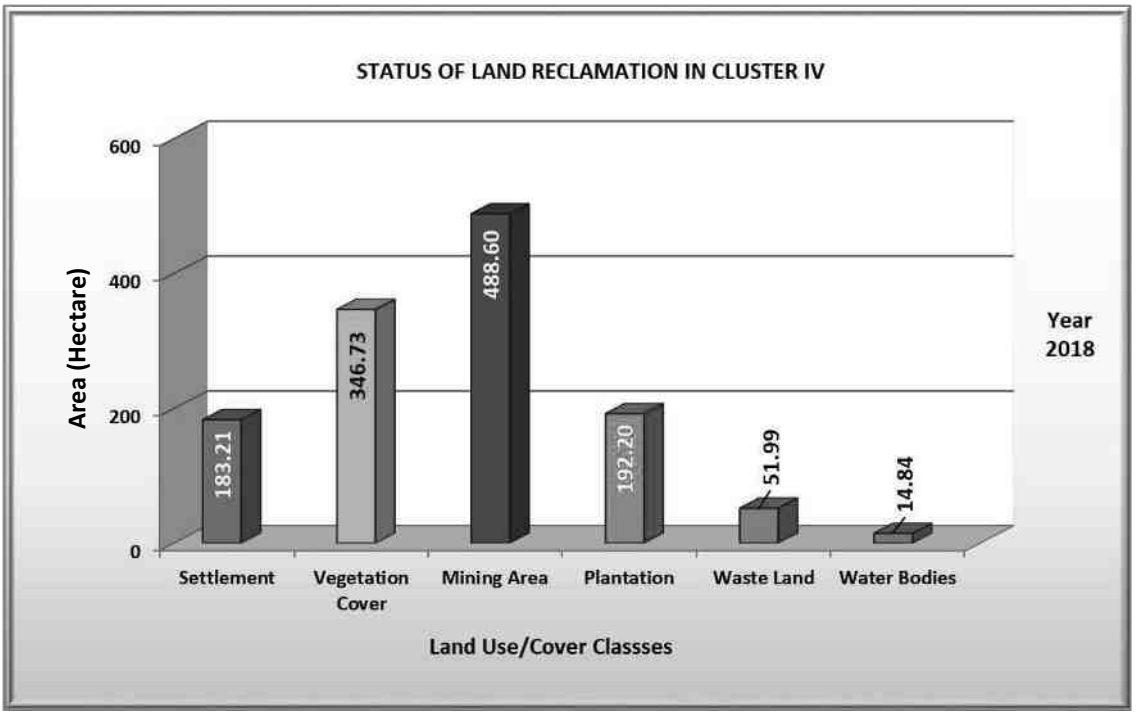


Fig. 4: Land Reclamation status of Cluster IV



Photo 1: Ecological Restoration Site, Damoda Colliery, Cluster I



Photo 2: Ecological Restoration Site in Cluster IV



Photo 3: Ecological Restoration Site in Cluster VII



Photo 4: Plantation on OB in Cluster X

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Yearwise (2014-15 to 2021-22) Plantation details of Cluster IV

Year	Biological reclamation (in Ha)/Afforestation	Location	Mode	Remarks
2014-15	3.4	West mudidih, AKWMC	Departmentally	
2015-16	3.02	Keshalpur, AKWMC	Departmentally	
2016-17	5.7	AKWMC (near suryamandir, Katras)	Departmentally	
2016-17			1160+525 = 1685 Nos of Gabion plantation done by DFO, Dhanbad	
2018-19	3.47	AKWMC	Departmentally	
2019-20			600 Nos of Gabion plantation, done by DFO, Dhanbad	
2019-20	0.6	Shahid mriti Upwan, Gaslitand	Departmentally	
2020-21	1	Keshalpur, Sneh Smriti Upwan site, AKWMC	Departmentally	
2020-21	0.5	Parasnath udyan		Plantation done over extended portion of Parasnath Udhyan
2020-2021	11	AKWMC	By DFO, Dhanbad	
2021-2022	13	KCC	By DFO, Dhanbad	Workorder issued, plantation is yet to be done
Afforestion over an area of 28.69 Ha done from the period from 2014-15 to 2020-21 and workorder has been awrded to DFO, Dhanbad for plantion over an area of 13 Ha in the FY 2021-22. Apart of that total 2285 nos of gabion plantation has also been done in the said period.				

CHAPTER - XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 MINE CLOSURE PLANNING

12.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) <u>Technical aspects:</u>

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

- **Safety hazards including management of fire and subsidence**: In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

- **Management of Pit Slopes:** During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0-28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40m berm width and maximum height of 60m in case of external OB dump and the overall dump slope shall not exceed 22 to 28 degrees. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

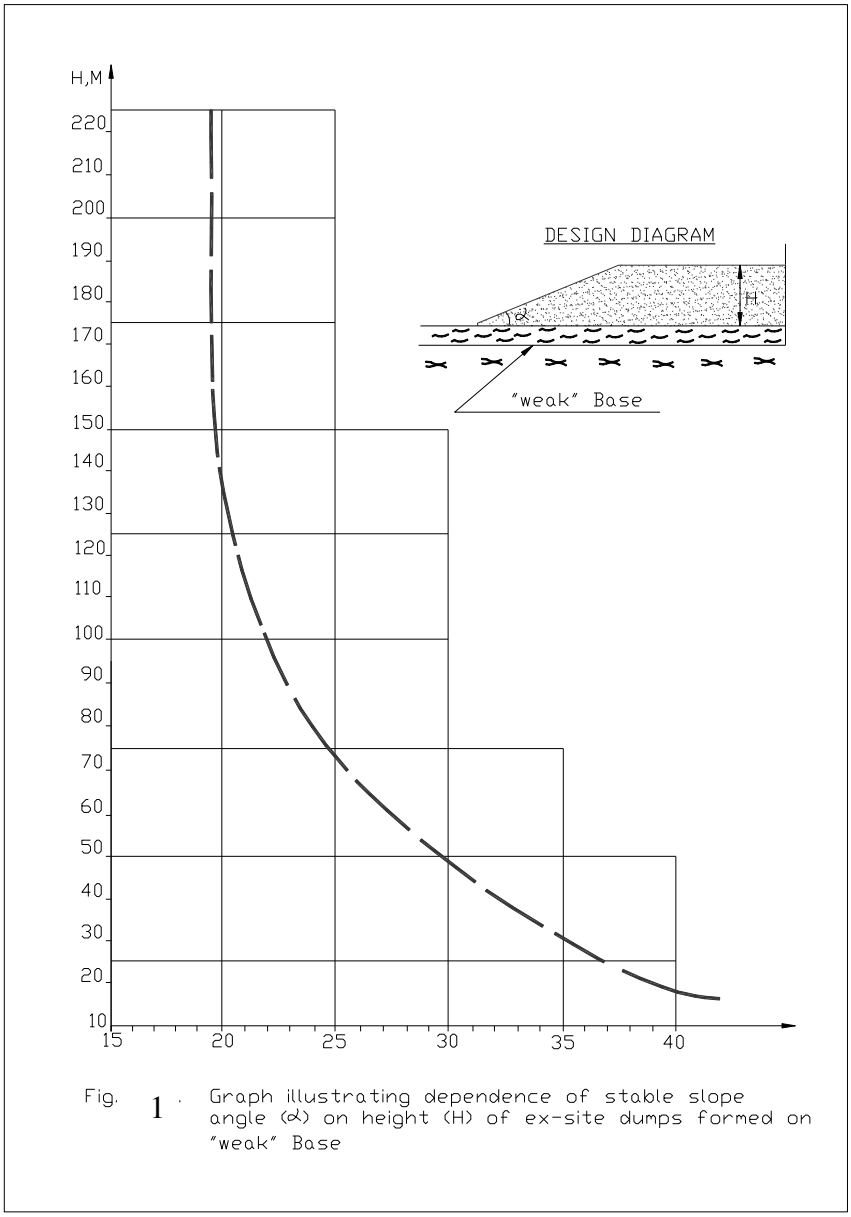


Fig. 1 . Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

Backfilling has already started in the OCP and the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will also serve as a lagoon which may be utilised as water reservoir for the locality. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

- **Management of hydrology and hydro-geology**: In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

  Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine vegetation will be grown on the entire vacant area.

- **Details of decommissioning of the infrastructures:** The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighbouring mines shall be explored.

- **Closure of entry to the open-cast mine:** At the end of the mine life, end pit slope within the seam and every exposed mouths of development gallery along the length of the bench / box-cut should be closed with non-combustible material (OB rock & mutti), compacted properly and sprayed with Thermoseal (a mica based sealant).

(b) Environmental aspects

This would include the following:

- **Management of final voids**: In the mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

- **Reclamation of forests/vegetation:** It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested.

- **Channelisation of available water:** If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing.

- **Management of Recharge Areas**: The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.

- **Acceptable Surface and Ground Water Flows**: In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects

The social aspects of land use planning relating to mine closure would include the following:

- **Re-deployment of Workforce:** The company employees will be gainfully engaged in the neighbouring projects after cessation of mining activities.

- **Management of Community Facilities:** In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects:

There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure. The cost of Progressive Closure activities is realized by levying a cost of 2.50/Te of coal for UG Mines.

The Final Mine closure cost has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.3 MINE CLOSURE OBLIGATIONS

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows:

(a) **Health & Safety :** Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars;

(b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981; Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2000; DGMS Directives on Noise & Ground Vibration;

(c) **Forest :** Forest (Conservation) Act, 1980.

(d) **Rehabilitation :** CIL's policy, however, applicable for land oustees only.

(e) **Decommissioning/asset disposal, etc.**

12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Post-Mining Land Use Plan has been shown in Chapter IX. Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of UG in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows :

The Company	:	Employees, Management & Stakeholders
The Community	:	Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.
The State	:	The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

- Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.
- In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.
- Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.
- As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following :

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste;
- The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

12.8 CLOSURE COSTS

As per MOC guidelines, a corpus escrow account @ ₹ 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ₹ 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

There is already a mine closure plan approved by the 305th BCCL Board, Dated 12.03.2014. According to the approved mine closure plan the total life of the mine was considered to be 7 years and total mine closure cost up to the considered life of the mine was calculated to be ₹ 1484.114 Lakhs. As per the directives ₹ 814.801 (Principal amount) Lakhs were deposited in to the Escrow Account Number 150100009051 by 31st March 2017. Further, the same escrow account shall be continued for AKWM Colliery and the amount already accrued shall be adjusted against the new closure cost calculated.

A revised mine closure plan is prepared incorporating all the major current and proposed changes in the mining activities. As per the data furnished by the mine/area, the project area and leasehold area in respect AKWM Colliery is the same and the closure cost is calculated accordingly. The mine closure cost for the revised mine closure plan is calculated in following way:

In AKWM colliery, the existing leasehold area and project area is 325.10 Ha. An area of 207.50 Ha is required for opencast operations in the leasehold of AKWMC. Also, **4.27 Ha** of the Project Area is now abandoned quarry. Thus, out of the project area of 325.10 Ha, **211.77 Ha** (207.50+4.27) area has been considered for the calculation of closure cost **as per Open cast norms** and the remaining **113.33 Ha** has been considered for the calculation of closure cost of the area as **per Underground norms**.

The overlapping area (where UG & OC operations have been done in different vertical levels) has been considered for calculation of closure cost as per opencast norms.

12.8.1 The total amount that shall be further deposited for final mine closure activities of **AKWM Colliery** in case of underground workings during the considered period of 28 years stands out to be **₹ 276.798 lakhs** and in case of opencast workings during the considered period of 8 years stands out to be **₹ 1228.382 lakhs** as per the present status of the mine.

Table No. 12.1 Break-Up cost of Mine Closure of AKWM Colliery

Year	UG Section	OC Section	Total
1	4.739	128.638	133.378
2	4.976	135.07	140.047
3	5.225	141.824	147.049
4	5.487	148.915	154.402
5	5.761	156.361	162.122
6	6.049	164.179	170.228
7	6.351	172.388	178.739
8	6.669	181.007	187.676
9	7.002		7.002
10	7.352		7.352
11	7.720		7.72
12	8.106		8.106
13	8.511		8.511
14	8.937		8.937
15	9.384		9.384
16	9.853		9.853
17	10.346		10.346
18	10.863		10.863
19	11.406		11.406
20	11.976		11.976
21	12.575		12.575
22	13.204		13.204
23	13.864		13.864
24	14.557		14.557
25	15.285		15.285
26	16.050		16.050
27	16.852		16.852
28	17.695		17.695
Total	**276.798**	**1228.382**	**1505.18**

The amount already deposited in the escrow account will also be available for mine closure activities and should be included to arrive at the total funds available for Mine Closure Activities.

Table No. 12.2 Total Amount available for Mine Closure Activities of AKWMColliery

	Amount (in ₹ lakhs)	
	UG Section	**OC Section**
Amount Already Deposited in Escrow Account	29.157	785.644
Amount to be Deposited in the Escrow Account in the Future	276.798	1228.382
Total Amount available for Mine Closure Activities	**305.955**	**2014.026**

12.11.2 Based on the existing mine closure planning norms, the above calculated cost at Final WPI of January 2017 on mine closure may be tentatively grouped under different heads as given in Table No. 12.3 A and 12.3 B for underground and opencast respectively, as per guidelines of CMPDI(HQ).

Table 12.3 A Break up costs of Mine Closure Activities for AKWM Colliery (Underground)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	10.708
	Residential Buildings	32.370
	Industrial Structures like CHP, Workshop, field sub-station, cap lamp room, haulage, fan installation etc.	19.367
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**	
	Sealing of incline mouths and air shafts	16.277
C	***Subsidence Management**	14.533
D	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	26.924
E	***Plantation**	
	Plantation over the cleared area obtained after dismantling and on other barren spaces	39.774
F	**Monitoring/Testing of parameters for three years**	
	Air Quality	20.897
	Water Quality	19.398
G	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	23.406
H	***Miscellaneous and other mitigative measures**	44.669
I	**Manpower Cost for Supervision**	37.632
	TOTAL	**305.955**

Note: * : To be covered under Progressive Mine Closure activities also

Table 12.3 B Break up costs of Mine Closure Activities for AKWM Colliery (Opencast including Abandoned Quarry)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	4.028
	Residential Buildings	53.774
	Industrial Structures like CHP, Workshop, field sub-station, etc.	6.042
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	30.210
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	35.648
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	1785.635
	Bio-Reclamation including soil spreading, plantation and maintenance	8.056
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	6.042
F	***Plantation**	
	Plantation over area obtained after dismantling	10.070
	Plantation around fencing	4.028
	Plantation over the cleared external OB Dump	0.403
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	4.431
	Water Quality	4.028
H	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	5.236
I	***Miscellaneous and other mitigative measures**	40.281
J	**Manpower Cost for Supervision**	16.112
	TOTAL	**2014.026**

Note: * : To be covered under Progressive Mine Closure activities also

12.8.3 Progressive Closure Costs

The break up costs of Progressive Closure Activities undertaken by BCCL in AKWM Colliery as per earlier approved Mine Closure Plan is given in the following table:

Table 12.4 Break up costs of Mine Closure Activities for AKWM Colliery (earlier approved) and Expenditure incurred during Progressive Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)			Amount Claimed (Lakhs) (2014-15)	Amount Claimed (Lakhs) (2015-16)
		OC	UG	Total		
A	**Dismantling of Structures**					
	Service Buildings	2.968	15.730	**18.698**		
	Residential Buildings	39.626	47.549	**87.175**		
	Industrial Structures like CHP, Workshop, field sub-station, etc.	4.452	28.449	**32.901**		
B	**Permanent Fencing of Mine Void and other dangerous area**					
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	22.262		**22.262**		
C	**Permanent Sealing of mine entries(incline mouth and air shaft)**					
	Sealing of incline mouths and air shafts		23.909	**23.909**		
D	**Subsidence Management**		21.348	**21.348**		
E	**Grading of Highwall slopes**					
	Levelling and grading of highwall slopes	26.269		**26.269**		
F	**OB Dump Reclamation**			**0.000**		
	Handling/Dozing of external OB Dump into mine void	1315.815		**1315.815**		1524.638
	Bio-Reclamation including soil spreading, plantation and maintenance	5.936		**5.936**		
G	**LANDSCAPING**					
	Landscaping of the cleared land for improving its esthetic	4.452	39.550	**44.002**		2.071
H	**Plantation**					
	Plantation over area obtained after dismantling	7.421	58.425	**65.846**		
	Plantation around fencing and around quarry area	2.968		**2.968**	67.94789	
	Plantation over the cleared external OB Dump	0.297		**0.297**		82.844
I	**Monitoring/Testing of parameters for three years**					
	Air Quality	3.265	30.696	**33.961**		
	Water Quality	2.968	28.494	**31.462**		
J	**Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	3.859	34.381	**38.240**	16.62778	8.285
K	**Miscellaneous and other mitigative measures**	29.682	65.616	**95.298**		
L	**Manpower Cost for Supervision**	11.873	55.279	**67.152**		
	TOTAL(%)	**1484.113**	**449.426**	**1933.539**	**84.57567**	**1617.838**

The estimate of total expenditure incurred upon the progressive closure activities are provided by BCCL.

CHAPTER - XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 MINE CLOSURE PLANNING

12.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) Technical aspects;

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

- **Safety hazards including management of fire and subsidence**: In the mine closure plan, action for control of likely fire areas of the mines will be discussed.

  Action will also be suggested to cover all the safety aspects.

  Following steps will be taken as precaution against fire and subsidence while mining:-

  i. Panel size will be so designed so that depillaring with caving will be completed within the incubation period of the coal seam.
  ii. Panel will be isolated in proper fashion before depillaring takes place.
  iii. Surface will be properly dozed and leveled wherever there are cracks and fissures so that air does not breathe in through surface.

- **Management of Pit Slopes**: As per the available records, there are 8 nos. of small quarries in the area which are proposed to be filled upto the required depth. Hence after the closure of the mine, there is little likelihood of any slope failure.
- **Management of hydrology and hydro-geology**: In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

  Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine vegetation will be grown on the entire vacant area.
- **Details of decommissioning of the infrastructures:** The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighbouring mines shall be explored.

- **Closure of entry to the open-cast mine:** Not applicable.

(b) Environmental aspects

This would include the following:

- **Management of final voids**: In the mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

- **Reclamation of forests/vegetation:** It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested.

- **Channelisation of available water:** If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing

- **Management of Recharge Areas**: The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.

- **Acceptable Surface and Ground Water Flows**: In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects;

The social aspects of land use planning relating to mine closure would include the following:

- **Re-deployment of Workforce:** The company employees will be gainfully engaged in the neighbouring projects after cessation of mining activities.
- **Management of Community Facilities:** In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects.

There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure.

The Final Mine closure cost has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.3 MINE CLOSURE OBLIGATIONS

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows:

(a) **Health & Safety:** Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars;

(b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981; Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2000; DGMS Directives on Noise & Ground Vibration;

(c) **Forest:**
Forest (Conservation) Act, 1980.

(d) **Rehabilitation:**
CIL's policy, however, applicable for land oustees only.

(e) Decommissioning/asset disposal, etc.

12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of UG in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows:

The Company : Employees, Management & Stakeholders

The Community : Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.

The State : The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

- Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.
- In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.
- Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.
- As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following:

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste
- The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

12.8 CLOSURE COSTS

As per MOC guidelines, a corpus escrow account @ ₹ 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ₹ 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

There is already a mine closure plan approved by the 305th BCCL Board, Dated 12.03.2014. According to the approved mine closure plan the total life of the mine was considered to be 13 years and total mine closure cost up to the considered life of the mine was calculated to be Rs 361.094 Lakhs. As per the directives Rs.112.46 Lakhs (Principal amount) were deposited in to the Escrow Account Number 150100009053 by 31st March 2017. **Further, the same escrow account shall be continued for AAR Colliery.**

A revised mine closure plan is prepared incorporating all the major current and proposed changes in the mining activities. As per the data furnished by the mine/area, the project area and leasehold area in respect of AAR Colliery differs and is given below and the closure cost is calculated accordingly. The mine closure cost for the revised mine closure plan is calculated in following way:

In AAR colliery, the existing leasehold area is 254.64 Ha. As per data furnished by the mine, the present Project area is 175.57 Ha excluding the area falling under DC Railway line, DB road and River and Barrier (79.07 Ha). **An area of 91.34 Ha is required for opencast operations** in the leasehold of AARC. Based on the land use of TOR, 64 Ha is abandoned, not backfilled quarry. However, as per the data furnished by the mine/area, only **1.56 Ha** of the Project Area is now abandoned quarry which is not backfilled at present. **Thus, out of the project area of 175.57 Ha, 92.90 (91.34+1.56) Ha area has been considered for the calculation of closure cost as per Open cast norms and the remaining 82.67 Ha has been considered for the calculation of closure cost of the area as per Underground norms.**

The overlapping area (where UG & OC operations have been done in different vertical levels) has been considered for calculation of closure cost as per opencast norms.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

12.11.1 Thus, total amount that shall be further deposited for mine closure activities of **AAR Colliery** in case of underground workings during the considered period of 21 years stands out to be ₹ **64.83 lakhs** and in case of opencast workings during the considered period of 8 years stands out to be ₹ **903.250 lakhs** as per the present status of the mine.

Table No. 12.1 Break-Up cost of Mine Closure of AAR Colliery

Year	UG Section	OC Section	Total
1	1.815	95.45	97.265
2	1.906	100.223	102.129
3	2.001	105.234	107.235
4	2.101	110.496	112.597
5	2.206	116.02	118.226
6	2.316	121.821	124.137
7	2.432	127.912	130.344
8	2.554	134.308	136.862
9	2.682		2.682
10	2.816		2.816
11	2.956		2.956
12	3.104		3.104
13	3.259		3.259
14	3.422		3.422
15	3.594		3.594
16	3.773		3.773
17	3.962		3.962
18	4.160		4.16
19	4.368		4.368
20	4.586		4.586
21	4.816		4.816
	64.830	**911.464**	**976.294**

The amount already deposited in the escrow account will also be available for mine closure activities and should be included to arrive at the total funds available for Mine Closure Activities.

Table No. 12.2 Total Amount available for Mine Closure Activities of AAR Colliery

	Amount (in ₹ lakhs)	
	UG Section	**OC Section**
Amount Already Deposited in Escrow Account	79.958	32.500
Amount to be Deposited in the Escrow Account in the Future	64.830	911.464
Total Amount available for Mine Closure Activities	**144.788**	**943.964**

12.11.2 Based on the existing mine closure planning norms, the above calculated cost at Final WPI of January 2017 on mine closure may be tentatively grouped under different heads as given in Table No. 12.3 A and 12.3 B for underground and opencast respectively, as per guidelines of CMPDI(HQ).

Table 12.3 A Break up costs of Mine Closure Activities for AAR Colliery (Underground)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	5.068
	Residential Buildings	15.319
	Industrial Structures like CHP, Workshop, field sub-station, cap lamp room, haulage, fan installation etc.	9.165
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**	
	Sealing of incline mouths and air shafts	7.703
C	***Subsidence Management**	6.877
D	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	12.741
E	***Plantation**	
	Plantation over the cleared area obtained after dismantling and on other barren spaces	18.822
F	**Monitoring/Testing of parameters for three years**	
	Air Quality	9.889
	Water Quality	9.180
G	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	11.076
H	***Miscellaneous and other mitigative measures**	21.139
I	**Manpower Cost for Supervision**	17.809
	TOTAL	**144.788**

Note: * : To be covered under Progressive Mine Closure activities also

Table 12.3 B Break up costs of Mine Closure Activities for AAR Colliery (Opencast)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	1.888
	Residential Buildings	25.204
	Industrial Structures like CHP, Workshop, field sub-station, etc.	2.832
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	14.159
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	16.708
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	836.918
	Bio-Reclamation including soil spreading, plantation and maintenance	3.776
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	2.832
F	***Plantation**	
	Plantation over area obtained after dismantling	4.720
	Plantation around fencing	1.888
	Plantation over the cleared external OB Dump	0.189
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	2.077
	Water Quality	1.888
H	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	2.454
I	***Miscellaneous and other mitigative measures**	18.879
J	**Manpower Cost for Supervision**	7.552
	TOTAL	**943.964**

Note: * : To be covered under Progressive Mine Closure activities also

12.8.3 Progressive Closure Costs

The break up costs of Progressive Closure Activities undertaken by BCCL in AAR Colliery as per earlier approved Mine Closure Plan is given in the following table:

Table 12.4 Break up costs of Mine Closure Activities for AAR Colliery (earlier approved) and Expenditure incurred during Progressive Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)	Amount Claimed (Lakhs) (2014-15)	Amount Claimed (Lakhs) (2015-16)
A	**Dismantling of Structures**			
	Service Buildings	11.501		4.2
	Residential Buildings	34.765		
	Industrial Structures like CHP, Workshop, field sub-station, cap lamp room, haulage, fan installation etc.	20.8		
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**			
	Sealing of incline mouths and air shafts	17.481		
C	**Subsidence Management**	15.608	2.69877	2.55357
D	**LANDSCAPING**			
	Landscaping of the cleared land for improving its esthetic	28.916		66.08629
E	**Plantation**			
	Plantation over the cleared area obtained after dismantling and on other barren spaces	42.717		
F	**Monitoring/Testing of parameters for three years**			
	Air Quality	22.443		
	Water Quality	20.833		
G	**Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	25.137	74.94412	8.69345
H	**Miscellaneous and other mitigative measures**	47.975		
I	**Manpower Cost for Supervision**	40.417		
J	**Reclamation of Abandoned Quarry**	32.5		
	TOTAL	**361.094**	**77.64289**	**81.53331**

The estimate of total expenditure incurred upon the progressive closure activities are provided by BCCL.

CHAPTER - XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 MINE CLOSURE PLANNING

12.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects :

(a) Technical aspects;

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

Safety hazards including management of fire and subsidence: In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

Management of Pit Slopes: During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0-28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40 m berm width and maximum height of 60m in case of external OB dump and the overall dump slope shall not exceed 22 to 28 degrees. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

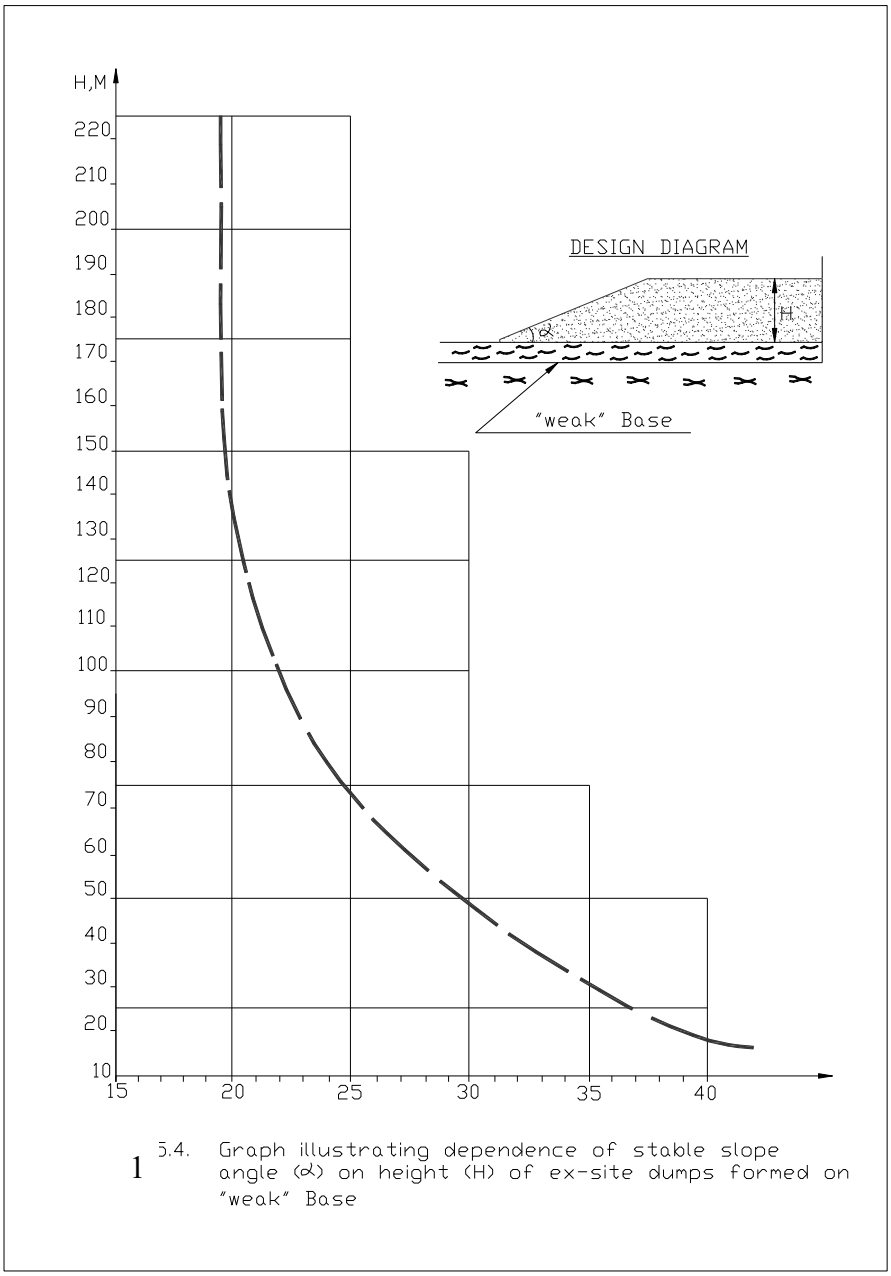


Fig. 5.4. Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

Backfilling has already started in the OCP and the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will also serve as a lagoon which may be utilised as water reservoir for the locality. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

- **Management of hydrology and hydro-geology**: In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

  Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine vegetation will be grown on the entire vacant area..

- **Details of decommissioning of the infrastructures:** The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighboring mines shall be explored.

i) **Closure of entry to the open-cast mine :** After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. However, the guidelines / instructions from DGMS, if any, will be followed.

(b) Environmental aspects

This would include the following:

- **Management of final voids**: In the mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.

- **Reclamation of forests/vegetation:** It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested

- **Channelisation of available water:** If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing

- **Management of Recharge Areas**: The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.

- **Acceptable Surface and Ground Water Flows**: In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects;

The social aspects of land use planning relating to mine closure would include the following:

- **Re-deployment of Workforce:** The company employees will be gainfully engaged in the neighboring projects after cessation of mining activities.

- **Management of Community Facilities:** In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects.

Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator. There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure. This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project.

The Final Mine closure cost has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.3 MINE CLOSURE OBLIGATIONS

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows :

(a) **Health & Safety :** Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars;

(b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981; Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2000;

DGMS Directives on Noise & Ground Vibration;

(c) **Forest :**

Forest (Conservation) Act, 1980.

(d) **Rehabilitation :**

CIL's policy, however, applicable for land oustees only.

(e) Decommissioning/asset disposal, etc.

12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Post-Mining Land Use Plan has been shown in Chapter IX. Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of mines in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows :

The Company	:	Employees, Management & Stakeholders
The Community	:	Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.
The State	:	The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be

invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.

In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.

Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.

As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following :

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste;
- The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

12.8 CLOSURE COSTS

As per MOC guidelines, a corpus escrow account @ 6.0 lakhs (August, 2009 Price Level) per Ha of the property leasehold shall be opened with the coal controller organization to meet the expenses of final mine closure. In 7th June 2011, MOC issued a revised guideline to replace the Para 6.2 of the original guidelines issued on 27.08.2009 by the following Para:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the property leasehold and it would be Rs. 1.00 lakh per Hectare for underground mine leasehold at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time. The mine closure cost for overlapping area of the mine would be deposited in the Escrow Account as applicable for opencast area and no separate cost for underground portion of the overlapping area is payable".

It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI(dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

In this Mining plan only opencast operation is taken into consideration and therefore Mine closure cost is computed based on opencast operation. At present u/g operation is closed due to fire and water, the life based on u/g working is not considered for determination of Mine Closure cost. The mine has adequate reserve to be mined in future. The underlying seams cannot be worked by underground method until the fire has been taken care off and only after that the underground mine will be restarted again. If so happens, a fresh new Mine Closure Plan will be submitted incorporating all the changes.

In Gaslitand Colliery, the existing leasehold area is 138.66 Ha, out of which 70.00 Ha is for opencast project. There is an abandoned quarry (Backfilled) of 6.50 Ha in the northern side of the leasehold area. The remaining 62.16 Ha of leasehold area (excluding Opencast Project and the abandoned backfilled quarry) has not been considered for the calculation of closure cost as the underground section is not operational, hence not considered as the existing project area. The cost of closure of 70.00 Ha (Opencast Project Area) is calculated as per the Open cast norms.

The Closure cost is estimated to be approximately **Rs. 674.523 lakhs**. The amount has been escalated based on WPI of October, 2016 (183.6) vis-à-vis WPI of August ’09 (129.6).

The tentative break up cost of activities as per the current guideline is given below in Table No. 12.1:

Table 12.1: Break up costs of the Mine Closure Activities of Gaslitand Colliery

Sl. No.	Activity	Mine Closure Cost (Rupees in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	**1.349**
	Residential Buildings	**18.010**
	Industrial Structures like CHP, Workshop, field sub-station, etc.	**2.024**
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	**10.118**
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	**11.939**
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	**598.032**
	Bio-Reclamation including soil spreading, plantation and maintenance	**2.698**
E	***LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	**2.024**
F	***Plantation**	
	Plantation over area obtained after dismantling	**3.373**
	Plantation around fencing	**1.349**
	Plantation over the cleared external OB Dump	**0.135**
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	**1.484**
	Water Quality	**1.349**
H	***Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**	**1.754**
I	***Miscellaneous and other mitigative measures**	**13.490**
J	**Manpower Cost for Supervision**	**5.396**
	TOTAL	**674.523**

Note: *: To be covered under Progressive Mine Closure activities also.

CHAPTER - XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 MINE CLOSURE PLANNING

12.1 OBJECTIVES OF CLOSURE PLANNING

As discussed at the outset, this Mining Plan deals with the working of OC Patch-A only. The project area for OC Patch-A is 83.72 Ha. which covers 49.60 Ha of excavation area and other area of about 34.12 Ha for OB Dump, coal Dump etc. After exhaustion of extractable reserve of OC Patch-A, the mine will be left with enough extractable reserve to carry out mining operation in future as per the production requirement of the Mine. As such, the mine will not finally be closed after exhaustion of OC Patch-A. The final Closure Plan of Katras Choitodih Colliery will be prepared when Mining Plan for all the seams is prepared. However, essential activities required to make area safe during extraction and after exhaustion of OC Patch-A has been discussed in this chapter.

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) Technical aspects;

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

- **Safety hazards including management of fire and subsidence**:

In the mine closure plan, action for control of likely fire areas of the mines will be discussed.

Action will also be suggested to cover all the safety aspects.

- **Management of Pit Slopes**:

As per the available records, there are 8 nos. of small quarries in the area. Some of the abandoned quarries are already filled/ party filled. The partly filled quarries are proposed to be filled upto the required depth. Hence after the closure of the OC Patch-A, there is little likelihood of any slope failure.

- **Management of hydrology and hydro-geology**:

In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine, vegetation will be grown on the entire vacant area.

- **Details of decommissioning of the infrastructures:**

The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighbouring mines shall be explored.

- **Closure of entry to the open-cast mine:**

The exposed/excavated area of the proposed open cast shall be back filled as far as possible. The area at the final stage that remains unfilled will be converted into water pond with regulated entry to this pond. The edge of the water pond shall be properly fenced to guard against inadvertent entry of stray animals. The pond water may be used for domestic requirement or for fishery.

(b) Environmental aspects

This would include the following:

- **Management of final voids**:

In the mine closure plan, voids due to mining are to be dealt with and the final land use plan will include filling of the voids for land reclamation where ever possible and for hydro reclamation where ever feasible.

- **Reclamation of forests/vegetation:**

  It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested.

- **Channelisation of available water:**

  If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing

- **Management of Recharge Areas**:

  The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.

- **Acceptable Surface and Ground Water Flows**:

  In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects;

The social aspects of land use planning relating to mine closure would include the following:

- **Re-deployment of Workforce:**

  The company employees will be gainfully engaged in the neighbouring projects after cessation of mining activities at Katras Choitodih Colliery.

- **Management of Community Facilities:**

  In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects.

There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure. The cost of Progressive Closure activities is realized by levying a cost of 2.50/Te of coal for Mines.

The Final Mine closure cost has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.3 MINE CLOSURE OBLIGATIONS

There is a need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows:

(a) **Health & Safety** : Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 1957 and its related DGMS Circulars;

(b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981; Environmental (Protection) Act, 1986 and Environmental Protection (Amendment) Rule, 2000; DGMS Directives on Noise & Ground Vibration;

(c) **Forest:**

Forest (Conservation) Act, 1980.

(d) **Rehabilitation:**

CIL's R&R Policy, however, applicable for land oustees only.

(e) Decommissioning/asset disposal, etc**.**

12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Post-Mining Land Use Plan has been shown in Chapter IX. Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of the mine in order to assess corrective measures to be implemented to sustain pre-mining

ecosystem and environment in the core and buffer zone (to the extent possible).

12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows:

The Company	:	Employees, Management & Stakeholders
The Community	:	Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.
The State	:	The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues from beginning of the project till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with changing requirement of mine.

The following steps have to be undertaken in relation to Mine Closure Planning:

Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential/prospective purchasers so that they could be invited and asked to submit sealed bids in this regard. This could ensure sale of assets yielding better financial gain.

In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.

Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.

As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following:

- The protection of mine Entries , building and other structures on the project site/mine premises against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste;
- Rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

12.8 CLOSURE COSTS

12.8.1 As per MOC guidelines, a corpus escrow account @ ` 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ` 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the property leasehold and it would be Rs. 1.00 lakh per Hectare for underground mine leasehold at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time.

There is already a mine closure plan for Katras Choitodih Colliery approved by the 312th BCCL Board, Dated 13.12.2014. As per the approved Mine Closure Plan, the total life of the mine was considered to be 23 years and total mine closure cost up to the considered life of the mine was calculated to be Rs 3402.219 Lakhs. As per the directives, Rs 168.34 Lakhs has been deposited in to the Escrow Account Number 150100010086 by the year 2016.

Further, the same escrow account shall be continued for Katras Choitodih Colliery and the amount already accrued shall be adjusted against the new closure cost calculated.

A modified Mine Closure Plan for Katras Choitodih Colliery (Recast) is being prepared incorporating all the major changes in the mining activities of the mine. The mine closure cost for Katras Choitodih Colliery (Recast) is calculated in following way:

The existing leasehold area of Katras Choitodih Colliery is 228 Ha. Out of total area of 228 Ha, only 83.72 Ha pertaining to mining of OC Patch-A has been considered as project area for the calculation of mine closure cost as per Open cast norms.

As the underground section of Katras Choitodih Colliery is currently not in operation, therefore, it is not considered in the project area.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

12.8.2 As per the guidelines for calculation of closure cost, the rates will stand modified based on Whole Sale Price Index (WPI) as notified by Government of India from time to time. Thus the total expenditure on this front has been calculated in following manner:

- The total amount for mine closure activities in respect of Katras Choitodih Colliery = 83.72 Ha X `6 Lakh X 1.41667 = ` 711.62 lakhs

*** The amount has been escalated based on WPI (Final/actual) of October 2016 (183.6) vis-à-vis WPI of August '09 (129.6).**

12.8.3 It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI (dt. 07.01.2013) the *"annual closure cost is to be computed, considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining technology in times to come. The underground mines in leasehold of

JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. The existing OC Mines working at shallow depth may be worked upto a greater depth in future. In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be correct in the long run. **In such a situation, it is envisaged that a Revised Mine Closure Plan should be prepared as per relevant guidelines and submitted for approval of the competent authority as per the requirement.**

At present UG production from Katras Choitodih Colliery is kept under suspension (since 15.06.2012) on account of safety concerns (waterlogged overlying seams within 60 m) .The mine was being worked in VIIIA seam through 5 Pit @ 200 TPD with 2 SDLs at the time of production suspension. The production from OC Patch-A has been started since Feb. 2015. The normative production capacity of OC Patch-A was 0.5 MTY and the life was for 6 years. In 2014-15, there was no coal production from the patch and only OB removal was done. However, the coal production during 2015-16 and 2016-17 (upto dec. 2016) was 0.581 and 0.375 MT respectively. Thus, the balance life of the mine is 4 years.

12.8.4 As per the data available from the mine, ` 168.34 lakhs has already been accrued in the escrow account. This amount has been considered to arrive at the balance amount to be deposited in the Escrow Account of Katras Choitodih Colliery. Thus, the balance amount required to be deposited will be ` 711.62 lakhs - ` 168.34 lakhs = ` 543.28 lakhs.

To arrive at the annual cost to be deposited in each year in an escrow account, **the mine closure cost for OC Patch-A** has been divided by 4. The annual closure cost for subsequent years are as given follows:

- Amount to deposited in 1st year will be the--- ` 135.82 lakhs
- Amount to be deposited in 2nd year will be— ` 135.82 (1 + 5%)^1 lakhs
- Amount to be deposited in nth year will be---- ` 135.82 (1 + 5%)^(n-1) lakhs

12.8.5 Thus, total Mine closure cost has been arrived at by adding existing amount available (` 168.34 lakhs) in Escrow Account and additional amount ( `**585.40** lakhs**)** to be deposited in phased manner. The total amount for final mine closure activities of **Katras Choitodih OC Patch-A** thus estimated is ` **753.74** lakhs**.**

The year-wise phasing of closure cost of Katras Choitodih Colliery is as below:

Year	**Amount (` in lakhs)**
Amount deposited for the year 2014-15 and 2015-16.	168.34
1St Year	135.82

2ND Year	142.61
3RD Year	149.74
4TH Year	157.23
Total	**753.74**

12.8.6 Based on the existing mine closure planning norms, the above calculated cost at WPI of Oct. 2016 on mine closure may be tentatively grouped under different heads as given in Table No. 12.1 as per the guidelines of CMPDI(HQ), Ranchi.

Table No. 12.1

Break up of Cost of Mine Closure of Katras Choitodih Colliery (Recast)

(OC Patch-A)

Sl. No.	Activity	Mine Closure Cost (` in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	1.51
	Residential Buildings	20.12
	Industrial Structures like CHP, Workshop, field sub-station, etc.	2.26
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	11.31
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	13.34
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	668.27
	Bio-Reclamation including soil spreading, plantation and maintenance	3.01
E	***LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	2.26
F	***Plantation**	
	Plantation over area obtained after dismantling	3.77
	Plantation around fencing	1.51
	Plantation over the cleared external OB Dump	0.15
G	**Monitoring/Testing of parameters for three years**	

Sl. No.	Activity	Mine Closure Cost (` in Lakhs)
	Air Quality	1.66
	Water Quality	1.51
H	***Entrepreneurship Development(Vocational/ skill development training for sustainable income of affected people**	1.96
I	***Miscellaneous and other mitigative measures**	15.07
J	**Manpower Cost for Supervision**	6.03
	TOTAL	**753.74**

Note: *: To be covered under Progressive Mine Closure activities also

12.8.7 Thus, total amount that shall be deposited for final mine closure activities **Katras Choitodih Mine (Recast)** during the period of 4 years has been estimated as ` **585.40 lakhs**.

12.8.8 *The break up costs of Progressive Closure Activities undertaken by BCCL in Katras Choitodih Colliery is shown the following table:*

Table 12.2

Break up costs of Mine Closure Activities for Katras Choitodih Colliery and Expenditure incurred during Progressive Closure Activities (As per data furnished from BCCL)

Sl. No.	Activity	Total Expenditure (Lakhs) (2014-15)	Total Expenditure (Lakhs) (2015-16)
A	Dismantling of infrastructure	0	0
	service building	8.70603	0
	Residential building	0	0
	Industrial structure CHP,W/S, substation	0	0
B	Permanent fencing	0	0
C	levelling & grading of highwall slopes		
D	OB dump reclamation	0	0
	Handling/dozing of OB dump & Backfilling	0	0
	Handling/dozing of OB dump & Backfilling	0	0
	Technical and bio reclamation including plantation and post care		
E	Landscaping	0	0
	Landscaping of open space in LH area for improving aesthetics and eco values		
F	Plantation	0	0
	Plantation over cleared area obtained after dismantling	0	0

Sl. No.	Activity	Total Expenditure (Lakhs) (2014-15)	Total Expenditure (Lakhs) (2015-16)
	Plantation around quarry area and in safety zone	0	0
	Plantation over external OB dump		
G	Post closure Environment monitoring	0	0
	Air Quality	0	0
	Water Quality	0	5.745
H	Entrepreneurship development for sustainable income of affected people	0	0
	Sub-Total(OC Part)	0	0
	GRAND TOTAL	**8.70603**	**5.745**

****The estimate of total expenditure incurred upon the progressive closure activities are provided by BCCL.***

CHAPTER—XII

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

12.0 Need of Mine Closure Planning -

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. in-situ stress field, ground water, surface drainage system as well as the socio-economic condition. Although mining activities are usually short term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mine set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues viz. Reclamation and environmental protection, rehabilitation of disturbed area. Community implementation of mine closure plan will incur some extra cost, neglecting this aspect will lead to future problems of attending compensation or expensive socio-economic problems.

Mine closure encompasses restoration process designed to restore physical, chemical and biological quality, disturbed by the mining activities. Mine closure is not just something that happens at the end of a mine's life rather mine closure is an ongoing series of decisions and activities beginning in the pre-mining stage of mine and ending with a creation of self-sustainable site that can be returned to the community.

Thus, a mine closure plan needs to define the liabilities, responsibilities and authorities of the different agencies like the mine management, other regulatory bodies, Central and State Governments after mine closure.

Hence, efforts have been made to identify the likely impacts on geo-environmental and socio-political set-up due to closure of the proposed mine during the planning stage itself, so that it will offer an opportunity to generate resources for mitigative measures during closure of the mine.

12.1 Reasons for closure-

Major part of the leasehold area of Salanpur Colliery falls beneath important surface features like Katras Township, DC Railway Line and Nichitpur link line of EC Railway, Railway Colony (Katrasgarh RS), IOW (Katrasgarh), RK siding line (abandoned in Aug. 2003), Salanpur Village, Guhi Bandh Village, Rampujan Village, MADA Water Tank, State Govt. Offices, DB Road etc (Refer Surface cum Topographical Plan).

The Railways are not permitting development beneath its property. Permission for depillaring in the area is not being granted by DGMS resulting in closure of underground mining operation. It is being considered to shift DC Railway line from the existing alignment on account of fire in some mines and a study by RITES is underway to firm up an alternate alignment on non-coal bearing area. This may result in vacation of the major surface area in future and pave the way for future mining. However, no approved plan exists in place as of now and the scenario of future mining in the leasehold area appears very bleak at present.

At present, Seam III and II(Top) is being developed. In this mining plan, II(Top) is not proposed for development due to thinness of the seam. The total development reserves has been estimated as 1.362 Mt considering Seam-III, II(Bot) & Seam-I. The life of the Mine life would be 11 years with normative production of 0.13 Mty Depillaring is not possible due to major surface constraint within the lease hold area.

The mine may be closed in future on account of exhaustion of economically recoverable coal reserves in the lease hold area. The mine may also be closed on account of other unforeseen reasons i.e. Force Majeure or directives from statutory organizations or court etc. for which information and notices shall be served to concerned Government authorities and departments. As per guidelines of Ministry of Coal, Govt. of India, Mine Closure Plan has to be submitted along with the mine plan for getting competent approval within one or two years of date of approval of mine plan.

12.2 Life Cycle Concepts-

Mining projects have a definite life cycle. All the mines have to eventually close their operation. The reasons for the closure may be many including economic conditions, depletion of mine-able resource or any other unforeseen safety reasons.

In the present project proposal the mine life cycle planning is governed by the extractable reserves of the proposed mining area. In general, the total extractable reserve is estimated considering both development as well as depillaring reserves of identified workable seams. In this mine, depillaring has not been done in past due to surface constrain and unless overlying seams are depillared, lower seams can not be depillared. This is mainly due to major surface constrain like Katras Town, Private basti, Rly land etc, Considering the development reserves Seam-III, II(Bottom) & Seam-I and its production

schedule, the life is estimated as 11 years from the date of obtaining Environmental Clearance from MoEFCC. The life of the mine will extent further and may be more if surface constrain is removed in future. It is suggested that the activities for closure will be initiated at an early stage of project life in a gradual/ planned manner.

12.3 Objectives of Closure Planning-

The mine closure phase is supposed to be closed when the mine is decommissioned, facilities at site are removed, the mine entries are sealed/ fenced off, the management of waste dump/ tailing is completed and the site is released in ecologically sustainable state suitable for proposed land use.

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- To protect public health and safety;
- To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- To minimize adverse socio-economic impacts.

12.4 Different aspects of Mine Closure Planning-

The mine closure planning broadly involves the following aspects :

(a) Technical aspects;

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

- **Safety hazards including management of subsidence**:-

  Action will also be suggested to cover all the safety aspects.

Following steps will be taken as precaution subsidence while mining:-

i. Panel size will be so designed so that depillaring with caving (if done in future) will be completed within the incubation period of the coal seam. Depillaring is possible only when surface constrain is removed and land is acquired.
ii. Panel will be isolated in proper fashion before depillaring takes place.
iii. Surface will be properly dozed and leveled wherever there are cracks and fissures so that air does not breathe in through surface.

❖ **Management of Pit Slopes (for existing as well as proposed quarry):**

The final quarry slopes shall be so designed and then subsequently developed that after the closure of the mine, there is no likelihood of any slope failure. The final slope of the quarry has been designed with above consideration. However, strict compliance with the proposed final slope of quarry and subsequent slope stability studies would be made.

❖ **Management of hydrology and hydro-geology**:

In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank Over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby Katri River flowing southerly on west side of the property. After closure of this mine (if depillaring in underground working is done in future or quarry is made) , the entire surface area will be back filled, dozed and vegetation will be grown.

❖ **Details of decommissioning of the infrastructures:**

The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighbouring mines shall be explored.

❖ **Closure of entry to the open-cast mine and underground mine:**

All entries to the mine (UG or OC/ Quarry) must be planned to be effectively closed so that illegal mining from these openings and safety hazards by way of entry of fire and water etc, will be prevented in the abandoned mines.

(b) Environmental aspects:

This would include the following-

❖ **Management of final voids in case of quarry**: -

In the mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible. The study on slope study will be made by some scientific agency and in final closure plan their suggestions will be incorporated.

❖ **Reclamation of forests/vegetation: -**

It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested

❖ **Channelisation of available water: -**

If the mine (UG/OC/Quarry) is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing

❖ **Management of recharge areas**: -

The pre-mining and post mining scenario on the hydro-geological recharge system would be included in the closure plan.

❖ **Acceptable Surface and Ground Water Flows**:

In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects:-

The social aspects of land use planning relating to mine closure would include the following:

❖ **Re-deployment of Workforce:**

The company employees will be gainfully engaged in the neighbouring projects after cessation of mining activities.

❖ **Management of Community Facilities:**

In view of the short life of the project, no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) Financial aspects.

There are two types of Closure, namely, Progressive Mine Closure and Final Mine Closure. The cost of Progressive Closure activities is realized by levying a cost of Rs. 2.50/Te of coal for UG Mines. The Final Mine closure cost has been dealt with at the end of this Chapter. It has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure.

12.4 Mine Closure Obligations:-

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows :

(a)	**Health & Safety**:	i)	Regulation Nos. 6, 61, 106, 112 of Coal Mines
		ii)	Regulations, 1957 and its related DGMS Circulars;
(b)	**Environment :**	i)	Water (Prevention & Control of Pollution) Act, 1974;
		ii)	Air (Prevention & Control of Pollution) Act, 1981;
		iii)	Environmental (Protection) Act, 1986
		iv)	Environmental Protection (Amendment) Rule , 2000;

v) DGMS Directives on Noise & Ground Vibration;

(c) **Forest :** Forest (Conservation) Act, 1980.

(d) **Rehabilitation :** CIL's policy, however, applicable for land oustees only.

(e) **Decommissioning/asset disposal**, etc**.**

12.5 Impact assessment remedial measures:

Post-Mining Land Use Plan has been given in Chapter IX. Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 1-2 years after closure of UG in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

12.6 Practice after the closure of the mine-

As the sources of dust and fume generation would no longer be present, the present practice of arresting the air pollution, as enumerated in Chapter-XI. However, water sprinkling would be done on the roads, which remain in use after the mine closure.

Quality of air would be monitored for a period of 3 years after cessation of mining activity. Three samples at fortnight frequency for 3 years, one sample in core zone and one sample each in upwind and downwind direction will be collected and analysed.

12.6.1 Dump Reclamation -

Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority. The existing void will serve as a lagoon and may be utilised as water reservoir for the locality. The entire area shall be suitably fenced.

The present mine is an underground unit and generally no solid waste will be generated during the mining operation except stone generates during drift drivage .

12.6.2 Details of Surface Structures proposed for dismantling-

12.6.2.1 Infrastructure details -

As far as possible, industrial structures shall be utilised by the adjacent mine. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. Service Buildings: The service buildings/ structures, viz. workshop, stores, office building, cap-lamp room, Pit Top office, winding rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B. Other Infrastructures: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and UG assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

12.6.2.2 Post closure disposal / Re-use of the Buildings, Plants & Machineries-

a. Disposal or reuse of existing HEMM, CHP, workshop and railway siding for OC-
No quarry is in operation in Salanpur Mine.

b. Disposal or reuse of haulage, ventilation, workshop and railway siding for UG-

At the time of closure of the mine, it is expected that most of the equipments would complete its rated life and would be surveyed off as per the Company's guidelines. The surveyed off equipments would be auctioned as per prevalent norms.
However, if some of the equipments would not have covered their rated life, they would be diverted to the neighbouring projects for gainful utilisation.

There is a abandoned R K Railway siding in the leasehold area which is under dismantling with due care.

c. Disposal or reuse of transmission lines and sub-station-
As per the electricity demand of the existing neighbouring projects, an analysis would be made as to whether the existing sub-station and transmission lines could be gainfully used or not. If the scope of gainful utilization is not found, they will be dismantled and the usable items/spares/conductors etc. would be dispatched to needy Areas/Projects.

d. Disposal or reuse of residential and non-residential buildings-

At the time of final closure, a list of surface buildings would be prepared in detail. Thereafter following steps would be taken in chorological order in respect of the available buildings:-

- An assessment would be made to find that whether the available buildings can be used by the existing neighboring projects or any new project that might have come up in the vicinity.

- In case, the listed assets cannot be utilized by the nearby project, efforts would be made to sale these assets after making the list available to potential purchasers and asking the interested purchasers to submit sealed bids.
- Thereafter, the state agencies/local agencies may be asked to take possession of the buildings, if they required few of them.
- When there would be no takers, the buildings would be demolished and usable items would be recovered for future use.

12.7 Safety and Security Arrangement

12.7.1 Mine entry-

After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. Flags/Boards with warning signals shall be posted at vulnerable places to avoid chances of accidents. However, the guidelines / instructions from DGMS, if any, will be followed.

Sealing details and dimensions shall also be prepared for the purpose. The minimum thickness of mine sealing will be 100cm RCC (M20) with nominal reinforcement. For incline entry, the mine entry path of 5 m will be filled with debris and clay before sealing the mine.

12.7.2 Details of fencing around abandoned quarry, indicating the length of the fencing-

At present, no quarry exist in Mine area. If re-opened in future then the void of the existing quarry would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around.

Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

12.7.3 Slope stability arrangement for high wall and back filled dumps

As regards stability of existing back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding hill ranges leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality. For the stability of the back-filled dump, the slope of the dump will be maintained at a stable angle. Vegetation cover will also be provided along the slopes to arrest any failure.

12.7.4 Providing one time lighting arrangement-

Sufficient lighting as per standard is provided at all the required places, i.e., Mine office, haulage room, fan house, cap lamp room, mine entry, workshop, sub-station, haul road in quarry etc.

After closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. to be utilised for the neighbouring projects and local communities.

12.7.5 Survey records of workings-

All the mine workings including subsidence areas, roads, ponds, tanks etc. shall be resurveyed and records shall be updated. Copy of such records shall also be submitted to the appropriate competent authorities, such as DGMS and State Authorities.

12.7.6 Disposal management of hazardous material-

At the time of closure, assessment would be made as to find whether there is any hazardous material that could cause problem. Such hazardous material e.g. explosives, chemicals, oil etc. shall be appropriately disposed off.

12.8 Stakeholders Involvement -

Various stakeholders effected due to mine closure need to be identified and they may be as follows:

The Company	:	Employees, Management & Stakeholders
The Community	:	Local business and service providers, land holders, neighbours and nearby residents, local Government and NGOs and Community Groups.
The State	:	The State Government, the Central Government and its concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

12.9 Closure Action Plan-

Closure planning is an exercise that begins at the start of a mine opening and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following proposal / steps have to be undertaken in relation to Mine Closure Planning:

Prior to the surface (including infra-structure) demolition/restoration, a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, waste material, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.

In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.

Work force on roll of BCCL may be re-deployed for gainful utilization of employees of BCCL.

As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

12.10 Protective Measures to be taken-

Protective measures must include the following:

- Protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- Maintenance of all mechanical, hydraulic and waste management system;
- Continuation of all monitoring programmes;
- Control of all contaminated effluents;
- Securing of all petroleum products, chemicals and waste;

12.11 Mine Closure Cost:

Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator.

There would be two types of expenditures on account of mine closure activities in respect of Salanpur Colliery.

A) Revenue expenditures

This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project. The cost of progressive mine closure activities is already part of the project cost.

B) Expenditures to be incurred just prior to actual mine closure and in the post closure period

As per MOC guidelines, a corpus escrow account @Rs.1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ Rs.6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

There is already a mine closure plan approved by the 305th BCCL Board, Dated 12.03.2014. According to the approved mine closure plan the total life of the mine was considered to be 12 years and total mine closure cost up to the considered life of the mine was calculated to be Rs 369.439 Lakhs. As per the directives Rs 142.90049 Lakhs (Principal Rs 125.296 lakhs and Interest Rs 17.604 lakhs) were deposited in to the Escrow Account Number 150100009050 by the year 2016. Further, the same escrow account shall be continued for Salanpur Colliery.

As per the data furnished by the mine/area, leasehold area and project area in respect of Salanpur UG mine is the same and the closure cost is calculated accordingly.

In Salanpur Colliery, the existing leasehold and project area is 177.49 Ha. Out of this, 5.46 Ha is abandoned and not backfilled quarry, 21.00 Ha is considered for suspended opencast patch and the remaining 151.03 Ha is considered for underground operations. Thus, out of the project area of 177.49 Ha, 26.46 (5.46 + 21.00) Ha area has been considered for the calculation of closure cost as per Open cast norms and the remaining 151.03 Ha has been considered for the calculation of closure cost of the area as per Underground norms.
The overlapping area (where UG & OC operations have been done in different vertical levels) has been considered for calculation of closure cost as per opencast norms.

The money deposited in the Escrow Account has to deal with the following:-

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

12.11.1 The total amount that shall be further deposited for final mine closure activities of **Salanpur Colliery** in case of underground workings during the considered period of 11 years stands out to be **₹ 198.309 lakhs** and in case of opencast workings during the considered period of 5 years stands out to be **₹ 176.585 lakhs** as per the present status of the mine. The year-wise break-Up cost of Mine Closure of Salanpur Colliery is given in Table No. 12.1.

Table No. 12.1

Break-Up cost of Mine Closure of Salanpur Colliery

Year	Amount to be Deposited (in ₹ lakhs)		
	UG Section	OC Section	Total
1	13.959	31.958	45.916
2	14.657	33.555	48.212
3	15.390	35.233	50.623
4	16.159	36.995	53.154
5	16.967	38.845	55.812
6	17.815		17.815
7	18.706		18.706
8	19.641		19.641
9	20.623		20.623
10	21.655		21.655
11	22.737		22.737
	198.309	**176.585**	**374.895**

The amount already deposited in the escrow account will also be available for mine closure activities and should be included to arrive at the total funds available for Mine Closure Activities.

Table No. 12.2

Total Amount available for Mine Closure Activities of Salanpur Colliery

	Amount (in ₹ lakhs)	
	UG Section	OC Section
Amount Already Deposited in Escrow Account	60.296	65.000
Amount to be Deposited in the Escrow Account in the Future	198.309	176.585
Total Amount available for Mine Closure Activities	**258.605**	**241.585**

12.11.2 Based on the existing mine closure planning norms, the above calculated cost at Final WPI of November 2016 on mine closure may be tentatively grouped under different heads as given in Table No. 12.3 A and 12.3 B for underground and opencast respectively, as per guidelines of CMPDI(HQ).

Table 12.3 A

Break up costs of Mine Closure Activities for Salanpur Colliery (Underground)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	9.051
	Residential Buildings	27.360
	Industrial Structures like CHP, Workshop, field sub-station, cap lamp room, haulage, fan installation etc.	16.370
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**	
	Sealing of incline mouths and air shafts	13.758
C	***Subsidence Management**	12.284
D	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	22.757
E	***Plantation**	
	Plantation over the cleared area obtained after dismantling and on other barren spaces	33.619
F	**Monitoring/Testing of parameters for three years**	
	Air Quality	17.663
	Water Quality	16.396
G	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	19.783
H	***Miscellaneous and other mitigative measures**	37.756
I	**Manpower Cost for Supervision**	31.808
	TOTAL	**258.605**

Note: * : To be covered under Progressive Mine Closure activities also

Table 12.3 B

Break up costs of Mine Closure Activities for Salanpur Colliery (Opencast)

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	0.483
	Residential Buildings	6.450
	Industrial Structures like CHP, Workshop, field sub-station, etc.	0.725
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	3.624
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	4.276
D	***OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	214.189
	Bio-Reclamation including soil spreading, plantation and maintenance	0.966
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its esthetic	0.725
F	***Plantation**	
	Plantation over area obtained after dismantling	1.208
	Plantation around fencing	0.483
	Plantation over the cleared external OB Dump	0.048
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	0.531
	Water Quality	0.483
H	***Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	0.628
I	***Miscellaneous and other mitigative measures**	4.832
J	**Manpower Cost for Supervision**	1.933
	TOTAL	**241.585**

Note: * : To be covered under Progressive Mine Closure activities also

12.11.3 *The break up costs of Progressive Closure Activities undertaken by BCCL in Salanpur Colliery as per earlier approved Mine Closure Plan is given in the following table:*

Table 12.4

Break up costs of Mine Closure Activities for Salanpur Colliery (earlier approved) and Expenditure incurred during Progressive Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)	Amount Claimed (Lakhs) (2014-15)	Amount Claimed (Lakhs) (2015-16)
A	**Dismantling of Structures**			
	Service Buildings	10.655		
	Residential Buildings	32.21		
	Industrial Structures like CHP, Workshop, field sub-station, etc.	19.271		
B	**Permanent Sealing of mine entries(incline mouth and air shaft)**			
	Sealing of incline mouths and air shafts	16.196		
C	**Subsidence Management**	14.461		**2.56609**
D	**LANDSCAPING**			
	Landscaping of the cleared land for improving its esthetic	26.791		
E	**Plantation**			
	Plantation over area obtained after dismantling	39.577		**1.81038**
F	**Monitoring/Testing of parameters for three years**			
	Air Quality	20.793		
	Water Quality	19.301		
G	**Enterpreneuship Development(Vocational/skill development training for sustainable income of affected people**	23.29	41.80181	
H	**Miscellaneous and other mitigative measures**	44.448		**173.29465**
I	**Manpower Cost for Supervision**	37.446		
	Sub-Total(UG Part)	**304.439**		
	Abandoned Quarry Reclamation			
J	**Reclamation of the abandoned quarry**	65.000		
	Sub-Total(OC Part)	**65.000**		
	GRAND TOTAL	**369.439**	**41.802**	**177.671**

The estimate of total expenditure incurred upon the progressive closure activities are provided by BCCL.

Bharat Coking Coal Ltd.
(A Subsidiary of Coal India Limited)
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To whom it may concern

This is to certify herethat there is no mining induced subsidence movement over and around the working area of cluster-IV group of mines namely Amalgamated Keshalpur west mudidih colliery, Amalgamated Angarpathra Ramkanali colliery, Gaslitand colliery, Katras Choitudih colliery & Salanpur colliery have been observed after obtaining Environmental clearance.

AM(Env)
Cluster IV

Scanned by CamScanner

Annexure-13

RC STATUS

JH10AN9675 **Status: ACTIVE**

Goods Carrier(HGV)

DIESEL **Not Available**

LPK2518

TATA MOTORS LTD

DHANBAD, Jharkhand

Owner Name:	***M*S* *U*A***	Registration Date:	**20-Mar-2014**

Validity

Fitness/REGN:	**17-Oct-2021**	MV Tax:	**19-06-2021**
Insurance:	**11-Mar-2022**	PUCC:	**22-Sep-2021**

*If Insurance/PUCC validity are not available, same may be verified from physical document.

TERMS OF USES

- The content on this portal is meant for sharing information regarding vehicles on the basis of information available on centralized VAHAN and vehicle National Register. Using content of this portal for any commercial purpose or any derivative work or misuse of any kind is strictly prohibited and may invite legal consequences.
- The content can be removed from the portal without notice and at any time as per Ministry of Road Transport and Highways/NIC direction.
- Ministry of Road Transport and Highways/NIC shall not be held responsible for any interactions/passing of information(s) etc. between any user via e-mail, chat and any other mediation with another user. Ministry of Road Transport and Highways/NIC has no obligation to monitor any such disputes arising between the users and shall not be party to such dispute/litigation etc.
- These terms and conditions shall be governed by and construed in accordance with the Indian Laws. Any dispute arising under these terms and conditions shall be subject to the jurisdiction of the courts of Indian territory only.

RC STATUS

JH10BB2322 **Status: ACTIVE**

Goods Carrier(HGV)

DIESEL **Not Available**

LPK2518

TATA MOTORS LTD

DHANBAD, Jharkhand

Owner Name:	***A*E*H *U*A* *A*A*O**	Registration Date:	**27-Sep-2016**

Validity

Fitness/REGN:	**24-Sep-2021**	MV Tax:	**26-06-2021**
Insurance:	**16-Sep-2021**	PUCC:	**18-Sep-2021**

*If Insurance/PUCC validity are not available, same may be verified from physical document.

TERMS OF USES

- The content on this portal is meant for sharing information regarding vehicles on the basis of information available on centralized VAHAN and vehicle National Register. Using content of this portal for any commercial purpose or any derivative work or misuse of any kind is strictly prohibited and may invite legal consequences.
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- These terms and conditions shall be governed by and construed in accordance with the Indian Laws. Any dispute arising under these terms and conditions shall be subject to the jurisdiction of the courts of Indian territory only.

RC STATUS

JH10AJ0359 **Status: ACTIVE**
Goods Carrier(HGV)
DIESEL **Not Available**
LPK2518
TATA MOTORS LTD
DHANBAD, Jharkhand

Owner Name:	***O*A* *U*A* *H*U*H*R***	Registration Date:	**07-Mar-2013**

Validity

Fitness/REGN:	**11-Apr-2022**	MV Tax:	**06-06-2021**
Insurance:	**25-Feb-2022**	PUCC:	**02-Oct-2021**

*If Insurance/PUCC validity are not available, same may be verified from physical document.

Financed: **YES**

TERMS OF USES

- The content on this portal is meant for sharing information regarding vehicles on the basis of information available on centralized VAHAN and vehicle National Register. Using content of this portal for any commercial purpose or any derivative work or misuse of any kind is strictly prohibited and may invite legal consequences.
- The content can be removed from the portal without notice and at any time as per Ministry of Road Transport and Highways/NIC direction.
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- These terms and conditions shall be governed by and construed in accordance with the Indian Laws. Any dispute arising under these terms and conditions shall be subject to the jurisdiction of the courts of Indian territory only.

RC STATUS

JH02AE6241 **Status: ACTIVE**
Goods Carrier(HGV)
DIESEL **Not Available**
LPK 2518
TATA MOTORS LTD
HAZARIBAG, Jharkhand

Owner Name:	***I*A*J*N *U*A***	Registration Date:	**25-Nov-2014**

Validity

Fitness/REGN:	**23-Dec-2021**	MV Tax:	**28-06-2021**
Insurance:	**12-Nov-2021**	PUCC:	**25-Sep-2021**

*If Insurance/PUCC validity are not available, same may be verified from physical document.

Financed: **YES**

TERMS OF USES

- The content on this portal is meant for sharing information regarding vehicles on the basis of information available on centralized VAHAN and vehicle National Register. Using content of this portal for any commercial purpose or any derivative work or misuse of any kind is strictly prohibited and may invite legal consequences.
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- These terms and conditions shall be governed by and construed in accordance with the Indian Laws. Any dispute arising under these terms and conditions shall be subject to the jurisdiction of the courts of Indian territory only.

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
विभागाध्यक्ष (पर्यावरण) का कार्यालय
कोयला भवन,कोयला नगर, धनबाद

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Office of the HoD (Environment)
Koyla Bhawan, Koyla Nagar, Dhanbad

पत्रसंख्या: भाकोकोलि/ विभागाध्यक्ष (पर्या)/फाईल-Plantation/B-3/2021/271-278(H) दिनांक: 18.02.2021

सेवा में,

वन प्रमंडल पदाधिकारी,

धनबाद

विषय : Work Order for carrying afforestation over 13 ha of OB dump of BCCL.

संदर्भ:(i) Our letter no.भाकोकोलि/उपमहाप्रबंधक(पर्या)/फाईल-B-3/2020/1529-1534(H) dt 10.12.2020
(iii) Your letter no.88 dated 12.01.2021

माननीय महोदय.

This has reference to above mentioned letters, competent authority has approved for carrying afforestation over 13 ha of OB dump of BCCL through DFO, Dhanbad for a total estimated value of ₹ 37,96,039.00 (Rupees thirty seven lakhs ninety six thousand thirty nine only) for four years with the following terms and conditions in respect of above mentioned work:-

1. The Period of work will be 04 years as per the estimate provided by Forest Department.

2. The aforesaid work is to be carried out at below mentioned sites:

S No	Name of the site	Type	Ha
1	AGKCC, Katras Area	OB Dump	13

3. The Forest department shall conduct all its afforestation activities subject to all laws, rules, statutory orders and regulations applicable to the site and the nature of the work.

4. The Forest department shall take up afforestation works on company's land with due expertise and supervision as per the scheme & estimates duly sanctioned as per the estimate submitted by forest department (The estimate has been submitted by Forest Department considering 15% enhancement every year in labour wages of preceding year).

5. The estimate has been submitted by Forest Department considering 15% enhancement every year in labour wages of preceding year. However, the payment of Completion work, first year maintenance work and second year maintenance work will be made as per the actual labour wages prevailing in the corresponding year.

6. The Forest department shall exercise precautions on the aid and advice of the mine management for the safety of all lives and properties involved in the afforestation activities.

7. **SCOPE OF WORK**
This work shall be done with the following attributes:

(i) Self-sustaining / healthy plantation at the end of project period/ at the handover of the site.

(ii) The plants planted shall be of native species, high root density, soil binding species, thick canopy and/or fruit bearing. The following suggested native species shall preferably but not limited to be planted at the sites:

S.No.	Botanical Name	Common name	S.No.	Botanical Name	Common name
1.	*Ailanthus excelsa*	Mahanim	2.	*Ficus hispida*	Kath gular
3.	*Albizzia lebbeck*	Siris	4.	*Ficus religiosa*	Pipal
5.	*Alstonia scholaris*	Chatni	6.	*Albizia Procera*	Safed Siris
7.	*Azadirachta indica*	Neem	8.	*Madhuca indica*	Mahua
9.	*Bombax ceiba*	Semal	10.	*Melia composita*	Bakain
11.	*Butea monosperma*	Palas	12.	*Tamarindus indica*	Imli
13.	*Cassia fistula*	Amaltas	14.	*Terminalia arjuna*	Arjun
15.	*A. Odoratissima*	Kala Siris	16.	*Aegle marmelos*	Bel
17.	*Dalbergia sissoo*	Shisham	18.	*Mangifera indica,*	Aam
19.	*Ehretia laevis*	Chamror	20.	*Zizyphus nummularia*	Ber
21.	*Ficus glomerata*	Gular	22.	Embilica officianlis	Awala
23.	*Syzygium cumini*	Jamun	24.	Anthocephalus indicus	Kadamb
25.	*Acacia Catechu*	*Desi Kher*	26.	Gmelina arbora	Gamhar
27.	And other fruit bearing native species or the species deemed suitable by the Forest deptt.				

(iii) Survival of the plantation shall not be less than 80 per cent at the end of the project period.

8. Annual Joint Inspection report of the inspection carried out by joint team of Forest Department and BCCL personnel after the completion of each year work should indicate name of the site, year of plantation, number of plants, name of the species present, date of inspection and survival rate.

9. The display boards shall be installed at all the plantation sites indicating, the name of the company, the no. of plantation, species planted, name of site of plantation and plantation year.

10. All the materials & manpower required with regard to the aforesaid work shall be arranged by you at your own cost.

11. The Forest department shall pay wages not less than the minimum wages fixed by the Govt of Jharkhand to the labourers engaged in the execution of the aforesaid work and it will be the responsibility of the Forest department to ensure the compliance of the payment of wages to its workmen/labourers as per law and company shall not be held responsible for the same.

12. In case of revision of minimum wages by the Govt of Jharkhand during the work, a revised estimate of the corresponding year of the scheme as per the work order shall be submitted to the company by Forest Department and claim the amount of difference in wages payable due to increase in labour wages on the basis of man days works on revised wage for which the forest department shall certify.

13. As the afforestation work has been directly monitored by Ministry of Coal, every year on monthly basis; therefore, you will provide the plantation data from June 2021 to October 2021 on monthly basis during the completion year (2021-22).

14. The afforestation sites as mentioned in the work order shall be handed over to mine management after the Joint inspection at the end of the Maintenance year-2 and having survival rate not less than 80%.

15. **TERMS OF PAYMENT**

Total project cost is ₹ 37,96,039.00 (Rupees thirty seven lakhs ninety six thousand thirty nine only as per the estimate submitted by Forest Department. The payment schedule will be as follows: -

S. No	Financial Year	Details of the work	Amount (Rs.)	Remarks
1.	2020-21	Advance Work	13,28,797.00	Wages @ ₹ 295.80 per MD
2.	2021-22	Completion work	14,70,510.00	Wages @ ₹ 340.17 per MD
3.	2022-23	Maintenance work-1	5,79,193.00	Wages @ ₹ 391.19 per MD
4.	2023-24	Maintenance work-2	4,17,539.00	Wages @ ₹ 449.87 per MD
Total			37,96,039.00	

16. The estimate for the Completion work, Maintenance work-1 and Maintenance work-2 is based on the tentative increase in the labour wages @ 15% of preceding year's wages as submitted in the estimate by the Forest Department. Therefore, the forest department shall certify the rate of labour wages for the corresponding year and demand letter/ bill based on the actual rates of labour wages to that corresponding year.

17. **Paying Authority:** HOD (Pay), Pay Office, BCCL HQ, Koyla Bhawan, Dhanbad.

18. All the payment will be made by ELECTRONIC MODE through bank in the account of DFO, Dhanbad. You are required to fill the format of Electronic Fund Transfer (EFT) in triplicate which is enclosed as annexure-A.

19. For release of the payment, you have to submit
    a) The letter of acceptance of the work order along with the Demand letter/Bill for the Advance work.

    And for further payments regarding this work order
    a) Utilization certificate of the preceding payment made to you in respect of this work order
    b) Joint inspection report of preceding year's work.
    c) Demand letter/Bill based on the actual rates of labour wages to that corresponding year for payment.

    The utilization certificates along with joint inspection report shall be accepted by the accepting authority i.e. HOD (Env), BCCL.

20. BCCL shall not have any liability in case of any accident etc. towards Forest Department's personnel/ staffs /workers during the execution of the work.

21. All other conditions stipulated in aforementioned reference letters shall be complied.

22. Matter relating to any dispute or difference arising out of this work order shall be subject to the jurisdiction of Dhanbad court only.

23. Child labour is prohibited under Mines Act, therefore, child labour shall not be deployed in the aforesaid work.

18/2/21

विभागाध्यक्ष (पर्यावरण)

ANNEXURE-A

PROFORMA FOR COLLECTING PAYMENT THROUGH ELECTRONIC MODE INCLUDING ELECTRONIC FUND TRANSFER (ETF) & ELECTRONIC CLEARING SYSTEM (ECS)

1	VENDOR/SUPPLIER/CONTRACTOR/CUSTOMER'S NAME & ADDRESS (With Telephone No. and Fax No.)	
2	PARTICULARS OF BANK ACCOUNT	
	A) BANK NAME	
	B) BRANCH NAME (Including RTGS Code)	
	ADDRESS	
	TELEPHONE No. & FAX No.	
	C) 9 – DIGIT CODE NUMBER OF THE BANK & BRANCH (Appearing on the MICR cheque issued on the bank) OR 5 – digit code No. OF SBI	
	D) ACCOUNT TYPE (S.B. Account/Current Account OR Cash Credit with code 10/11/13)	
	E) LEDGER No./LEDGER FOLIO No.	
	F) ACCOUNT NUMBER (CORE BANKING) & STYLE OF ACCOUNT (As appearing on the cheque Book)	
3	DATE OF EFFECT	

I hereby declare that the particulars given above are correct and complete. If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold the user institution responsible. I have read the option invitation letter and agree to discharge responsibility expected of me as a participant under the scheme. Any Bank charges levied by the Bank of such e-transfer shall be borne by us.

Date :
Signature of the Contractor

Certified that the particulars furnished above are correct as per our records.

Signature of the Authorized Officials
from the Bank

भारत कोकिंग कोल लिमिटे
एक मिनी रत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
उप महाप्रबंधक (पर्यावरण) का कार्यालय
कोयलाभवन,कोयलानगर, धनबाद–826005
CIN : U10101JH1972GOI000918

Bharat Coking Coal Limited
A Mini Ratna Company
(A Subsidiary of Coal India Limited)
Office of the Dy. GM (Environment)
Koyla Bhawan, Koyla Nagar, Dhanbad -826005
CIN : U10101JH1972GOI000918

OFFICE OF THE GENERAL MANAGER "ATRAS AREA" F2/3418 03/03/20

पत्रसंख्या: भाकोकोलि/ विभागाध्यक्ष (पर्या)/फाईल-Plantation /2020/210-214(H) दिनांक: 26.02.2020

सेवा में,
वन प्रभंडल पदाधिकारी,
धनबाद

विषय : Work Order for carrying afforestation over 54.5 ha of OB dumps of BCCL.

संदर्भ: (i) Our offer letter no.भाकोकोलि/उपमहाप्रबंधक(पर्या)/फाईल-Plantation/2019/2959-2963/ (H) dt 13/14.12.2019.
(ii) Your letter no.130, dated 16.01.2020

Dear Sir,

This has reference to above mentioned letters, Competent Authority has approved for carrying afforestation over 54.5 ha of OB dumps through DFO, Dhanbad, for a total value of Rs. 14608770.00 (Rupees One crore forty six lakhs eight thousand seven hundred seventy only) for four years with the following terms and conditions in respect of above mentioned work:-

1. The Period of work from the date of acceptance of work order will be 04 years.

2. The aforesaid work is to be carried out at below mentioned sites:

S No	Name of the site	Type	Ha
1	ABOCP, Block-II	OBD	12.4
2	ABOCP, Block-II	OBD	5.6
3	AKWMC, Katras	OBD	11
4	ABG, Govindpur	OBD	4.5
5	NAKC, Govindpur	OBD	5
6	NT-ST-JG, Lodna	OBD	16
	TOTAL		54.5

3. The Forest department shall conduct all its afforestation activities subject to all laws, rules, statutory orders and regulations applicable to the site and the nature of the work.

4. The Forest department shall take up afforestation works on company's land with due expertise and supervision as per the scheme & estimates duly sanctioned as per the estimate submitted by forest department (The estimate has been submitted by Forest Department considering 15% enhancement every year in labour wages of preceding year).

AM(Envt.)
Pl discuss 3/3/2020

Scanned with CamScanner

5. The payment of Completion work, first year maintenance work and second year maintenance work will be made as per the actual labour wages prevailing in the corresponding year.

6. The Forest department shall exercise precautions on the aid and advice of the company for the safety of all lives and properties involved in the afforestation activities.

7. **SCOPE OF WORK:**

This work shall be done with the following attributes:

(i) Self-sustaining / healthy plantation at the end of project period/ at the handover of the site.

(ii) The plants planted shall be of native species, high root density, soil binding species, thick canopy and/or fruit bearing. The following suggested native species shall preferably but not limited to be planted at the sites:

S.No.	Botanical Name	Common name	S.No.	Botanical Name	Common name
1.	*Ailanthus excelsa*	Mahanim	2.	*Ficus hispida*	Kath gular
3.	*Albizzia lebbeck*	Siris	4.	*Ficus religiosa*	Pipal
5.	*Alstonia scholaris*	Chatni	6.	*Albizia Procera*	Safed Siris
7.	*Azadirachta indica*	Neem	8.	*Madhuca indica*	Mahua
9.	*Bombax ceiba*	Semal	10.	*Melia composita*	Bakain
11.	*Butea monosperma*	Palas	12.	*Tamarindus indica*	Imli
13.	*Cassia fistula*	Amaltas	14.	*Terminalia arjuna*	Arjun
15.	*A. Odoratissima*	Kala Siris	16.	*Aegle marmelos*	Bel
17.	*Dalbergia sissoo*	Shisham	18.	*Mangifera indica,*	Aam
19.	*Ehretia laevis*	Chamror	20.	*Zizyphus nummularia*	Ber
21.	*Ficus glomerata*	Gular	22.	Embilica officianlis	Awala
23.	*Syzygium cumini*	Jamun	24.	Anthocephalus indicus	Kadamb
25.	*Acacia Catechu*	*Desi Kher*	26.	Gmelina arbora	Gamhar
27.	And other fruit bearing native species or the species deemed suitable by the Forest deptt.				

(iii) Survival of the plantation shall not be less than 80 per cent at the end of the project period.

8. Annual Joint Inspection report of the inspection carried out by joint team of Forest Department and BCCL personnel after the completion of each year work should indicate name of the site, year of plantation, number of plants, name of the species present, date of inspection and survival rate.

9. The display boards shall be installed at all the plantation sites indicating, the name of the company, the no. of plantation, species planted, name of site of plantation and plantation year.

Scanned with CamScanner

19. For release of the payment, you have to submit
    a) The letter of acceptance of the work order along with the Demand letter/Bill for the Advance work.

    And for further payments regarding this work order
    a) Utilization certificate of the preceding payment made to you in respect of this work order
    b) Joint inspection report of preceding year's work.
    c) Demand letter/Bill based on the actual rates of labour wages to that corresponding year for payment.

    The utilization certificates along with joint inspection report shall be accepted by the accepting authority i.e. HOD (Env), BCCL.

20. BCCL shall not have any liability in case of any accident etc. towards Forest Department's personnel/ staffs /workers during the execution of the work.

21. Child labour is prohibited under Mines Act, therefore, child labour shall not be deployed in the aforesaid work.

26/2/2020

विभागाध्यक्ष (पर्यावरण)

Copy to:-

1. TS to D (T) OP/ D(T) PP, BCCL..... for kind information please.
2. GM (Vigilance), BCCL..... .....for kind information please.
3. CGM (Environment), CIL, Kolkata. ..... for kind information please.
4. HOD, (Pay)/ In-charge Pay Office, BCCL HQ, Koyla Bhawan, Dhanbad.
5. Master File/Office Copy
6. GM, Block- II Area
7. GM, Govindpur Area
8. GM, Katras Area
9. GM, Lodna Area

] For kind information please

26/2/2020

विभागाध्यक्ष (पर्यावरण)

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Plantation in FY 2019-20 over 11 Ha Ob dump Area



Preparation of nursery for plantation site 13 Ha Ob dump



Hole digging for plantation site 13 Ha Ob dump



Over Head Dust Suppression Arrangement installed at Haul Road for wetting the coal loaded over trucks



Block Plantation Around CHP



Water Arrangement at CHP Hooper

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.

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2020-21)

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

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2021

Job no - 200419012

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2020-21)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV & XVI 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
Hydrogeology Department
Exploration Division
CMPDI (HQ), Ranchi

MARCH – 2021

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CMPDIL

CENTRAL MINE PLANING & DESIGN INSTITUTE

HYDROGEOLOGY SECTION, EXPLORATION DEPARTMENT

GONDWANA PLACE, KANKE ROAD, RANCHI, JHARKHAND– 834031

(Accredited Groundwater Professional Institutions by CGWB/CGWA)

(Accredited by NABL, valid upto: 2022)

(Accredited as a FAE in (HG) by QCI-NABET, valid upto: Aug'2021)

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Annexure – I

DETAILS OF THE REPORT

Sl No.	ITEMS	INFORMATIONS
1	Geographical Area	Jharia Coalfield (JCF): 453 sq. km. Raniganj Coalfield (RCF part): 19.64 sq. km. (Cluster-XVI area only)
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.
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	Dhanbad Dist: Bokari Dist:
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 25 m upto 650 m
7	Hydrogeological properties	Unconfined Aquifer (Damoda BJ Section & Block-III): Hydraulic Conductivity – upto 0.50 m/day Transmissivity – 10 - 42 m^2/day
		Semi-confined to confined Aquifer (Sitanala & Kumari Block): Hydraulic Conductivity – 0.0006-1.44 & 0.05-0.0027 m/day Transmissivity – 0.06 – 0.573 m^2/day
8	Groundwater Level Monitoring Network	Out of total 252 nos. of monitoring stations 64 nos located within core mining area and rest comes within Buffers zone. 60 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 4 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 0.80 to 16.25 m (Avg. 4.95 m bgl) in '2020 Post-monsoon – 0.75 to 10.10 m (Avg. 3.26 m bgl) in '2020 RCF area (part): Pre-monsoon – 2.30 to 9.70 m (Avg. 4.30 m bgl) in '2020 Post-monsoon – 1.75 to 5.50 m (Avg. 2.70 m bgl) in '2020
10	Groundwater Quality	Potable (Annexure- VII)
11	Proposed Piezometers	Proposed piezometers (23 nos.) to monitor impact of coal mining on groundwater regime within the coalfield area (JCF & part of RCF) for maximum depth upto 290 m.
12	Stage of Groundwater Development (CGWB)	Dhanbad District-76.30% (GWRE-2017)

GROUNDWATER LEVEL & QUALITY REPORT FOR CLUSTER OF MINES OF BCCL

1.0 INTRODUCTION

1.1 LOCATION DETAILS AND BRIEF ABOUT THE PROJECT

The 15 nos. Cluster of mines (Cluster-I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV and XVI) of BCCL is located in the Jharia coalfield in Bokaro district of and Dhanbad district of Jharkhand and part of Raniganj coalfield of Dhanbad district of Jharkhand.

The area of Jharia Coalfield (JCF) is 453 sq. km. and Raniganj Coalfield (RCF part) is 19.64 sq. km. (Cluster-XVI area only). 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 conducting hydrogeological study by quarterly monitoring of groundwater level and quality of the Jharia coalfield and Raniganj coalfield (part) within BCCL command area for 15 nos. Cluster of mines of BCCL. The data collected shall submitted to the MoEF&CC, CPCB & SPCB within stipulated timeframe. The work being done yearly and require d 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 taken into account for hydro-geological investigation of the study area.

i) The monitoring of the groundwater levels done four times/year during (May, August, Nov and Jan).
ii) The monitoring of the groundwater quality done during May including Arsenic and Fluride.
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 AMSL in Barora area (Cluster-I) to 160 m above mean sea level (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) areas 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 southeast 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-II***). 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 in Barakar River and Panchet dam in 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 flooded by water, either permanently or seasonally. The primary factor that distinguishes **wetlands** from other landform or water bodies is the characteristic vegetation of 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 given 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 upto 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 stations computed and then monthly district rainfall series has constructed by considering arithmetic average of all the station rainfall values within the district. The monthly rainfall series of the state has 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 utilized for identification of the mean spatial patterns and rainfall intensity trends. From mean and standard deviation (SD), the coefficient of variation (CV) calculated as follows: 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 see 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, September and southwest monsoon season, annual respectively. The trend lines 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. In the monthly rainfall June, July, August, September and seasonal rainfall shows decreasing trend. During the last 30 years highest rainfall of 390.3 mm received in June in the year 1994, 492.1 mm received in June in the year 2017, 431.5 mm received in August in the year 1997, while highest rainfall of 395.2 in September received in the year 1995. Highest annual rainfall of 1587.9 mm received in the year 1999 and highest southwest monsoon rainfall of 1364.6 mm received in the year 1994 (Climate Research and Services, IMD, Ministry of Earth Sciences, Pune, Jan'2020).

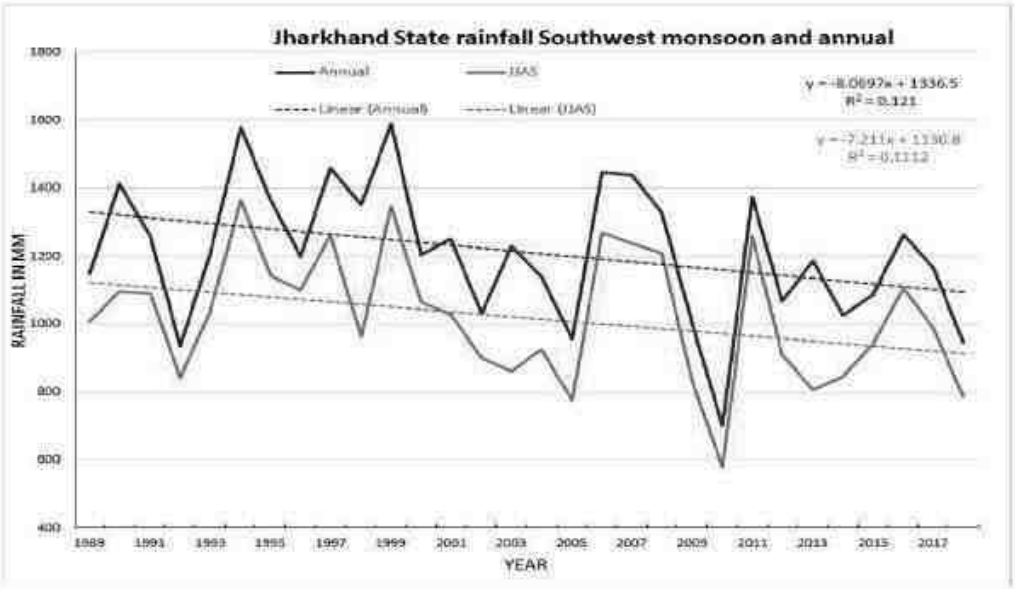


Fig-1.

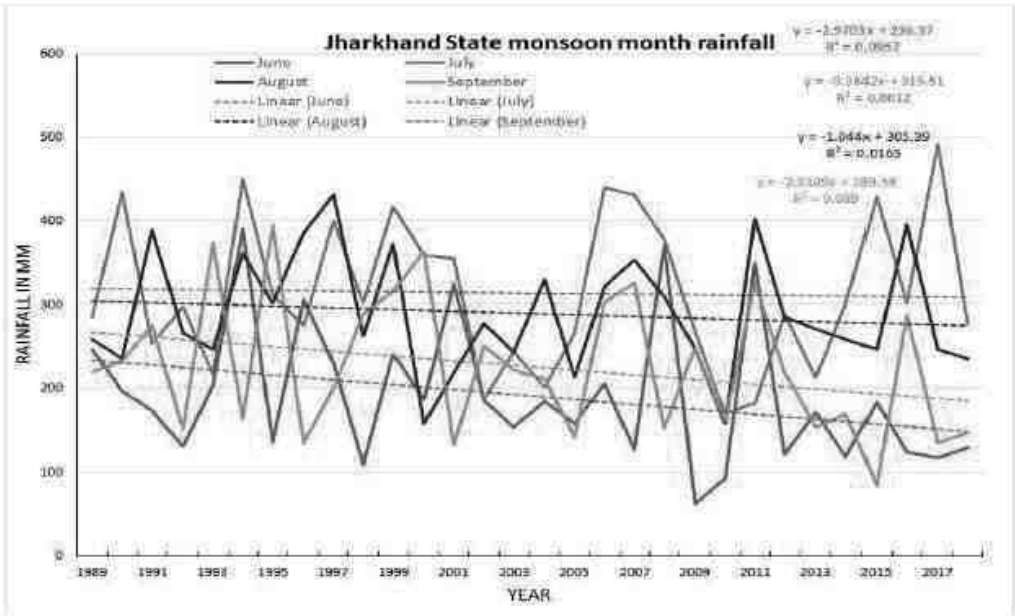


Fig-2.

2.0 GEOLOGY AND HYDROGEOLOGICAL SETUP OF THE AREA

2.1 REGIONAL GEOLOGY

The Jharia Coalfield covers an area of 453 sq. km. located in Dhanbad District, Jharkhand. The non-coal bearing Talchir Formation exposed in patches along the northern fringe of the Coalfield. The Barakar FormatioN overlies the Talchir is covering the most part of the Jharia Coalfield and having an area of 218 sq. km. This successively overlain by the non-coal bearing Barren Formation mainly exposed in the central part of the Coalfield. This, in turn, 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 in 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 which only 35 sq. km. comes under leasehold area of BCCL out of 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 in the area

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 constituted of fine to coarse grain sandstone having primary porosity of intergranular void space. The secondary porosity formed due to presence of faults, fracture, joints, etc. Sandstone of Gondwana formations in JCF and RCF are very hard, compact and cemented sandstone and forming less potential aquifer, particularly the 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 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 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 potential than semi-confined to confined aquifer.

SEMI-CONFINED TO CONFINED AQUIFER

The semi-confined to confined aquifer consisting of sandstone bed is sandwiched with coal seams/shale beds and multiple aquifer system developed due to presence of multiple numbers 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 potential.

Table –2 Generalized Hydrogeological Units developed in the study Area

Sl. No.	Type of Aquifer	Depth range (m)	Core zone (within 3 km)	Buffer zone (within 10 km)
1.	Unconfined	0 – 25 (Avg.)	Alluvium, weathered sandstone	Alluvium, weathered sandstone
2.	Semiconfined/ confined	Beyond 25 upto 650 m	Multiple Sandstone horizons in Barakar formation	Multiple Barakar, sandstone, Barren Measure, Raniganj sandstone and Talchir shale

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 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 un-confined aquifer, the sandstone partings in-between impervious layers of shale and coal seams 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). 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 considered for the study Area

Hydraulic Parameter	Unconfined aquifer Site: Damuda (BJ Section) and Block-III area	Semi-confined aquifer Site: (1): Sitanala Block (2): Kumari Block
Transmissivity (m^2/d)	10.68 – 41.48	0.0621 – 0.573
Hydraulic conductivity (m/d)	0.5	0.05 – 0.0027
Specific yield	0.03 to 0.04 (as per GEC recommended values)	

3.0 GROUND WATER LEVEL MONITORING

To collect the representative groundwater levels in the study area, CMPDI has established a monitoring network of total 252 monitoring stations out of which 64 located within core zone and rest comes within Buffer zone. Total 60 nos. dug well within JCF and 04 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-II**. Water level monitoring in all hydrograph stations has been done in pre-monsoon as well as in post monsoon whereas in 64 stations monitoring done in quarterly (May'20, Aug'20, Nov'20 and Jan'21) basis.

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 in 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 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 given from 2005 to 2020 of CMPDI monitoring stations (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
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

3.2 GROUNDWATER LEVEL SCENARIO IN NON-MINING/MINING AREA

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

Table – 5: Depth to water table

Formation	*Area*		*DTW (bgl, m) [Year-2020]*		*Average GWL (m)*	
			Pre-monsoon (Apr/May)	*Post-monsoon (Nov/Dec)*	*Pre-monsoon*	*Post-monsoon*
Sedimentary (Gondwana)	Non-mining		1.40-11.35	0.75-4.60	5.45	2.55
	Mining	OC	0.90-12.50	0.55-5.85	5.15	2.24
		UG	1.20-16.25	0.55-4.75	5.85	2.75
Metamorphics (Hard rock)	Peripheral part of the Coalfield		0.45-15.10	0.45-9.50	7.25	3.85

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 the JCF and RCF (part) area. The average hydraulic gradient of the water table within mining and non-mining areas given in Table-6. There is no significant change in hydraulic gradient observed. Relatively steep gradient near active opencast mining areas w.r.t., Non-Mining, Underground mines and Metamorphics areas observed.

Table – 6: Average hydraulic gradient

Sl. No	*Formation*	*Area*		*Average hydraulic gradient*
1	Sedimentary (Gondwana)	Non-Mining		1.0×10^{-3} to 3.0×10^{-3}
		Mining	OC	3.0×10^{-2} to 6.0×10^{-3}
			UG	2.0×10^{-2} to 4.0×10^{-3}
2	Metamorphics (Hard rock)	Peripheral part of the Coalfield		1.0×10^{-3} to 3.0×10^{-3}

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 works out 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-westerly slope. The RL varies from 182 m to 216 m AMSL. Katri River, Kumari Jore and its tributaries are controlling the drainage pattern of the area. The area comes under the watershed of Katri River.

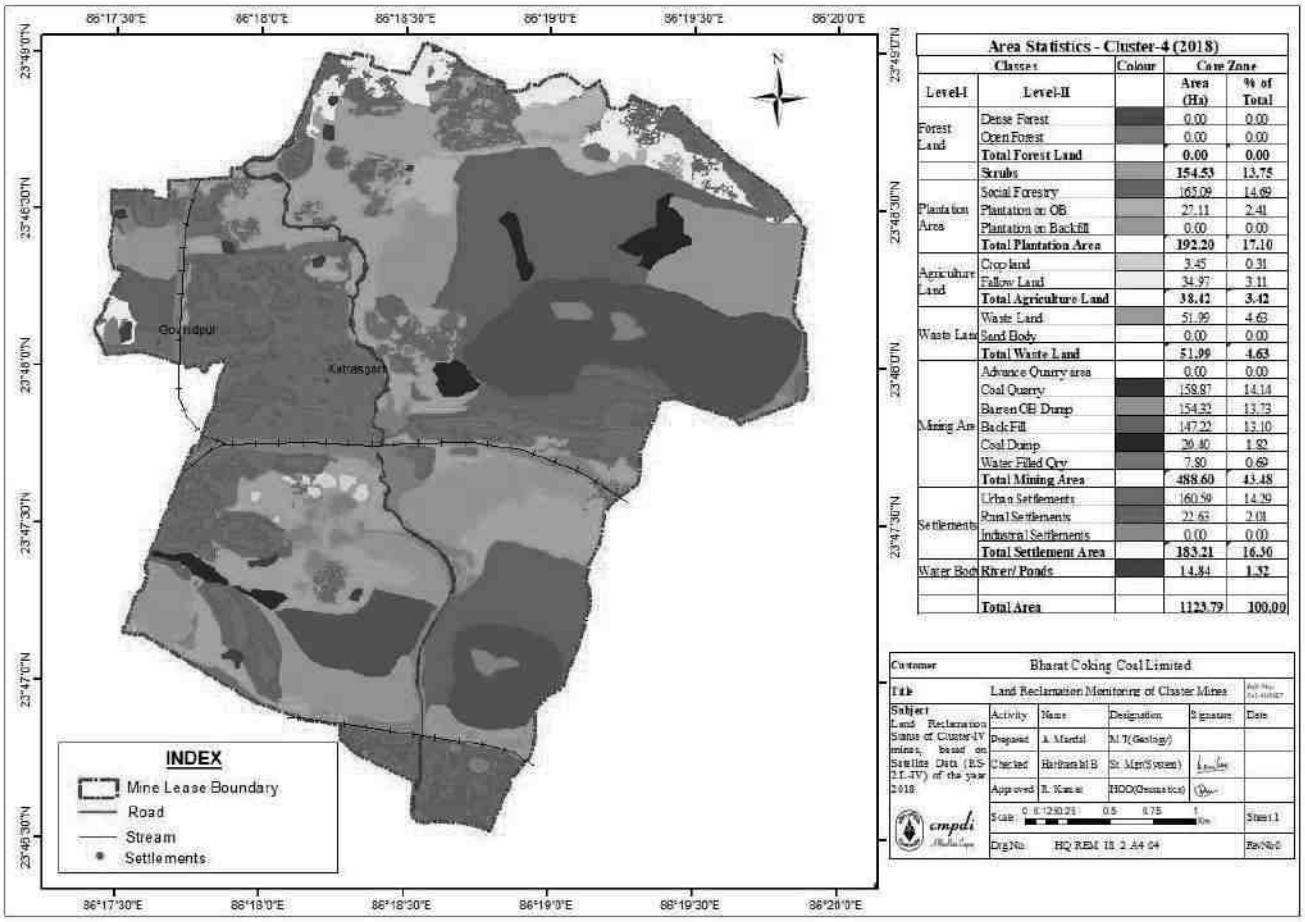
Monitoring stations (**A-26, A28A, B-64 and B-65A**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-26	Malkhera	6.98	2.69	3.18	4.78	6.58	2.23	3.33	3.83	4.75	6.23	3.58	3.88
2	A28A	Lakarka	4.00	1.33	3.03	3.35	2.45	1.25	3.15	3.60	2.22	4.15	2.00	2.51
3	B-64	Keshalpur	1.85	0.93	0.50	1.37	0.95	0.30	0.45	1.20	1.42	2.15	0.55	1.85
4	B65A	Jhinjipahari	9.25	0.03	2.30	4.10	11.05	1.85	0.95	2.95	4.18	10.03	2.10	2.40
Average WL (bgl)			5.52	1.25	2.25	3.40	5.26	1.41	1.97	2.90	3.14	5.64	2.16	2.66

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 0.95 m Max – 11.05 m
Post-monsoon GW Level (m): Min – 0.45 m Max – 3.88 m

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



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

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 fluctuation Below ground level (May, Aug, Nov'20 & Jan'21)	Avg. Fluctuation (in meters) during 2020-21	Geological Formation
1	I	4 nos.	0.15 to 10.00 m	2.76 m	Barakar
2	II	5 nos.	0.67 to 10.33 m	3.66 m	Barakar
3	III	5 nos.	0.32 to 10.33 m	2.95 m	Barakar
4	IV	4 nos.	0.03 to 9.25 m	3.27 m	Barakar
5	V	4 nos.	0.02 to 5.60 m	2.51 m	Barakar
6	VI	2 nos.	1.65 to 10.50 m	4.02 m	Barakar
7	VII	7 nos.	0.48 to 9.45 m	2.26 m	Barakar
8	VIII	4 nos.	1.41 to 8.45 m	2.87 m	Barakar
9	IX	6 nos.	0.30 to 9.40 m	1.53 m	Barakar
10	X	4 nos.	0.06 to 6.40 m	2.40 m	Barakar
11	XI	4 nos.	0.36 to 8.47 m	1.50 m	Barakar & Barren Measure
12	XIII	6 nos.	0.20 to 8.92 m	3.60 m	Raniganj
13	XIV	3 nos.	0.77 to 7.55 m	2.35 m	Raniganj
14	XV	3 nos.	0.85 to 4.88 m	1.20 m	Barakar & Barren Measure
15	XVI	3 nos.	0.70 to 5.90 m	0.75 m	Barakar

Depth to water level (in bgl) values described that water level goes down to maximum 10.50 m during pre-monsoon'2020 and maximum upto 8.60 m during post-monsoon'2020. Un-confined aquifer affected around 20 m to 30 m maximum 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 shown in **Annexure–VII**. Water Table contour map and Depth to water level map shown in **Plate-IV & V**.

Monitoring groundwater (quantity & quality) to assess the present condition and resource has done regularly in the coalfield areas. Well hydrographs (**Annexure–VI and VII**) are prepared and studied to identify potentially adverse trends so that appropriate action can protect groundwater resource. Hydrograph trend analysis of CGWB monitoring wells and CMPDI observation wells, reveals decline

trends in both Pre and Post-monsoon GW level trends (max. upto 0.55 cm/year in Cluster-I, Cluster-V and Cluster-VII) but no significant decline 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) given in **Annexure–V** and Quality is given in **Annexure–VII**.

5.0 GROUND WATER QUALITY

The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) collected from dug wells and analyzed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) analyzed during the month of June'2020 at CMPDI, RI-II, Dhanbad. The water sampling details given in **Annexure–V** and Water sample locations shown in **Plate-II**. The water quality data enclosed in **Annexure–VII.**

The study of the variations in water quality parameters described below:

The pH of the groundwater samples varies between 7.81 (GW-6) to 8.21 (GW-3), the pH is within the IS 10500 limit of drinking water standard.

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 178 (GW-11) to 764 mg/l (GW-5), the TDS values are above the IS 10500 standards of drinking water.

The alkalinity of the water samples varies from 76 (GW-6) to 152 mg/l (GW-11) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 32 (GW-11) to 180 mg/l (GW-15) and are ***slightly above*** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 148 (GW-8) to 680 mg/l (GW-5) and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 38 (GW-8) to 178 mg/l (GW-13) and the value of sulphate in water sample are within the permissible limit (200 mg/l). The Iron, Copper, Manganese, Lead, Zinc and Chromium concentration in the water samples found to be below the upper ISI limits for drinking water.

6.0 STAGE OF GROUNDWATER EXTRACTION

The groundwater mainly utilized for domestic needs and for irrigation purposes. The groundwater abstraction is mainly through dug wells and bore wells. The stage of groundwater development in Dhanbad District is 76.30% (as per 2017 GWRE). The highest stage of development is in Jharia Block (127.0%) & Dhanbad Block (107.50%) and lowest stage of development is in Baliapur Block (78.24%) as per GWRE-2013. 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. As per the assessment by Central Ground Water Board (CGWB), Patna in 2017, Block wise data of Dhanbad District given below:

Table–8A: Block wise Stage of Groundwater development

Sl No.	Administrative Unit		Stage of GW Development	Category (GWRE-2013)	Category (GWRE-2017)
	District	Block			
1	Bokaro	Bermo	156.30%	**Over- exploited**	**Over- exploited**
2	Dhanbad	Baghmara	91.74%	Critical	Critical
3	Dhanbad	Baliapur	78.24%	Semi- Critical	Semi- Critical
4	Dhanbad	Dhanbad	107.50%	**Over- exploited**	**Over- exploited**
5	Dhanbad	Jharia	127.0%	**Over- exploited**	**Over- exploited**
6	Dhanbad	Topchachi	98.45%	Critical	Critical

- **Dynamic Groundwater Resource Assessment, CGWB as per 2013 & 2017.**

Table–8B: 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) 2020		GW level declining trend 2005-2020		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	Bermo (SOD: Over-exploited)	2173 (2065+108)	NIL	2112 (1698+414)	61	5.46	2.69	YES	YES	Recharge structure needed
Cluster-II	Baghmara (SOD: Critical)	8350	Jamunia river	6737 (2755+3982)	1613	5.83	2.17	NO	NO	Excess mine water needed to be utilized
Cluster-III		12760 (10960+1800)	NIL	8946 (7849+1097)	3814	4.91	1.96	NO	NO	
Cluster-IV		5900	MADA	5100 (3605+1495)	800	5.52	2.25	NO	NO	
Cluster-V		12690 (11025+1665)	MADA	11063 (5710+5353)	1897	4.18	1.67	YES	YES	
Cluster-VI	Dhanbad (SOD: Over-exploited)	4150	MADA	4150 (1664+2486)	0.0	7.50	3.49	YES	NO	--
Cluster-VII		21565	MADA	20826 (17596+3230)	739	5.56	3.71	YES	YES	Excess mine water needed to be utilized water
Cluster-VIII	Jharia (SOD: Over-exploited)	9320	MADA	5294 (3730+1564)	4026	6.03	3.16	NO	NO	
Cluster-IX		12980	MADA	9358 (4549+4809)	3622	5.81	4.28	NO	NO	
Cluster-X		11825	Damodar river	6201 (4255+1946)	5624	5.69	3.29	YES	NO	
Cluster-XI	Dhanbad (SOD: Over-exploited)	24960	MADA & DVC	19425 (14015+5410)	5535	3.40	1.91	NO	NO	
Cluster-XIII	Baghmara (SOD: Critical)	4815	Damodar river	4815 (4679+136)	0.0	6.80	3.22	NO	NO	--
Cluster-XIV		2600	NA	2550 (2412+138)	50	5.42	3.08	NO	NO	--
Cluster-XV		6200	NA	5941 (4600+1341)	259	3.83	2.63	NO	NO	--
Cluster-XVI	Nirsa (SOD:Safe)	1910	DVC (Barakar river)	1730 (1380+350)	180	3.18	3.13	NO	NO	--

MADA – Mineral Area Development Authority, Jharkhand, Dhanbad (payment basis).

DVC – Damodar Valley Corporation, Maithon/Panchet, Jharkhand (payment basis).

7.0 IMPACT OF MINING ON GROUND WATER REGIME

7.1 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 of recharge to aquifers
- Change in groundwater flow pattern

The general need in mine planning from the hydrogeological point of view is the estimation of make of water (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 the 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.

7.2 POTENTIAL CONSEQUENCES OF OPENCAST AND UNDERGROUND COAL MINES OF JHARIA COALFIELD ON HYDROGEOLOGICAL REGIME

Generally, in the opencast and underground mines of Jharia Coalfield, alluvium and overlying weathered mantle are the first to excavate 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, the depression in the water table created. The initial discharges due to this depression is large in amount due to concentration of flow to that region. In the top zones, water table condition prevails and away from the opening in the stratified section, semi-confined conditions exist. With progress of mine operations, there is an increase in the depth of incision as a result; the semi-confined aquifers are also punctured.

During mining the hydraulic gradients generally, steeps down near mine i.e. within the mine influence area. In the up-dip region, only un-confined aquifer punctured through the mining process and thus only it

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 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.

7.3 ESTIMATION OF RADIUS OF MINE INFLUENCE ZONE

Radius of Influence can 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 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 has used for Barakar Formations i.e. 0.05 m/d or 5.7×10^{-7} m/sec.

It may be appropriate to mention here that the presence of prominent boundaries/water bodies, faults or interfringing of sandstone and shale beds may restrict propagation of the 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 not directly affected. During the working of board and pillar method, subsidence takes place during the extraction of total coal (depillaring), both the phreatic and semi-confined aquifers get affected. Surface vigilance and filling up subsided zone, if any, has to constantly in view. The effect on groundwater level for most of the coal mine in Jharia coalfield has been observed in the down-dip side, generally within a distance upto 500 m and becomes milder/ negligible thereafter.

8.0 CONSERVATION MEASURES & FUTURE STRATEGY

- BCCL has installed 25 Pressure Filter Plant of total capacity of 4.16 MGD to meet drinking water requirement nearby the 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 with the capacity of 5.84 MGD are in progress.

- BCCL 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 plant has proposed at other sites of BCCL.
- A scheme entitled '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 through pipe line by mine discharge at mines of Barora, Block-II and Govindpur Area.
- Rooftop rainwater harvesting (RWH) will took up in the project area using the administrative buildings. 138 no. of quarters having roof-top area of about 14950 sq. m. is already prepared to harvest rainwater and around 13150 cum/annum of water is going to be recharged the nearby groundwater system through RWH structures. Proposal already 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 rainfall and abundant ground water recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may 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 through connecting pipeline to abandoned dug wells. Utilization of mine water for irrigation use 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.
- Creation of awareness among workers and local peoples about Rainwater harvesting and artificial recharge will have priority. This aspect usually covered during the Environmental Week celebrated every year (5 to 12 June).
- 23 nos. of Piezometer proposed to install within JCF and RCF to monitor GW level (**Plate-III**).

Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will continued under routine monitoring (May, August, November & Jan).

9.0 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



RECHARGE POND / ABANDONDED IN THE JCF 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



FILTER PLANT IN THE MINE AREA

Fig-15.



Government of India
Ministry of Environment, Forest and Climate Change
Wetlands Division

List of Ramsar Sites in India

S. No	Name of Ramsar site	State	Area in hectares	Date of designation	Coordinates
1.	Ashtamudi Wetland	Kerala	6,140	19/08/2002	08°57'N 076°34'E
2.	Beas Conservation Reserve	Punjab	6,429	26/09/2019	31°23'N 075°11'E
3.	Bhitarkanika Mangroves	Odisha	65,000	19/08/2002	20°39'N 086°54'E
4.	Bhoj Wetland	Madhya Pradesh	3,201	19/08/2002	23°13'N 077°19'E
5.	Chandertal Wetland	Himachal Pradesh	49	08/11/2005	32°28'N 077°36'E
6.	Chilika Lake	Odisha	116,500	01/10/1981	19°42'N 085°21'E
7.	Deepor Beel	Assam	4,000	19/08/2002	26°07'N 091°39'E
8.	East Calcutta Wetlands	West Bengal	12,500	19/08/2002	22°27'N 088°27'E
9.	Harike Lake	Punjab	4,100	23/03/1990	31°13'N 075°12'E
10.	Hokera Wetland	Jammu & Kashmir	1,375	08/11/2005	34°04'N 074°42'E
11.	Kanjli	Punjab	183	22/01/2002	31°25'N 075°22'E
12.	Keoladeo National Park (MR)	Rajasthan	2,873	01/10/1981	27°13'N 077°31'E
13.	Keshopur-Miani Community Reserve	Punjab	344	26/09/2019	32°05'N 075°23'E
14.	Kolleru Lake	Andhra Pradesh	90,100	19/08/2002	16°37'N 081°12'E
15.	Loktak Lake (MR)	Manipur	26,600	23/03/1990	24°25'N 093°49'E
16.	Nalsarovar	Gujarat	12,000	24/09/2012	22°46'N 072°02'E
17.	Nandur Madhameshwar	Maharashtra	1,437	21/06/2019	20°01'N 074°06'E
18.	Nangal Wildlife Sanctuary	Punjab	116	26/09/2019	31°23'N 076°22'E
19.	Nawabganj Bird Sanctuary	Uttar Pradesh	225	19/09/2019	26°36'N 080°39'E
20.	Parvati Arga Bird Sanctuary	Uttar Pradesh	722	02/12/2019	26°56'N 082°09'E
21.	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu	38,500	19/08/2002	10°19'N 079°37'E
22.	Pong Dam Lake	Himachal Pradesh	15,662	19/08/2002	32°01'N 076°04'E
23.	Renuka Wetland	Himachal Pradesh	20	08/11/2005	31°37'N 077°27'E
24.	Ropar	Punjab	1,365	22/01/2002	31°01'N 076°30'E
25.	Rudrasagar Lake	Tripura	240	08/11/2005	23°28'N 091°16'E
26.	Saman Bird Sanctuary	Uttar Pradesh	526	02/12/2019	27°00'N 079°10'E
27.	Samaspur Bird Sanctuary	Uttar Pradesh	799	03/10/2019	25°59'N 081°23'E
28.	Sambhar Lake	Rajasthan	24,000	23/03/1990	27°00'N 075°00'E
29.	Sandi Bird Sanctuary	Uttar Pradesh	309	26/09/2019	27°18'N 079°58'E
30.	Sarsai Nawar Jheel	Uttar Pradesh	161	19/09/2019	26°58'N 079°15'E

Annexure – IV

Rainfall Data (in mm) At Dhanbad Observatory Station, IMD (Source: WRIS Website data)

Year	January	February	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Annual
1994	26.5	20.0	3.3	23.5	4.5	289.5	245.5	240.0	134.0	40.5	0.0	0.0	1027.3
1995	15.0	18.3	20.0	0.0	34.5	122.0	140.1	257.0	446.0	0.0	34.0	5.5	1092.4
1996	12.5	12.5	5.2	0.0	0.0	210.5	138.5	400.0	214.0	24.0	0.0	0.0	1017.2
1997	10.5	17.5	2.8	63.5	41.5	231.5	599.3	621.1	196.8	16.5	34.0	16.0	1851.0
1998	20.5	21.0	160.0	18.0	40.0	80.0	347.0	409.0	123.0	120.5	11.0	0.0	1350.0
1999	0.0	0.0	0.0	0.0	64.0	150.0	511.0	336.0	510.5	124.0	0.0	0.0	1695.5
2000	2.0	15.0	0.0	20.0	68.0	452.5	270.5	89.0	234.5	-	0.0	0.0	1151.5
2001	0.0	0.0	34.0	13.0	104.0	448.7	552.5	121.0	107.0	126.5	0.0	0.0	1506.7
2002	12.0	10.0	26.0	0.0	32.5	185.0	150.0	125.5	310.0	64.0	0.0	0.0	915.0
2003	6.0	58.5	38.5	40.0	24.0	-	366.1	279.0	145.1	151.6	0.0	2.3	1111.1
2004	18.45	2.13	1.55	53.93	9.53	95.95	408.57	261.07	174.01	63.01	51.10	12.85	1152.15
2005	44.49	23.11	26.16	17.90	28.95	272.26	388.86	158.86	69.03	117.63	0.09	1.67	1149.01
2006	0.00	0.00	3.11	12.64	86.68	113.20	505.72	316.06	339.51	9.80	3.73	0.00	1390.45
2007	0.00	58.69	35.76	21.08	25.33	139.60	666.30	416.85	363.93	43.63	1.57	0.00	1772.74
2008	16.44	1.96	6.27	6.78	37.26	180.58	422.25	275.33	198.31	27.64	0.00	0.00	1172.82
2009	0.00	0.26	5.81	0.19	105.82	78.32	232.20	370.39	429.16	68.56	11.31	0.98	1303.00
2010	0.59	19.64	7.62	38.24	93.72	146.68	157.31	198.97	239.75	78.76	5.26	40.53	1027.07
2011	0.00	1.60	18.25	12.81	102.58	294.61	174.35	445.43	214.88	30.35	0.69	0.00	1295.55
2012	18.45	2.13	1.55	53.93	9.53	95.95	408.57	261.07	174.01	63.01	51.10	12.85	1152.15
2013	0.07	17.62	0.79	15.24	105.51	176.77	170.14	276.70	135.76	304.46	0.00	0.00	1203.06
2014	9.27	35.71	21.21	8.16	62.77	112.58	283.73	223.38	214.48	30.30	0.00	0.00	1001.59
2015	12.06	3.33	26.71	45.73	32.91	162.96	385.21	239.38	71.34	15.62	0.00	0.61	995.86
2016	6.16	17.59	1.73	1.33	73.90	197.34	248.86	395.33	424.81	30.45	0.00	0.00	1397.50
2017	5.12	0.00	34.96	59.89	81.01	141.66	502.58	168.84	111.95	274.18	0.64	4.12	1384.95
2018	0.00	0.06	2.90	159.52	31.22	202.84	344.59	211.91	153.63	16.31	0.04	20.99	1144.01
2019	0.00	25.18	7.24	46.99	109.43	109.11	292.02	234.65	327.95	199.63	0.10	5.13	1357.43
2020	21.14	5.94	74.96	27.94	71.32	218.12	187.01	258.74	196.87	52.23	1.23	0.00	1115.50

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

Annexure – V

Location of Hydrograph Stations (Dug Wells)

Well No	Latitude	Longitude	Well No	Latitude	Longitude
A-3	23^{0}47'53.35" N	86^{0}19'55.14" E	**B-63**	Abandoned due to OCP	
A-12	23^{0}48'20.31" N	86^{0}16'51.64" E	**B-64**	23^{0}48'43.14" N	86^{0}18'44.25" E
A-16	23^{0}46'57.00" N	86^{0}21'38.57" E	**B-65A**	23^{0}48'53.65" N	86^{0}18'11.82" E
A-17	23^{0}45'09.44" N	86^{0}22'16.35" E	**B-67**	23^{0}43'30.70" N	86^{0}14'01.45" E
A-18	23^{0}44'37.65" N	86^{0}22'58.90" E	**D-3**	23^{0}46'46.31" N	86^{0}24'49.30" E
A-19	23^{0}41'12.86" N	86^{0}23'55.27" E	**D-4**	23^{0}44'29.37" N	86^{0}24'42.88" E
A-20	23^{0}44'56.64" N	86^{0}19'55.35" E	**D-5**	23^{0}42'20.05" N	86^{0}24'86.06" E
A-22	23^{0}43'06.65" N	86^{0}14'48.53" E	**D-7**	23^{0}43'12.08" N	86^{0}27'11.89" E
A-23	23^{0}45'06.38" N	86^{0}15'12.69" E	**D-8**	23^{0}44'06.13" N	86^{0}27'20.72" E
A-24	23^{0}45'20.44" N	86^{0}13'45.12" E	**D-23**	23^{0}47'20.89" N	86^{0}20'09.96" E
A-25	23^{0}47'06.20" N	86^{0}15'27.79" E	**D-25**	23^{0}47'03.28" N	86^{0}23'29.56" E
A-26	23^{0}46'49.24" N	86^{0}18'12.12" E	**D-30**	23^{0}48'36.10" N	86^{0}21'50.07" E
A-27	23^{0}48'42.55" N	86^{0}20'21.80" E	**D-33**	23^{0}45'34.62" N	86^{0}23'18.50" E
A-28A	23^{0}47'34.74" N	86^{0}18'04.18" E	**D-34**	23^{0}45'36.50" N	86^{0}23'02.45" E
A-29	23^{0}47'08.02" N	86^{0}16'02.72" E	**D-35**	23^{0}40'46.54" N	86^{0}25'46.33" E
A-32	23^{0}44'15.56" N	86^{0}20'43.80" E	**D-36**	23^{0}40'19.26" N	86^{0}25'18.98" E
A-33	23^{0}44'32.58" N	86^{0}16'58.28" E	**D-39**	23^{0}43'28.50" N	86^{0}26'0.10" E
A-34	23^{0}42'58.63" N	86^{0}15'19.31" E	**D-40A**	23^{0}43'20.18" N	86^{0}25'45.70" E
B-1	23^{0}48'48.06" N	86^{0}14'16.87" E	**D-41**	23^{0}42'40.00" N	86^{0}26'17.20" E
B-14	23^{0}48'00.81" N	86^{0}16'25.88" E	**D-43***	NA	NA
B-15	23^{0}46'06.92" N	86^{0}08'59.30" E	**D-47**	23^{0}45'20.59" N	86^{0}24'34.86" E
B-21A	23^{0}45'10.50" N	86^{0}09'36.38" E	**D-49**	23^{0}44'08.96" N	86^{0}26'32.71" E
B-23	23^{0}44'13.05" N	86^{0}11'46.56" E	**D-51**	23^{0}44'20.86" N	86^{0}27'11.37" E
B-24	23^{0}44'26.80" N	86^{0}13'09.38" E	**D-55**	23^{0}43'58.37" N	86^{0}24'07.45" E
B-25	23^{0}44'44.98" N	86^{0}13'57.80" E	**D-74**	23^{0}41'33.66" N	86^{0}25'06.10" E
B-32A	23^{0}45'49.18" N	86^{0}13'03.64" E	**D-77**	23^{0}41'00.74" N	86^{0}22'25.55" E
B-48	23^{03}4'35.09" N	86^{0}16'38.30" E	**D-80**	23^{0}46'09.46" N	86^{0}24'33.08" E
B-51	23^{0}47'40.20" N	86^{0}09'11.90" E	**DB-22**	23^{0}43'38.81" N	86^{0}45'09.00" E
B-53	23^{0}45'55.25" N	86^{0}09'35.44" E	**DB-23**	23^{0}43'44.24" N	86^{0}45'06.39" E
B-53A	DO	DO	**DB-24**	23^{0}43'53.00" N	86^{0}45'03.88" E
B-59	23^{0}47'59.87" N	86^{0}13'37.97" E	**DB-25**	23^{0}44'10.75" N	86^{0}44'35.84" E
B-60	23^{0}48'7.87" N	86^{0}15'37.12" E			
B-61A	23^{0}45'59.85" N	86^{0}11'40.80" E			
B-62A	23^{0}45'44.15" N	86^{0}11'27.80" E			

Annexure – VA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
A-3	Sijua	0.53	3.00	5.20	203	Barakar	Govt.	Domestic
A-12	Jamua	0.80	1.90	3.30	202	Barakar	Govt.	Domestic
A-16	Ekra, Kalali More	0.45	3.10	6.50	205	Barakar	Govt.	Domestic
A-17	Kachi Balihari	0.56	1.60	5.30	182	Barakar	Govt.	Domestic
A-18	Bhagabandh	0.61	1.45	3.37	182	Barakar	Govt.	Domestic
A-19	Bhaura	0.54	3.15	11.65	162	Barakar	Govt.	Domestic
A-20	Gorbhudih	0.43	3.30	8.30	181	BM	Govt.	Domestic
A-22	Nagdah, Niche	0.00	1.40	9.50	171	Raniganj	Govt	Irrigation
A-23	Machhyara	0.43	1.85	12.40	203	Raniganj	Govt	Domestic
A-24	Pipra Tanr	0.22	1.80	19.55	208	Raniganj	Govt	Domestic
A-25	Sinidih	0.22	2.00	11.30	203	Barakar	Govt	Domestic
A-26	Pasitanr	0.32	1.80	9.65	198	Barakar	Govt	Domestic
A-27	Chandor	0.60	2.50	5.50	221	Barakar	Govt	Domestic
A-28A	Lakarka 6 no.	0.65	1.30	5.25	199	Barakar	BCCL	Domestic
A-29	Aambagan	0.10	2.60	9.15	186	Barakar	Govt	Domestic
A-32	Baludih	0.55	2.30	6.85	182	BM	Govt	Domestic
A-33	Mahuda	0.75	2.00	10.80	195	BM	BCCL	Domestic
A-34	Bhatdih	0.55	3.50	24.50	162	Raniganj	BCCL	Domestic
B-1	Muraidih	0.47	1.80	5.35	212	Talchir	Govt	Domestic
B-14	Mathadih	0.76	2.15	3.75	201	Barakar	Govt	Domestic
B-15	Bera Basti	0.55	1.60	2.50	221	Talchir	Dhanu Roy	Domestic
B-21A	Dugdha	0.55	2.10	10.35	220	Metamorphics	Govt	Domestic
B-23	Lohapati	0.26	3.60	10.85	204	Raniganj	Govt	Domestic
B-24	Telmuchu	0.67	4.35	10.83	207	Raniganj	Govt	Domestic
B-25	Mahuda More	0.10	2.45	8.45	205	Raniganj	Govt	Domestic
B-32A	Madhuband	0.80	4.30	8.60	205	Barakar	BCCL	Domestic
B-48	Mahuda	0.65	2.10	11.50	181	Raniganj	Mosque	Domestic
B-51	Taranga	0.00	2.50	5.75	215	Metamorphics	Bisun	Irrigation
B-53	Karmatanr	0.58	2.70	13.25	195	Barakar	Govt	Domestic
B-53A	Damoda OCP							
B-59	Khodovaly	0.60	2.40	9.30	202	Barakar	BCCL	Domestic
B-60	Bahiyardih	0.77	3.00	15.60	196	Barakar	BCCL	Domestic
B-61A	Kesargora	0.48	2.00	11.20	201	Barakar	BCCL	Domestic
B-62A	Sadariyadih	0.15	3.10	9.50	188	Barakar	Govt	Domestic

Annexure – VA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
B-63	West Mudidih	0.60	1.70	3.35	196	Barakar	BCCL	Domestic
B-64	Keshalpur	0.65	1.10	3.40	195	Barakar	BCCL	Domestic
B-65A	Jhinjipahari	0.95	2.20	12.40	196	Barakar	Shiv Temple	Domestic
B-67	Simatanr	0.55	2.20	11.80	198	Raniganj	Govt	Domestic
D-3	Dhansar	0.60	1.70	8.70	217	Barakar	Govt	Domestic
D-4	Jharia	0.59	1.90	5.73	218	Barakar	Govt	Domestic
D-5	Jiyalgora	0.70	2.80	10.55	183	Barakar	Govt	Domestic
D-7	Golden Pahari	0.67	2.85	10.05	201	Barakar	BCCL	Domestic
D-8	Alokdiha	0.35	1.75	7.57	201	Metamorphics	BCCL	Domestic
D-23	Jogta (Sindra)	0.40	3.10	7.25	205	Barakar	BCCL	Domestic
D-25	Godhar More	0.60	2.75	5.60	219	Barakar	Govt	Domestic
D-30	Borkiboa	0.70	2.00	5.60	221	Talchir	H.Kumbhakar	Domestic
D-33	Kustore-4	0.55	1.85	3.45	196	Barakar	BCCL	Domestic
D-34	Kusunda-7	0.60	1.50	3.45	201	Barakar	BCCL	Domestic
D-35	Patherdih	0.40	2.00	11.20	160	Barakar	BCCL	Domestic
D-36	Sudamdih	0.90	2.00	6.20	141	Barakar	BCCL	Domestic
D-39	Tilabani	0.85	2.00	5.90	178	Barakar	BCCL	Domestic
D-40A	Khapra Dhaora	0.55	1.95	3.70	180	Barakar	Panchayat	Domestic
D-41	Joyrampur	0.50	1.80	4.00	180	Barakar	BCCL	Domestic
D-43	Alagdih	0.45	2.20	8.90	200	Metamorphics	Govt	Domestic
D-47	Parastanr	0.45	3.20	23.80	206	Barakar	BCCL	Domestic
D-49	Goluckdih	0.55	1.80	6.15	192	Barakar	BCCL	Domestic
D-51	Chankuiya	0.55	3.70	11.90	197	Barakar	BCCL	Domestic
D-55	Hariladih	0.48	2.80	11.80	184	Barakar	Govt	Domestic
D-74	Bhulan Barari	0.10	1.60	12.80	173	Barakar	Govt	Domestic
D-77	Rohoniatanr	0.40	3.15	6.70	156	Barakar	Govt	Domestic
D-80	Bastacolla	0.70	2.50	24.95	219	Barakar	Govt	Domestic
DB-22	Nichebasti	0.67	2.40	10.65	121	Barakar	Govt	Domestic
DB-23	Dahibari OC	0.70	2.30	8.00	-	Barakar	BCCL	Domestic
DB-24	Dahibari	0.60	3.60	13.70	125	Barakar	BCCL	Domestic
DB-25	Palasya	0.37	1.55	5.25	127	Barakar	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 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
A-3	4.67	2.37	3.70	3.42	4.87	0.47	0.67	0.77	1.27	0.47	3.47	0.47	1.57	0.47
A-12	2.45	1.4	3.00	2.68	2.50	0.70	2.55	0.85	2.80	1.0	2.10	0.45	2.60	0.50
A-16	5.5	2.9	5.55	4.17	5.85	3.15	3.65	2.20	4.30	3.65	5.45	1.95	7.15	1.75
A-17	2.19	1.91	3.79	2.64	2.44	2.69	2.44	2.24	3.34	2.84	2.94	2.24	2.14	1.69
A-18	1.76	1.19	2.84	1.29	1.14	0.89	1.29	0.99	1.24	0.99	2.29	0.69	1.09	0.34
A-19	3.00	2.75	3.05	2.75	7.81	4.11	6.37	2.45	5.55	2.45	4.85	3.43	6.05	3.25
A-20	3.97	2.55	4.59	2.93	7.49	3.50	4.27	1.77	4.57	2.57	4.57	1.82	8.47	3.87
A22A	1.50	2.0	3.20	1.96	3.25	1.75	4.27	1.77	3.35	1.30	2.60	2.00	2.90	1.98
A-23	8.76	6.82	11.3	9.37	11.87	8.13	6.40	1.50	11.15	7.17	11.97	3.77	8.92	5.62
A-24	16.28	14.98	17.2	14.5	16.62	12.43	11.87	6.97	14.58	6.88	15.88	2.48	*4.88	4.28
A-25	7.03	5.28	7.78	5.85	7.43	4.58	6.38	2.88	6.63	3.13	6.08	1.93	2.98	1.83
A-26	7.71	4.58	7.73	3.18	8.93	4.48	5.28	2.53	6.23	3.88	6.58	3.33	6.98	3.18
A-27	1.63	1.55	4.40	3.95	4.85	1.80	2.90	1.25	2.90	1.0	2.40	0.92	2.40	1.10
A28A	3.29	1.91	4.35	3.60	3.35	1.47	4.30	1.55	4.15	2.51	2.45	3.15	4.00	3.03
A-29	3.3	2.35	4.55	4.60	5.92	6.96	4.40	1.30	6.45	2.10	4.85	3.40	6.20	3.20
A-32	3.15	2.45	4.41	2.13	4.75	2.10	3.15	1.55	2.80	0.70	2.75	0.95	1.90	1.75
A-33	4.08	1.57	4.91	1.97	5.75	2.60	6.45	1.55	4.07	2.35	3.65	1.25	4.55	1.85
A-34	4.45	4.45	8.40	4.81	4.75	4.45	12.45	4.45	5.90	3.70	6.35	3.95	8.35	3.45
B-1	2.43	1.81	3.28	2.75	3.58	1.93	2.33	0.85	2.88	2.08	3.18	1.73	3.28	1.63
B-14	3.24	4.44	2.94	2.29	2.44	0.47	2.94	1.84	3.64	2.84	2.24	0.94	2.44	1.04
B-15	0.95	1.45	1.50	0.45	1.85	0.55	4.85	0.15	1.85	0.85	1.90	1.65	3.70	1.47
B21A	9.54	3.7	7.37	4.65	5.55	4.50	8.85	5.65	9.65	2.65	9.45	-	10.00	5.80
B-23	6.57	2.74	7.86	4.29	6.81	2.41	7.74	2.14	6.64	2.14	2.84	1.34	3.24	1.76
B-24	9.40	2.21	10.0	5.78	10.63	4.28	10.03	4.03	9.28	4.33	4.58	2.33	5.48	3.53
B-25	5.82	5.15	6.88	-	7.05	1.70	6.70	1.40	5.90	3.70	4.80	1.40	7.90	2.55
B32A	8.33	2.05	7.55	3.32	6.95	3.07	6.95	2.80	6.75	3.90	5.55	1.70	3.30	2.00
B-48	6.38	4.35	7.90	5.42	9.35	4.60	7.70	4.15	7.33	3.97	7.05	4.35	8.20	3.85
B-51	2.09	1.98	4.65	3.40	4.90	3.18	4.98	2.55	5.02	2.42	5.10	2.70	5.00	2.10
B-53	3.39	-	5.58	2.82	4.70	1.45	4.02	1.92	3.92	1.42	3.22	1.42	3.12	1.40
B-59	2.65	1.0	4.12	1.60	4.40	0.50	5.40	0.60	5.47	1.10	6.20	0.90	5.25	1.40
B-60	9.82	4.59	9.21	5.28	10.33	5.03	13.23	3.18	13.68	4.23	8.13	3.23	10.33	3.21
B61A	6.93	3.57	6.15	4.52	6.58	3.87	2.57	0.82	2.57	2.02	3.32	0.52	3.32	1.60
B62A	8.83	5.85	9.10	5.21	9.30	4.95	8.15	4.35	8.27	4.78	7.55	3.25	6.95	3.00

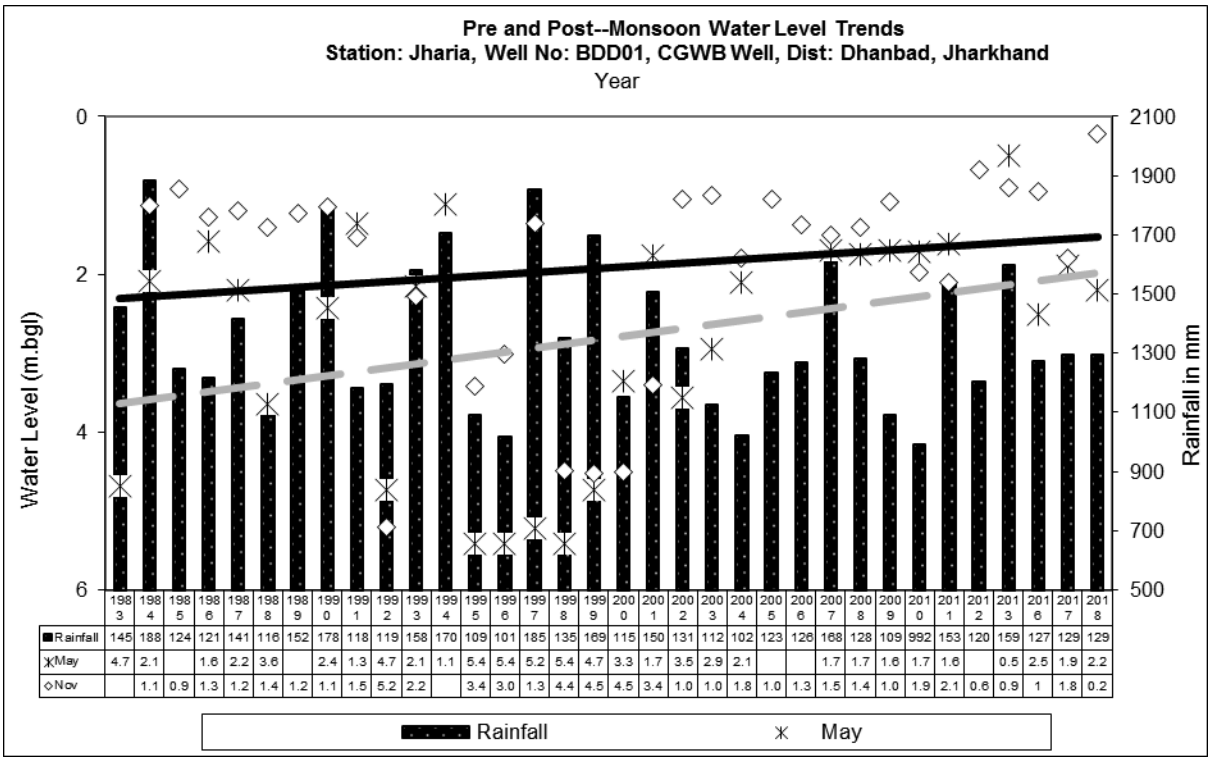
Annexure – VB

Historical Water Level data of Hydrograph Stations

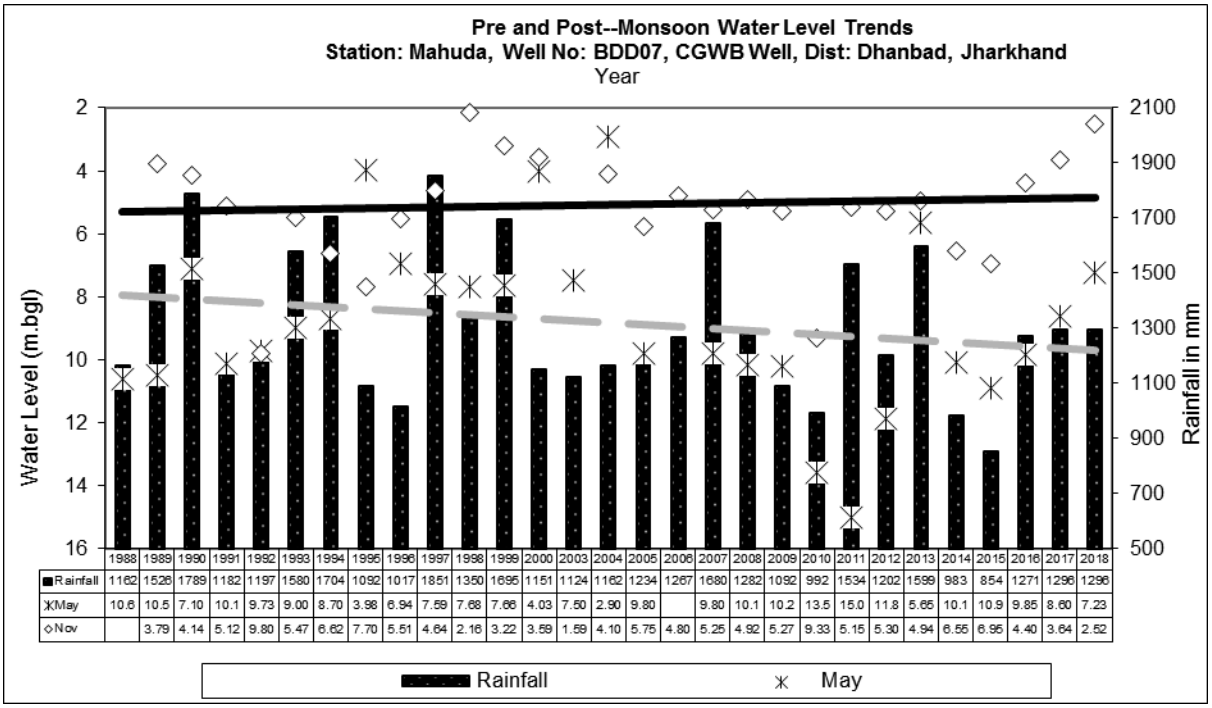
Well No	Water level below ground level (bgl) in meters													
	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
B-64	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85	0.95	0.45	1.85	0.50
B65A	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40	11.05	0.95	9.25	2.30
B-67	9.80	3.72	9.23	5.53	9.53	4.30	10.00	2.15	9.55	4.0	8.57	4.35	7.55	3.95
D-3	2.54	2.11	4.25	2.25	2.35	1.90	2.15	2.30	3.43	2.45	1.75	1.30	5.40	1.38
D-4	1.23	0.91	2.41	1.27	1.21	1.36	1.21	1.46	1.91	1.56	2.81	1.71	3.41	1.41
D-5	9.0	7.8	9.37	8.33	9.40	6.40	7.90	5.20	7.80	5.30	8.25	4.85	8.60	7.70
D-7	5.28	5.53	8.25	5.61	7.53	4.03	7.33	2.88	7.53	2.83	8.23	3.28	7.33	5.13
D-8	7.73	-	6.24	4.38	8.00	3.43	5.15	1.85	5.65	1.85	4.80	2.85	5.83	2.75
D-23	6.38	2.4	6.55	3.48	5.70	1.63	2.80	2.98	4.40	3.40	4.70	1.40	5.60	3.35
D-25	4.42	2.9	4.48	2.45	2.40	1.90	2.40	1.20	2.60	2.40	*9.90	*5.38	10.50	5.62
D-30	4.17	3.3	4.55	3.15	4.45	3.20	4.40	1.25	4.58	1.10	4.60	0.75	4.50	1.35
D-33	1.72	0.35	2.25	1.10	2.50	1.95	0.75	0.75	2.85	0.95	2.35	1.65	3.65	1.45
D-34	2.80	0.30	2.55	1.45	2.30	0.30	0.80	0.55	2.80	0.45	4.75	2.40	3.30	2.80
D-35	6.94	6.15	9.80	7.90	9.52	6.45	8.80	3.60	8.40	4.45	8.00	3.80	8.20	5.40
D-36	1.82	0.75	1.66	1.13	0.78	0.95	1.30	0.70	1.20	0.60	1.20	0.55	2.10	1.00
D-39	5.03	2.25	5.00	2.61	2.18	2.65	6.17	4.75	4.95	4.35	*12.60	*5.95	9.40	6.05
D40A	2.35	2.45	3.07	2.45	1.40	0.85	1.45	1.35	2.10	1.40	1.85	1.45	1.95	1.43
D-41	3.20	1.35	2.65	2.32	1.30	1.52	1.40	1.20	1.59	1.32	2.30	1.25	3.30	1.45
D-43	6.0	4.75	6.61	5.05	8.20	3.35	7.50	3.60	7.15	3.45	7.35	2.70	6.60	2.55
D-47	8.0	2.37	9.60	3.60	3.18	2.95	3.15	2.85	5.33	2.55	4.55	4.35	9.45	5.45
D-49	2.51	1.65	3.55	2.35	2.45	1.72	2.70	2.05	3.45	2.45	1.75	1.50	3.25	1.65
D-51	9.60	9.05	10.48	9.15	11.15	6.45	10.45	5.43	10.93	7.10	9.95	5.75	8.45	5.70
D-55	1.95	2.07	6.15	1.57	2.52	3.62	6.42	2.37	8.42	1.57	8.42	5.47	9.42	8.60
D-74	5.0	4.0	10.05	7.20	7.73	5.00	9.25	3.85	8.60	4.80	5.80	3.57	4.30	3.93
D-77	6.23	6.0	6.44	5.60	4.60	2.90	6.50	4.90	6.30	5.20	6.40	3.20	6.40	3.50
D-80	13.3	3.15	10.97	3.35	6.55	4.15	8.65	3.70	9.35	4.20	5.00	3.05	4.30	4.90
RCF (part)	May 14	Nov 14	May 15	Nov 15	May 16	Nov 16	May 17	Nov 17	May 18	Nov 18	May 19	Nov 19	May 20	Nov 20
DB22	6.48	3.03	4.59	3.53	5.38	3.33	1.93	1.63	2.34	1.93	4.93	1.63	2.63	2.25
DB23	3.95	2.13	3.38	6.04	5.30	0.90	2.05	1.90	2.85	1.75	1.60	0.80	2.50	1.95
DB24	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78	8.25	5.70	9.35	3.88	5.70	3.60
DB25	3.27	2.73	3.83	2.68	3.61	1.98	3.23	2.58	3.93	1.63	-	-	3.98	2.63

***New well**

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS

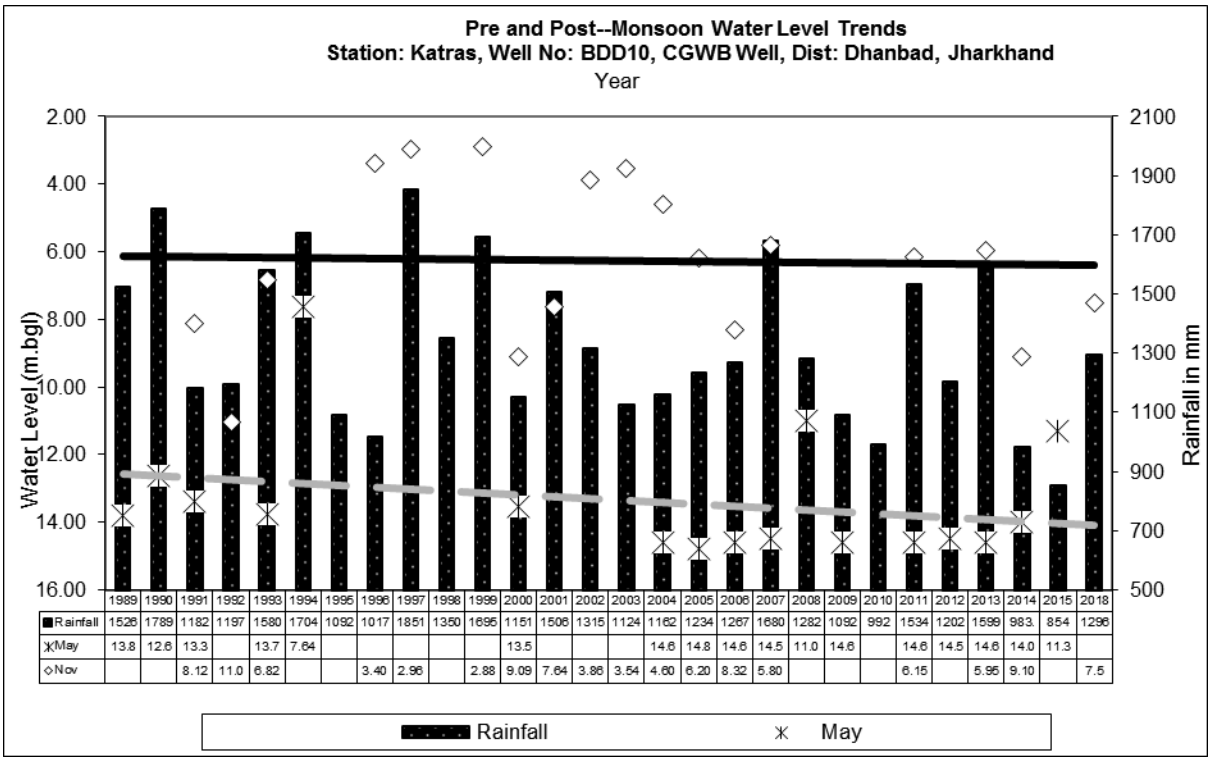


	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	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		

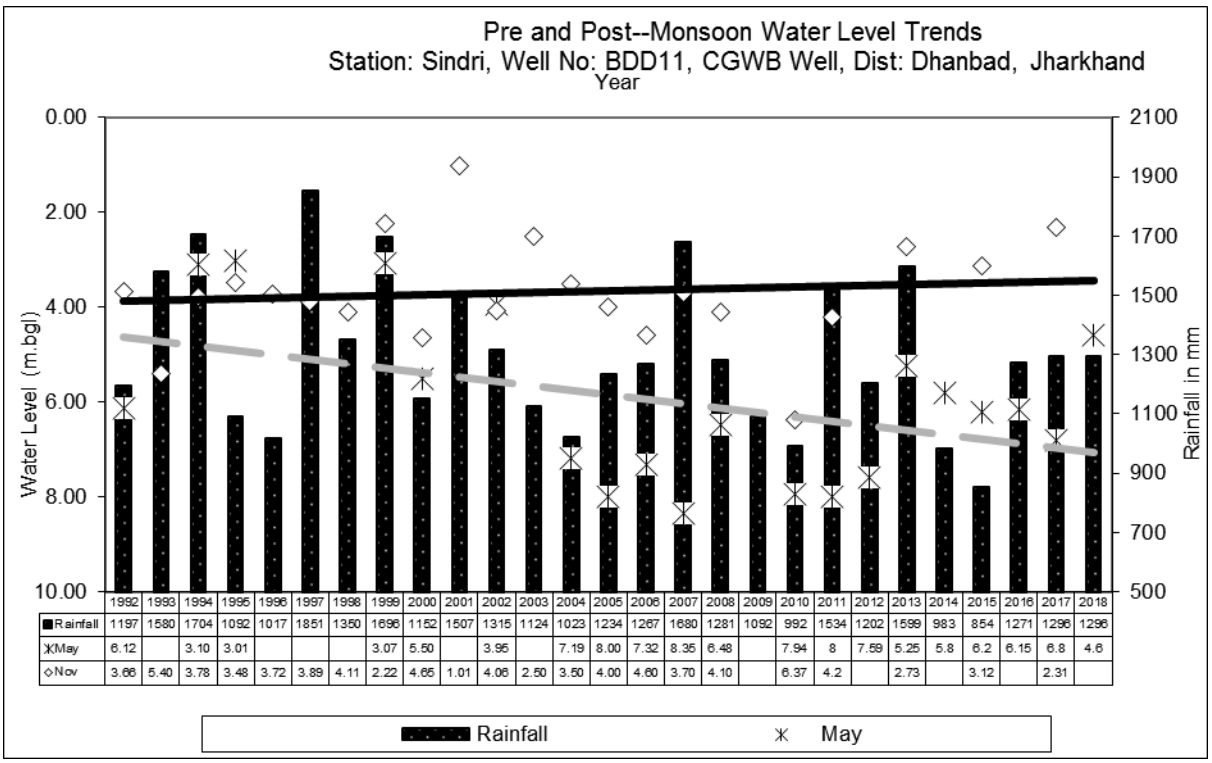


	1988	1989	1990	1991	1992	1993	1994	1996	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	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	

Annexure – VIII

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: June month of the assessment year of 2020-21

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					June'2020
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	01.06.2020
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	01.06.2020
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	01.06.2020
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	01.06.2020
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	01.06.2020
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	01.06.2020
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	02.06.2020
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	02.06.2020
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	02.06.2020
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	02.06.2020
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	01.06.2020
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	01.06.2020
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	01.06.2020
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	01.06.2020
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	02.06.2020

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-1 01.06.2020	**GW-2 01.06.2020**	**GW-3 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	2	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	40	48	54	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	18	22	28	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.62	0.78	0.54	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	6.72	5.48	10.18	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.21	8.10	8.12	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	42	54	38	10	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	112	138	140	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	204	244	214	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	182	206	198	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	2	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-4 01.06.2020	**GW-5 01.06.2020**	**GW-6 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	1	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	36	156	64	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	20	98	36	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.52	0.72	0.74	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	12.84	33.08	15.28	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.96	8.04	7.81	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	48	127	64	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	144	96	112	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	208	764	236	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	182	680	204	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	3	1	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-7 02.06.2020	**GW-8 02.06.2020**	**GW-9 02.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	1	1	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	64	52	144	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	36	24	68	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.46	0.76	0.58	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	16.28	8.92	28.42	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.88	8.12	8.15	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	62	38	174	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	76	132	96	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	244	196	744	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	172	148	636	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1	1	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY

(GROUND WATER- ALL PARAMETERS)

Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW-10 02.06.2020	**GW-11 01.06.2020**	**GW-13 01.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	3	2	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	52	32	164	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	46	26	104	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.82	0.56	0.76	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	18.42	12.48	7.88	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.21	7.96	8.03	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	88	44	178	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	98	152	88	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	248	178	756	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	192	164	680	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2	1	2	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

WATER QUALITY
(GROUND WATER- ALL PARAMETERS)

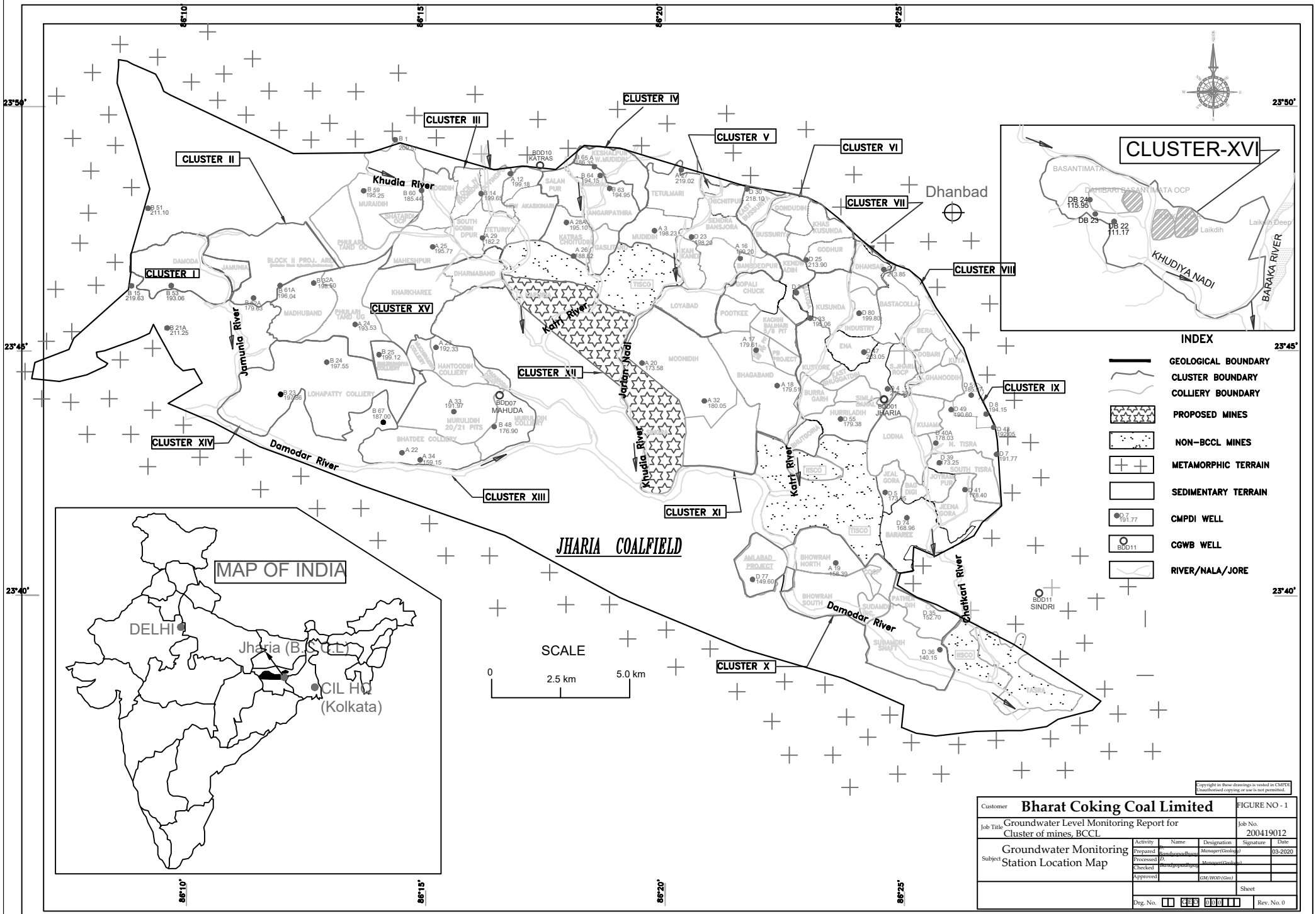
Year: 2020-21

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 14 01.06.2020	**GW15 01.06.2020**	**GW16 02.06.2020**			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1	1	3	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	44	180	122	1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	56	104	66	2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	<0.03	<0.03	0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.52	0.44	0.66	0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04	<0.04	<0.04	0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	11.48	7.58	14.76	0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.08	7.83	7.89	0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007	<0.007	<0.007	0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	40	152	128	2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	110	98	116	4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006	<0.006	<0.006	0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	204	756	512	25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	194	666	472	4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1	1	1	1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

Abbreviations

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

GROUNDWATER MONITORING STATION LOCATION MAP



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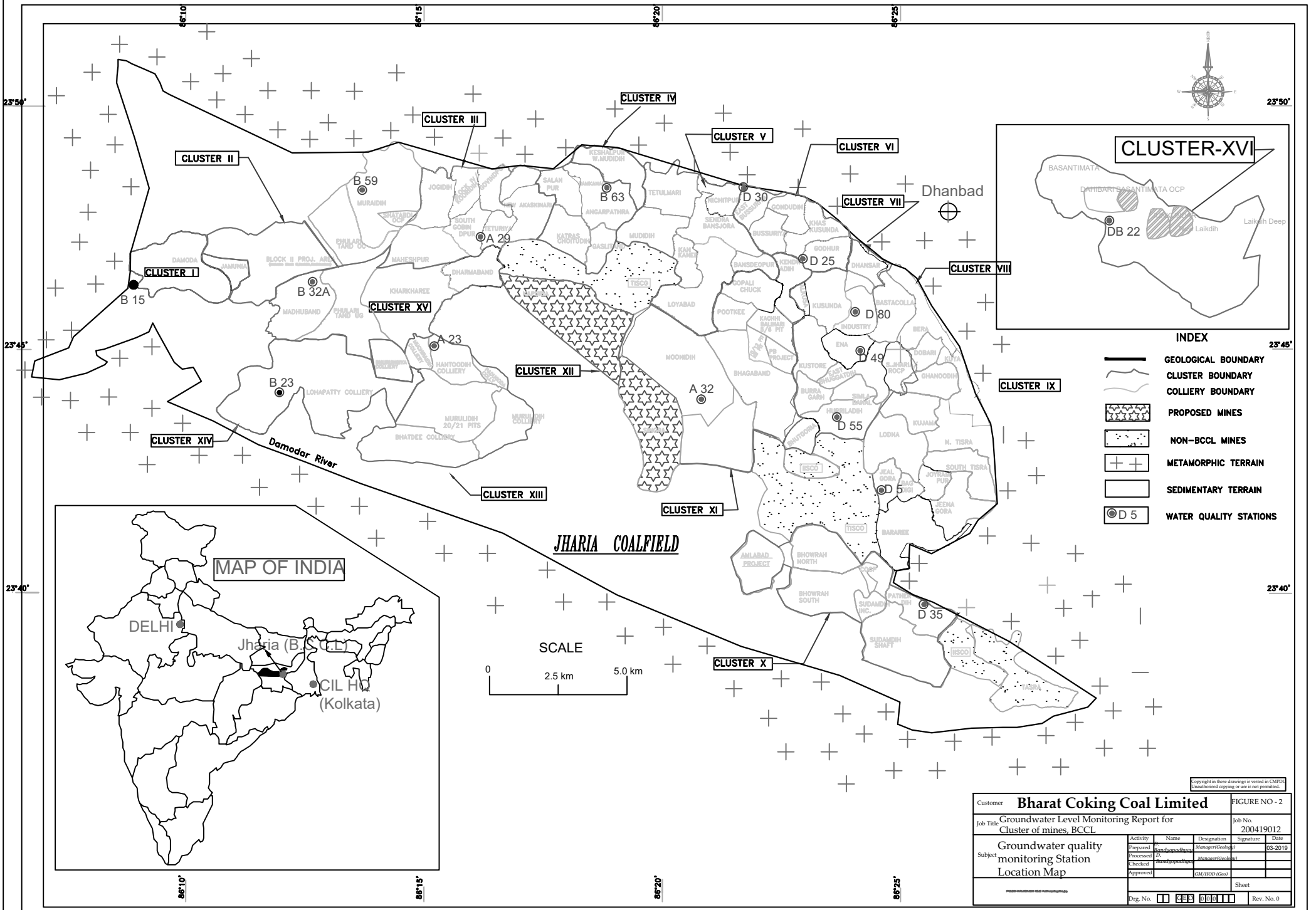
Customer	**Bharat Coking Coal Limited**		FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL		Job No. 200419012
Subject	Groundwater Monitoring Station Location Map		

Activity	Name	Designation	Signature	Date
Prepared	S. Bandyopadhyay	Manager(Geology)		03-2020
Processed	D. Bandyopadhyay	Manager(Geology)		
Checked				
Approved		GM/HOD (Geo)		

Sheet

Drg. No. [ ] CBS 000 [ ] Rev. No. 0

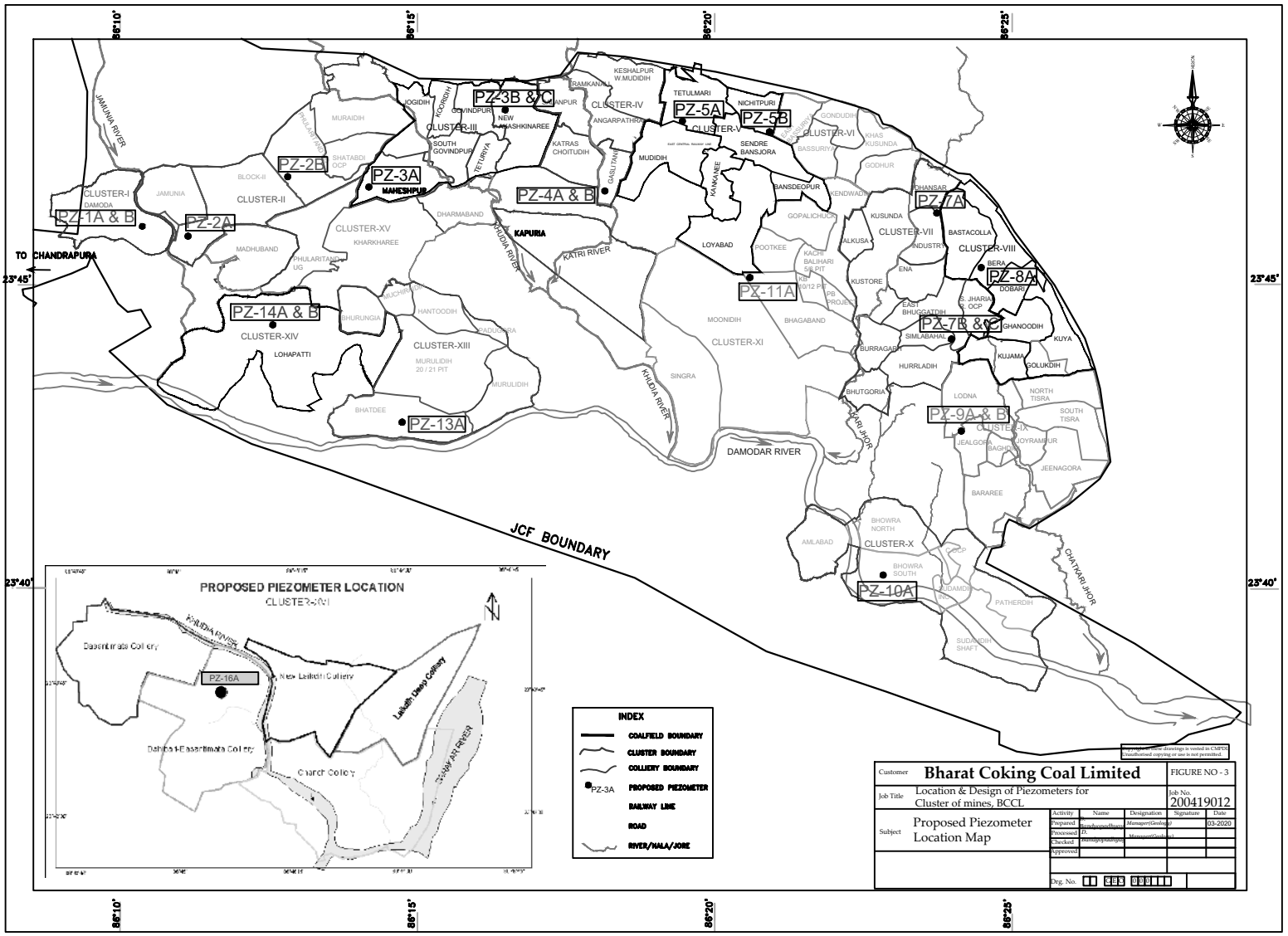
GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



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Customer	**Bharat Coking Coal Limited**				FIGURE NO - 2
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL				Job No. 200419012
Subject	Groundwater quality monitoring Station Location Map	Activity	Name	Designation	Signature / Date
		Prepared	B. Bandyopadhyay	Manager(Geology)	03-2019
		Processed	D. Bandyopadhyay	Manager(Geology)	
		Checked			
		Approved		GM/HOD (Geo)	
					Sheet
		Drg. No.	CES 000		Rev. No. 0

PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



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Customer	**Bharat Coking Coal Limited**		FIGURE NO - 3
Job Title	Location & Design of Piezometers for Cluster of mines, BCCL		Job No. 200419012
Subject	Proposed Piezometer Location Map		

Activity	Name	Designation	Signature	Date
Prepared		Manager(Geology)		03-2020
Processed		Manager(Geology)		
Checked				
Approved				

Drg. No. [redacted]

WATER TABLE CONTOUR MAP OF PRE-MONSOON 2020

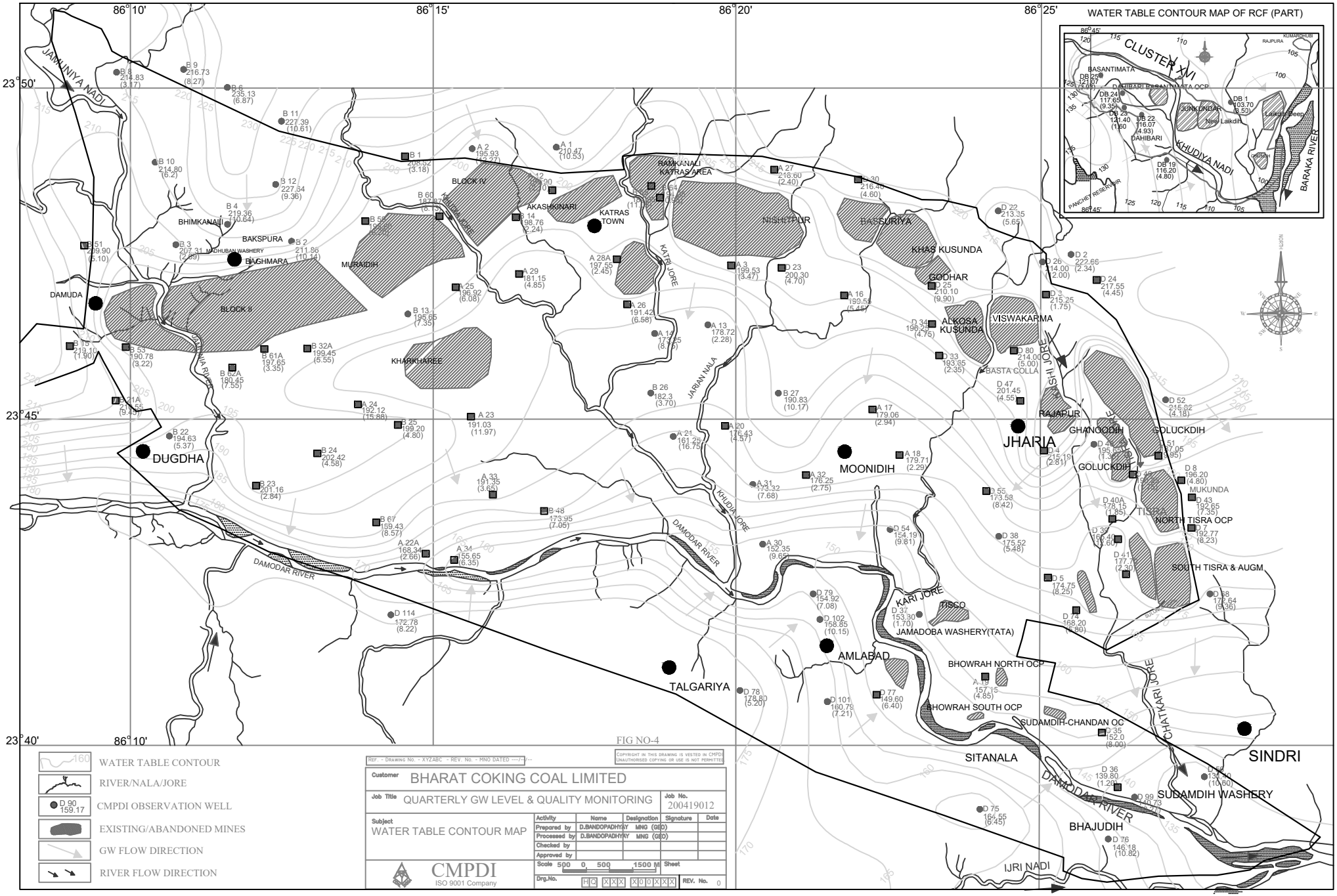


FIG NO-4

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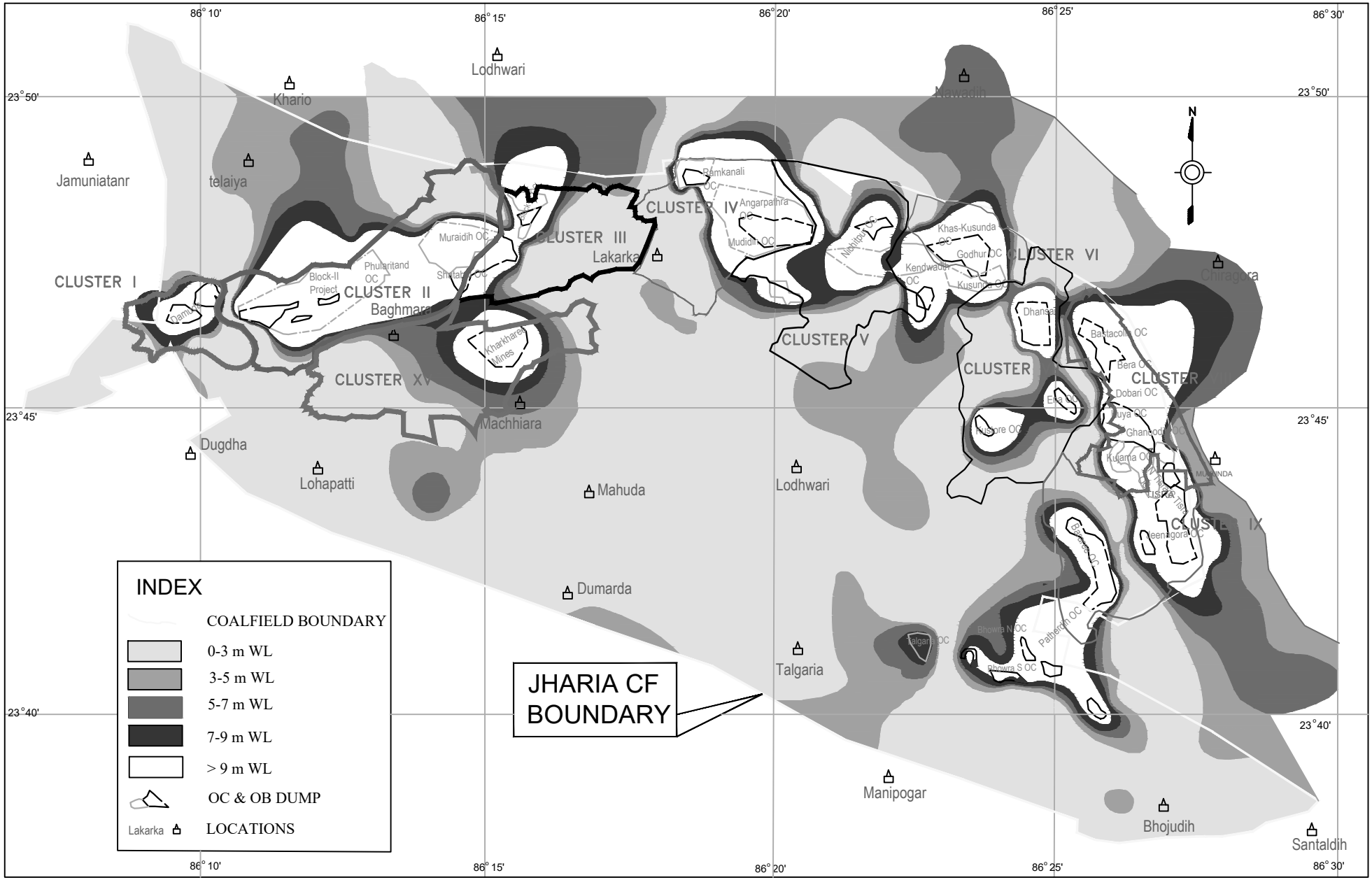
Customer	BHARAT COKING COAL LIMITED
Job Title	QUARTERLY GW LEVEL & QUALITY MONITORING
Job No.	200419012
Subject	WATER TABLE CONTOUR MAP

Activity	Name	Designation	Signature	Date
Prepared by	D.BANDOPADHYAY	MNG (GEO)		
Processed by	D.BANDOPADHYAY	MNG (GEO)		
Checked by				
Approved by				

Scale 500 0 500 1500 M | Sheet | Drg.No. HQ XXX X0 0 X XX | REV. No. 0

CMPDI
ISO 9001 Company

DEPTH TO WATER LEVEL MAP OF JHARIA COALFIELD



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Ref. - Drawing No. - XYZ/ABC - REV. No. - HNO DATED ----/--

Customer: BHARAT COKING COAL LIMITED

Job Title: HYDROGEOLOGICAL STUDIES FOR BCCL CLUSTERS

Job No.

Subject: DEPTH TO WATER LEVEL MAP

Activity	Name	Designation	Signature	Date
Prepared by	D.BANDYOPADHYAY			
Processed by	D.BANDYOPADHYAY			
Checked by				
Approved by				

Scale 500 0 500 1500 Mt. Sheet

Drg.No. REV. No. 0

CMPDI ISO 9001 Company

Rain Water Harvesting

The recharge to semi-confined aquifers takes place due to infiltration of direct rainfall in the outcrop zones/areas of these partings and interconnections formed by faults, fractures, etc. between top unconfined aquifer and themselves. The semi-confined aquifer is confining in nature in down dip-side whereas the same aquifer is in unconfined condition in the incrop side within the mining area of Cluster-IV (Geological Plan, **Plate No-IV** and Geological Cross section, **Plate No-VI**).

The artificial recharge structure in the core zone area may not be a viable solution because of the reason that recharged water would drain into the mine at a faster rate due to the steep hydraulic gradients resulted in the mining activity. Again, it may also lead to mine inundation.

Rain Water harvesting is a deliberate collection and storage of rain water that runs off on natural and man-made catchments area. The amount of water harvested depends on the frequency and intensity of the rainfall and characteristics of the catchments to allow the precipitate to infiltrate through the sub-soil and percolate down to recharge aquifers.

The rainwater within the mining area is being accumulated in earthen water pool developed on the surface and abandoned mine void for recharging the ground water of the area. The details have been tabulated below:

Table No-21: Surface ponds / reservoirs

Name of Colliery	Area of pond/mine void		Location
	Area (Ha.)	Depth (m)	
Amalgamated Keshalpur & west Mudidih	0.60	1.75 m	Keshalpur
	0.30	1.2 m	
	0.30	1.3 m	Belaujabad
	1.0	2.0 m	West Mudidih
	0.30	1.25 m	
Amalgamated Ramkanali Angarpathra	0.90	2 m	Rampur
	1.10	3 m	
	1.0	2.5 m	
	0.60	1.75 m	Kumarjuri
	0.30	1.55 m	
Salanpur	0.42	2.0 m	Salanpur
	0.70	2.35 m	
Around 15750 cum/annum of water is added to the groundwater system within the Cluster-IV mining area due to this recharge structures. Considering average water spread area is 0.6 times of total area and recharge factor is 0.0014 m/day during 150 days in a year.			

After mine closure, void of opencast will be filled up with rainwater and will maintaining the water table in the surrounding areas and may become a source of water supply to the community.

The abandoned underground mine workings (Salanpur Colliery and Katras Chitudih Colliery) and old quarry behave as huge ground water reservoirs and contain groundwater runoff (i.e. planned recharge). The pond, tanks, stop dams etc constructed in the rehabilitated and affected villages also augment the groundwater recharge.





Roof-top rainwater harvesting (RWH) will be taken up in the project area using the administrative buildings. 138 no of quarters having roof-top area of about 14950 sq. m. is already prepared to harvest rainwater at Koyla Nagar Campus, Dhanbad. Proposal already 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.



Pipeline layouts for roof water catchments area



Roof Water collection and recharging tank



Underground pipe layout



Roof water pipeline layout

Figure No-3: Rain Water Harvesting Structure at Koyla Nagar, BCCL Township towards north-east of Cluster-IV.

Check dams/Nala bunds **(Figure No-4)** have been made in the Jogta Nala and Kari Jore for recharging ground water aquifer within the buffer zone of Cluster-IV. A check dams (Weighted area 0.95 hac) in Kari Jore near Dhansar Colliery (around 8.50 km towards east) and another one at Jogta nala (Weighted area 0.80 hac) around 1.8 km towards east of Cluster-IV boundary is provided to facilitate groundwater recharge in the mining area. Considering recharge factor of 0.0014 m/day around 3700 cum/annum of water is added to the groundwater system through this check dams or Nala bunds near to the Cluster-IV area.



Figure No-4: Check Dams / Nala bunds at Jogta Nala, near Nischitpur OCP Mine, BCCL. This Recharge structure is within the buffer zone (1.8 km towards east of Cluster-IV).



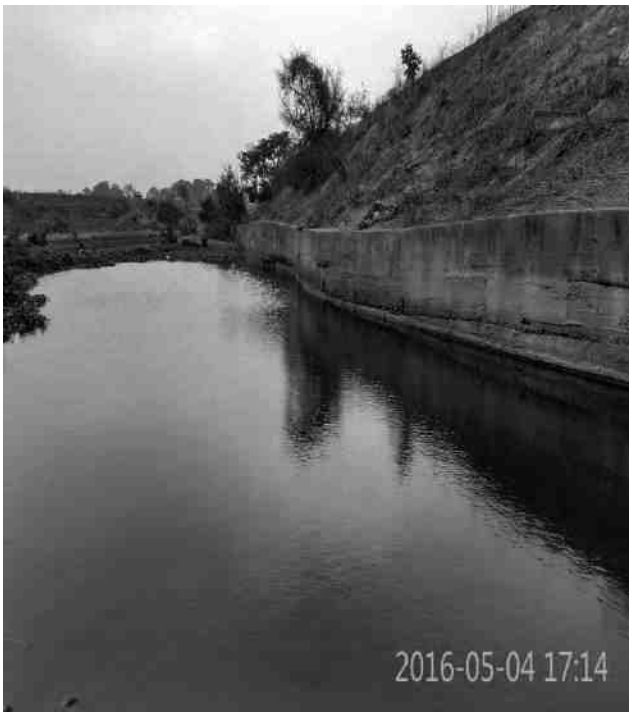
Rain Water Harvesting Pond at Green Park,Cluster-IV


Vivo V11Pro
AI Dual Camera
2019.11.20 09:20


Vivo V11Pro
AI Dual Camera



Water Harvesting at Cluster IV



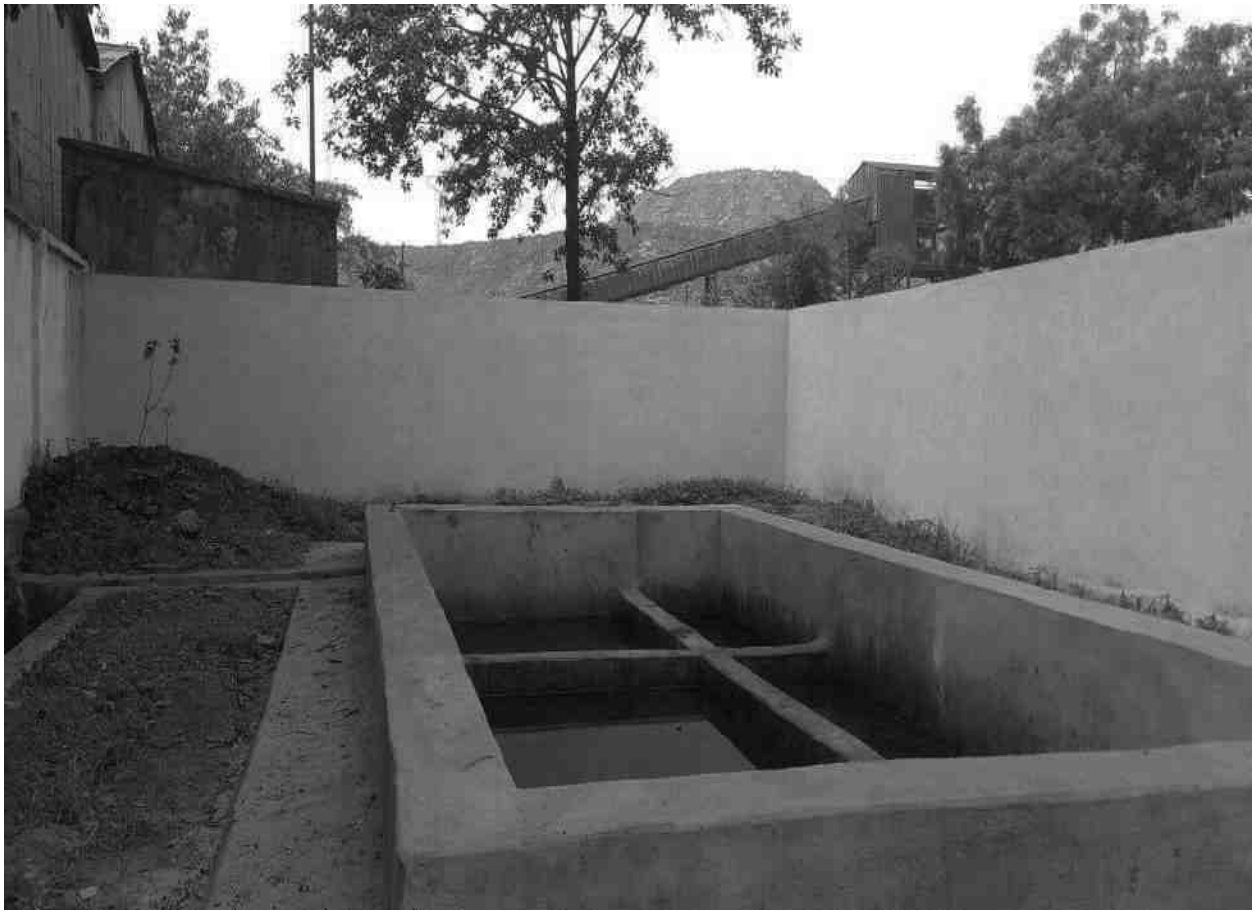




Toe wall and Embankment at Cluster IV

Oil and Grease Trap (48 KL)

AKWMC WORKSHOP, Katras Area




OIL AND GREASE TRAP
AUTO WORKSHOP
CLUSTER-IV, KATRAS AREA

Illumination Survey at departmental OCP (view point & transporting road) on 13/04/2021

Sl.No.	Place of illumination	Height of light source in (m)	Distance of light source in (m)	Standard of illumination	Illumination obtained	Types of light provided	Remarks
01.	At new view point						
	Pole - 1	8	10		H= 29, V=21	1 x 3 x 400w (MH)	
	Pole - 2	8	15		H= 23, V=19	1 x 2 x 60w (LED) & 1 x 400w (HPSV)	
02.	At VIII & seam OB bench			H=10			
	Pole - 1	8	5	—"—	H = 35	1 x 400w (HPSV)	
	Pole - 2	8	10	—"—	H = 24	—"—	
	Pole - 3	8	10	—"—	H = 27	—"—	
	Pole - 4	8	8	—"—	H = 26	—"—	
03.	Towards New view point to type curve (Transporting road)						
	Pole - 1	10	5	H=10	H = 12	1 x 60w LED light	
	Pole - 2	"	5	—"—	H = 12	—"—	
	Pole - 3	"	10	—"—	H = 07	—"—	
	Pole - 4	"	10	—"—	H = 06	—"—	
	Pole - 5	"	—	—"—	—	Light fuse	
	Pole - 6	"	8	—"—	H = 07	1 x 60w LED light	
	Pole - 7	"	—	—"—	—	Light Not provided	
	Pole - 8	"	8	—"—	H = 06	1 x 60w LED light	

Manager
AKWMC

Colliery Engineer
AKWMC

Safety Officer
AKWMC.

Illumination Survey at departmental OCP on 15/04/2021

Sl.No.	Place of illumination	Height of light source in (m)	Distance of light source in (m)	Standard of illumination	Illumination obtained	Types of light provided	Remarks
04.	At tyre curve (Entry point of dept OCP)	12	(A) 1om Nord side from light source.	H = 10	H = 23	1 × 400W (HPSV) 1 × 400W (MH)	
			(B) 1om east side from light source	— " —	H = 17	—•—	
05.	At 4 seam coal bench near shovel no. LST - 720	Machine light	1om (at front of machine.	H = 15 V = 25	H = 16 V = 21	4 × HPSV (at front of machine.)	
06.	At V seam OB bench near shovel No.- 524 (1om²)	Machine light	15m (at front of machine)	H = 15 V = 25	H = 14 V = 10	3 × LED (at front of machine)	
			1om (at back side of machine)	— " —	H = 10 V = 7	1 × LED light	
07.	In machine cabin of shovel no - 524	Cabin light	Cabin light	H = 50	H = 69	Cabin light	
08.	At V seam Coal bench.	Light source coming from upper bench		H = 10	H = 4	Light source coming from upper bench (More light required)	

Manager
AKWMC.

Colliery Engineer
AKWMC

Safety Officer
AKWMC.

Illumination Survey at Hired OCP [BSMCPL - BEPL(JV)] and near by area on 15/04/2021

Tetul mani Patel.

Sl. No.	Place of illumination	Height of light source in (m)	Distance of light source in (m)	Standard of illumination	Illumination obtained	Types of light provided	Remarks.
01.	At type curve (Junction point)	12	10 m (North side from light source)	H = 10	H = 23	1×400ω (HPSV) 1×400ω (MH)	
02.	Near weight bridge (Near type curve)	3	① 10 (west side from CISF room)	H=10	H=15, V=7	1×LED, 1×HPSV	
			② 10 (South side from CISF Room)		H = 13 V = 17	—11—	
03.	Coal loading Dept.	8	① 10 (North side from light source)	H = 10	H = 103	4×400ω (MH)	One DG set
			② 15 (East side from light source)	H = 10	H = 26	4×400ω (MH)	One DG set
04.	Near Excavator Tata Hitachi No- 470 (1)	Machine light	10 (at front at machine)	H = 15 V = 25	H = 12 V = 23	4× HPSV at front at machine.	
			8 (at back at machine)	—11—	H = 2 V = 5	1×HPSV at back at machine.	
05.	Machine cabin at Tata hitachi No. - 470(1)	Machine cabin light	—	H = 50	H = 35	Machine cabin light	

Manager
AKSWMC

Colliery Engineer
AKSWMC

Safety Officer
AKSWMC.

Illumination Survey at Hired OCP (BSMCPL - BEPL (JV)) on 15/04/2021

Sl. No.	Place of illumination	Height of light source in (m)	Distance of light source in (m)	Standard of illumination	Illumination obtained	Types of light provided	Remarks
06.	Near excavator Tata hitachi No. - 470 (2)	Machine light	10 (front side of machine)	H = 15 V = 25	H = 16 V = 24	5 × HPSV (machine light at front side.)	No light provided at back side
07.	Machine cabin of tata hitachi No. 470 (2)	Machine cabin light	-	H = 50	H = 43	Machine cabin light	
08.	Near excavator Tata hitachi No. - 350 (2)	Machine light	@10 (front side of machine)	H = 15 V = 25	H = 09 V = 19	5 × HPSV (Machine light at front side)	More light required.
			ⓐ 5 (Back side of machine)	—"—	H = 2 V = 3	1 × HPSV (Machine light at back side)	

Manager
AKWIMC

Colliery Engineer
AKWIMC

Safety Officer
AKWIMC.

Instantel Event Report

Date/Time	Vert at 13:04:25 March 16, 2021
Trigger Source	Geo: 0.700 mm/s, Mic: 130.8 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.0 sec at 2048 sps
Operator/Setup:	Operator/factory.MMB

Notes
Location:
Client:
User Name:
General:

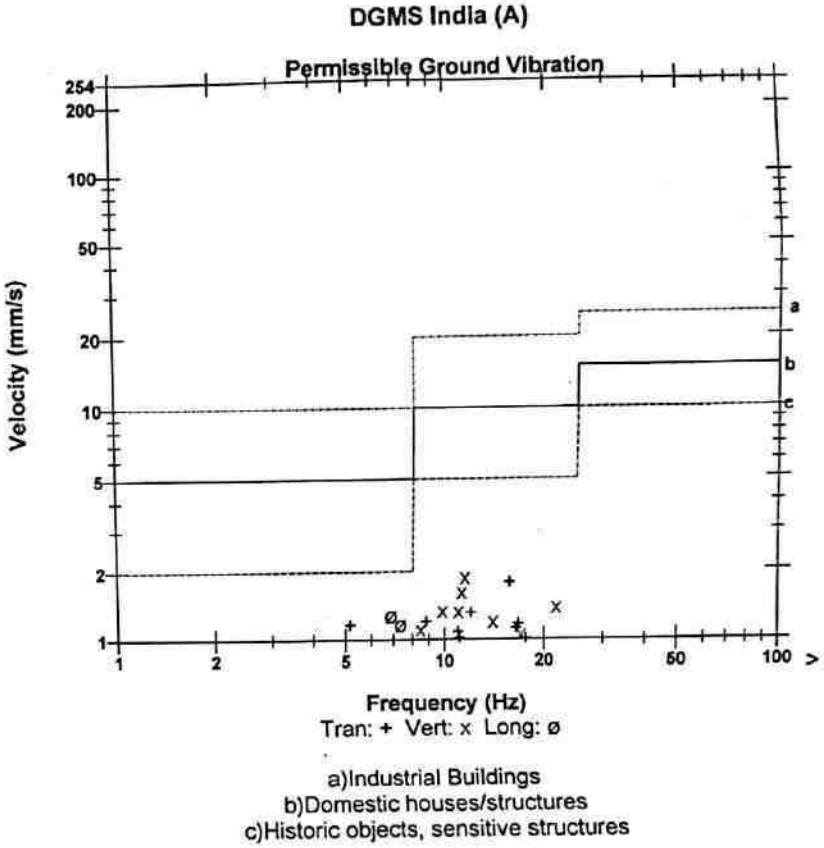
Serial Number	UM10858 V 10-81 Micromate ISEE
Battery Level	3.8 Volts
Unit Calibration	September 24, 2020 by CIMFR Dhanbad
File Name	UM10858_20210316130425.IDFW

Post Event Notes
Kantapahari hired
Distance from blast - 200 mtr

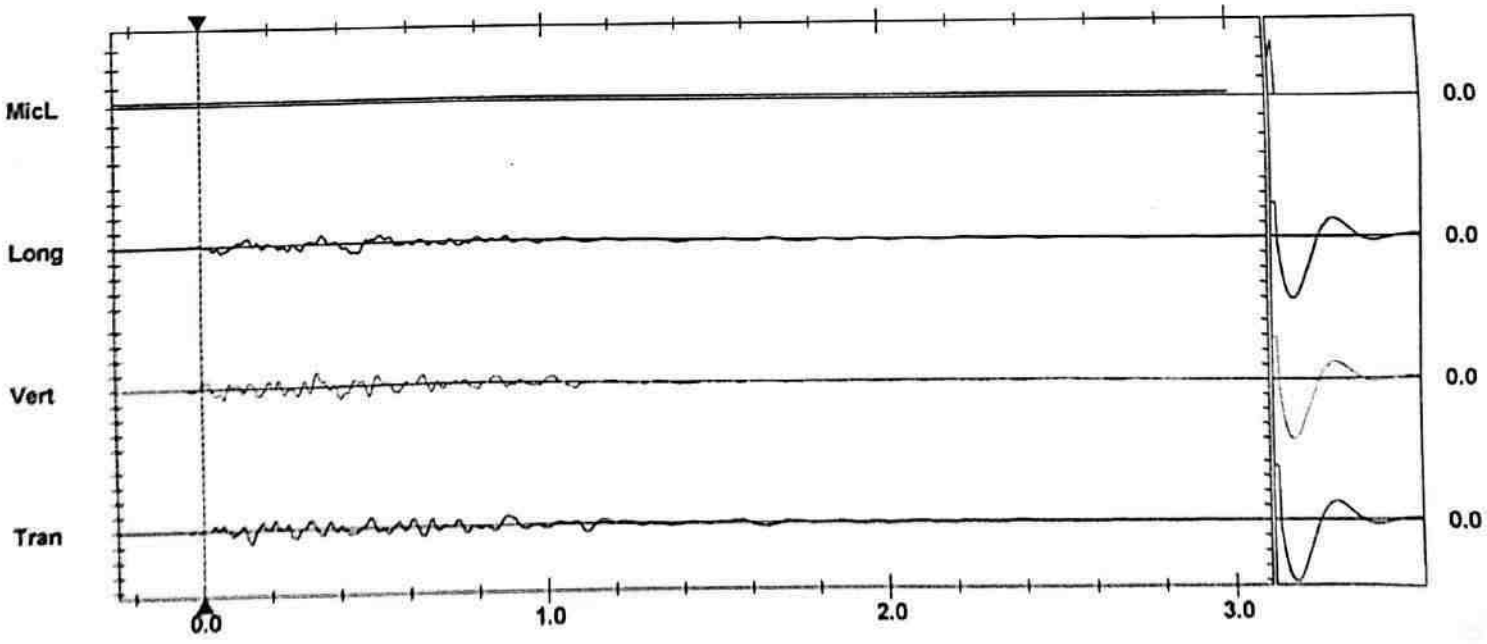
Microphone	Linear Weighting
PSPL	<88 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 0 mv)

	Tran	Vert	Long	
PPV	1.773	1.884	1.285	mm/s
ZC Freq	15.8	11.5	6.9	Hz
Time (Rel. to Trig)	0.141	0.333	0.454	sec
Peak Acceleration	0.025	0.035	0.026	g
Peak Displacement	0.022	0.021	0.030	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.5	7.5	Hz
Overswing Ratio	3.4	3.5	3.3	

Peak Vector Sum 2.100 mm/s at 0.141 sec
N/A: Not Applicable



a)Industrial Buildings
b)Domestic houses/structures
c)Historic objects, sensitive structures



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 1.000 pa.(L)/div
Trigger = ▶----------◀

Sensor Check

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Instantel Event Report

Date/Time	Long at 13:50:09 March 20, 2021
Trigger Source	Geo: 0.700 mm/s, Mic: 130.8 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.0 sec at 2048 sps
Operator/Setup:	Operator/factory.MMB

Notes
Location:
Client:
User Name:
General:

Serial Number	UM10858 V 10-81 Micromate ISEE
Battery Level	3.8 Volts
Unit Calibration	September 24, 2020 by CIMFR Dhanbad
File Name	UM10858_20210320135009.IDFW

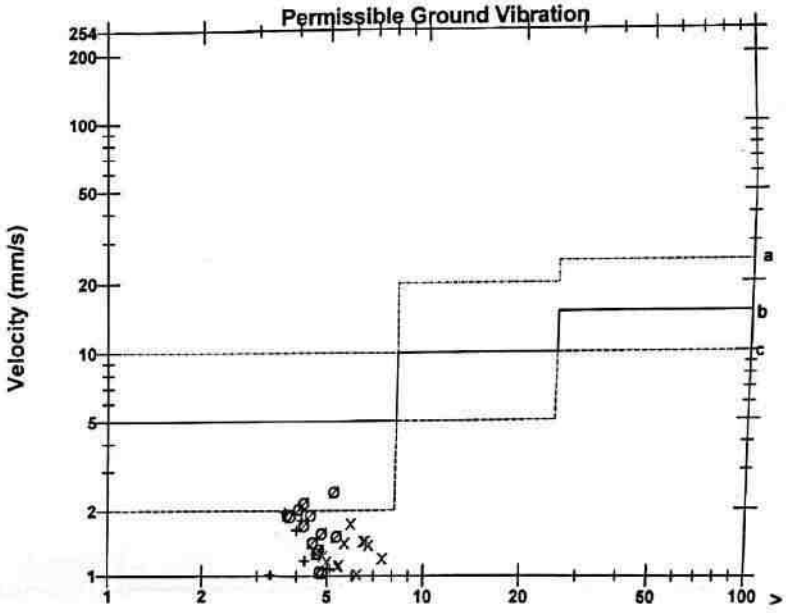
Post Event Notes
Kantapahari Hired
Distance from blast - 150 mtr

Microphone	Linear Weighting
PSPL	<88 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 0 mv)

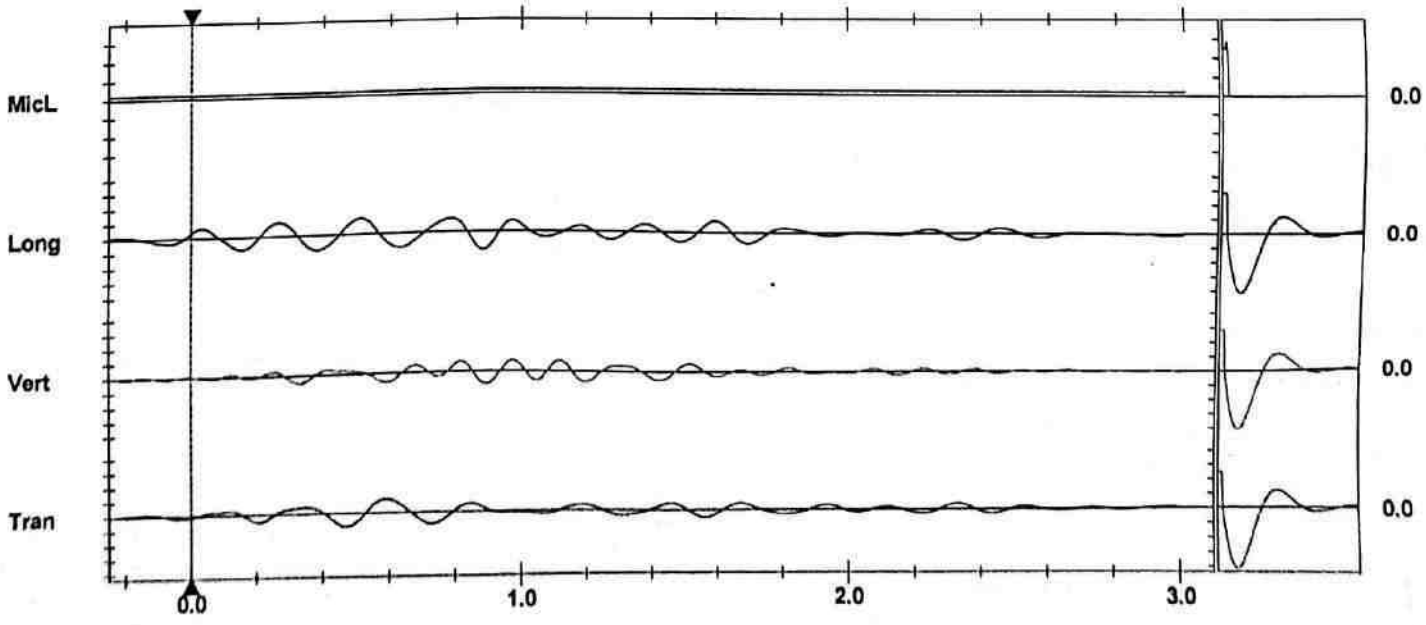
	Tran	Vert	Long	
PPV	1.955	1.766	2.451	mm/s
ZC Freq	3.6	5.9	5.2	Hz
Time (Rel. to Trig)	0.585	0.891	0.880	sec
Peak Acceleration	0.015	0.031	0.020	g
Peak Displacement	0.084	0.047	0.083	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.5	3.6	3.5	

Peak Vector Sum 3.026 mm/s at 0.887 sec
N/A: Not Applicable

DGMS India (A)



a)Industrial Buildings
b)Domestic houses/structures
c)Historic objects, sensitive structures



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 1.000 pa.(L)/div Sensor Check
Trigger =

Printed: April 6, 2021 (V 10.72 - 10.72)

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Instantel

Event Report

Date/Time	Tran at 14:19:03 March 27, 2021
Trigger Source	Geo: 0.700 mm/s, Mic: 130.8 dB(L)
Range	Geo: 254.0 mm/s
Record Time	3.0 sec at 2048 sps
Operator/Setup:	Operator/factory.MMB

Notes
Location:
Client:
User Name:
General:

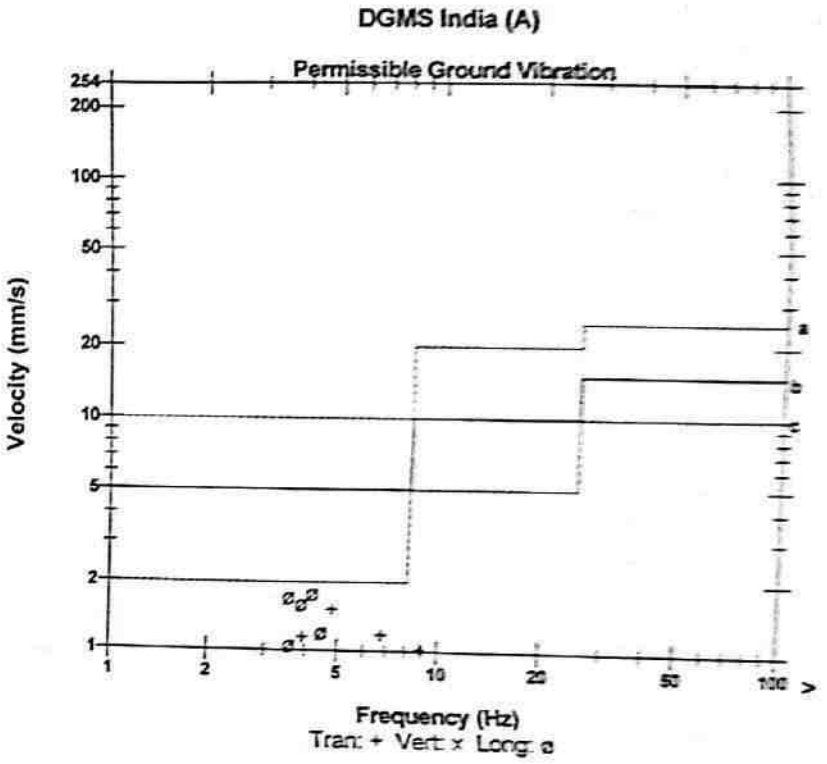
Serial Number	UM10858 V 10-81 Micromate ISEE
Battery Level	3.8 Volts
Unit Calibration	September 24, 2020 by CIMFR Dhanbad
File Name	UM10858_20210327141903.IDFW

Post Event Notes
Kantapahari hired
Distace from blast - 180 mtr

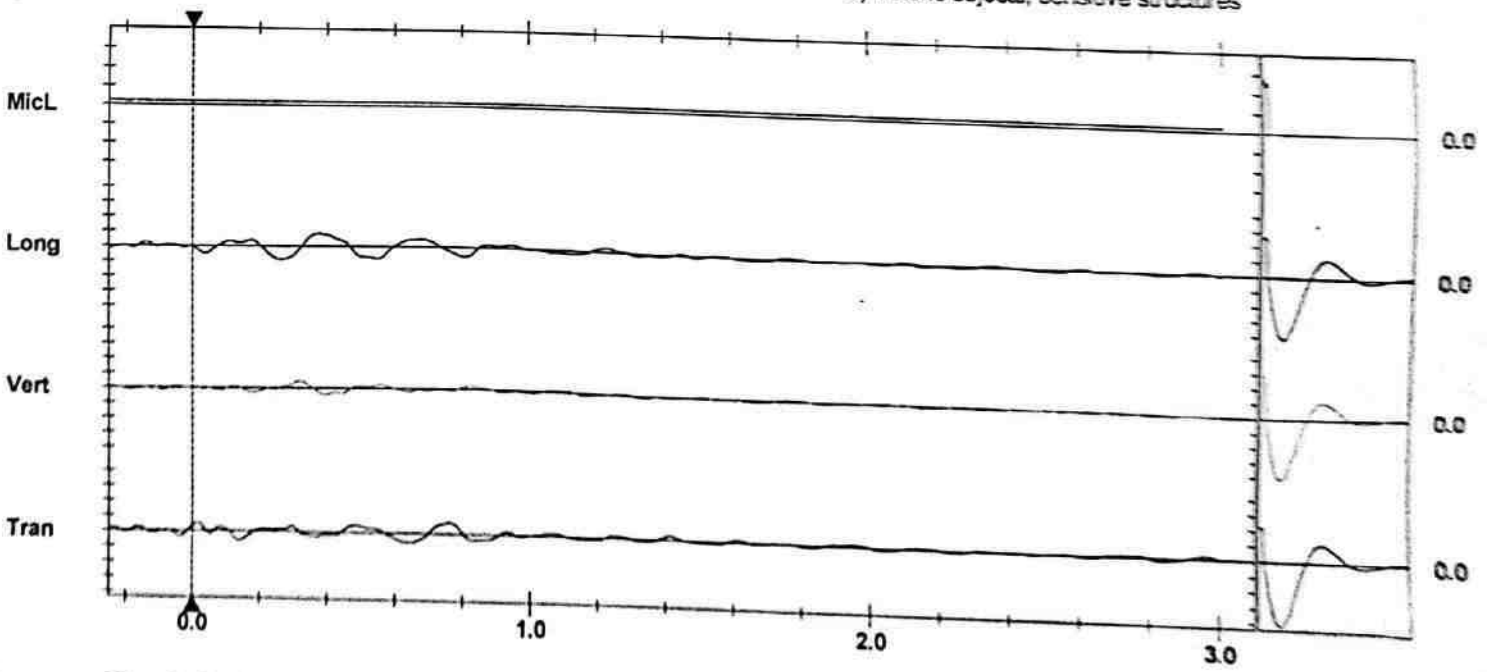
Microphone	Linear Weighting
PSPL	<88 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 0 mv)

	Tran	Vert	Long	
PPV	1.513	0.954	1.789	mm/s
ZC Freq	4.8	5.0	4.2	Hz
Time (Rel. to Trig)	0.759	0.318	0.263	sec
Peak Acceleration	0.012	0.010	0.013	g
Peak Displacement	0.052	0.030	0.081	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.5	7.5	7.3	Hz
Overswing Ratio	3.5	3.5	3.4	

Peak Vector Sum 1.905 mm/s at 0.380 sec
N/A: Not Applicable



a)Industrial Buildings
b)Domestic houses/structures
c)Historic objects, sensitive structures



Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 1.000 pa (L)/div
Trigger = ▶----------◀

Sensor Check

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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 – IV

(FOR THE MONTH MARCH, 2021)

E. C. no. J-11015/372/2010-IA.II (M) dated 23.10.2019.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Govindpur (N7)**
ii) K**atras Chotudih (N37)**
iii) **Block IV(N6)**
iv) **Nichitpur(N8)**
v) **RudhiBasti (N18)**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day 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.

NOISE LEVEL DATA

Name of the Project: **Cluster -IV**			Month: **MAR 2021**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Block IV(N6)**	**Industrial area**	05.03.2021	57.6	*75*
2	**Block IV**	**Industrial area**	19.03.2021	59.2	*75*
3	**Govindpur Village(N7)**	**Industrial area**	12.03.2021	61.2	*75*
4	**Govindpur Village**	**Industrial area**	30.03.2021	60.9	*75*
5	**Nichitpur(N8)**	**Industrial area**	15.03.2021	57.2	75
6	**Nichitpur**	**Industrial area**	26.03.2021	59.6	*75*
7	**Katras Chotudih(N37)**	**Industrial area**	12.03.2021	59.6	*75*
8	**Katras Chotudih**	**Industrial area**	30.03.2021	62.3	*75*
9	**Rudhi Basti(N18)**	**Residential area**	03.03.2021	50.7	*55*
10	**Rudhi Basti**	**Residential area**	16.03.2021	53.1	*55*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM,**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

KATRAS AREA
Safety

PME- Departmental

Year	Target(Annual)	Achievement(Target)
2012	1884	1752
2013	1920	1940
2014	1920	1826
2015	1730	1593
2016	1811	1338
2017	1650	1566
2018	1615	1393
2019	1512	1362
2020	1505	997(1505)
2021up to Feb	1534	156(254)

IME _ Contractor Workers

IME DONE 2013	IME DONE 2014	IME DONE 2015	IME DONE 2016	IME Done 2017	IME Done 2018	IME Done 2019	IME Done 2020	IME Done 2021 upto Feb
283	423	298	384	267	124	30	06	00

VTC

S. No	Worker		Years									
			2013	2014	2015	2016	2017	2018	2019	2020	2021 upto Feb	Total
1	Basic		12	24	92	89	60	71	29	41	02	420
2	Refresher	T	610	610	590	660	610	650	610	635	625	5600
		A	708	687	816	1093	769	705	715	686	89	6268
3	Contractor		138	391	566	357	188	159	27	11	00	1837
4	Change of Job							44	69	60	26	199

PME & IME of the Month of Feb 2021:

PME:79, IME :00

VTC

Refresher:41, Basic:01, Contractor:00 ,Change of Job:20

KATRAS AREA-IV, B.C.C.L

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Annexure-27

Table 4.9 : Afforestation programme of the Cluster-IV

	Year	Quarry land (abandoned)		Active Quarry Area		OB dumped out side quarry area		Service Building/ Mine Infrastructure / Coal dump		Green belt around OCP		Barren Land		Total Plantation	Total Area Under Additional Plantation (Ha)	Total Plantation cost @ Rs.55101/Ha (in Rs.Lakhs)
		Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings	Area (ha)	Trees/ saplings			
During active mining (A)	1	2	5000							2	5000	2	5000	15000	6	3.31
	2	2	5000							2	5000	2	5000	15000	6	3.31
	3	2	5000							2	5000	2	5000	15000	6	3.31
	4	2	5000							2	5000	2	5000	15000	6	3.31
	5	2	5000							2	5000	2	5000	15000	6	3.31
	6	3	7500							2	5000	2	5000	17500	7	3.86
	7	3	7500							2	5000	2	5000	17500	7	3.86
	8	3	7500							2	5000	2	5000	17500	7	3.86
	9	3	7500							2	5000	2	5000	17500	7	3.86
	10	3	7500							2	5000	2	5000	17500	7	3.86
	11	5	12500							2	5000	2	5000	22500	9	4.96
	12	5	12500							2	5000	2	5000	22500	9	4.96
	13	5	12500							2	5000	2	5000	22500	9	4.96
	14	5	12500							2	5000	2	5000	22500	9	4.96
	15	5	12500	5	12500					2	5000	2	5000	35000	14	7.71
	16	5	12500	5	12500					3	7500	3	7500	40000	16	8.82
	17	5	12500	5	12500					3	7500	3	7500	40000	16	8.82
	18	5	12500	5	12500					3	7500	3	7500	40000	16	8.82
	19	4.75	11875	5	12500					3	7500	3	7500	39375	15.75	8.68
	20			5	12500					3	7500	3	7500	27500	11	6.06
	21			5	12500					3	7500	3	7500	27500	11	6.06
	22			5	12500					3	7500	3	7500	27500	11	6.06
	23			5	12500	2	5000			3	7500	3	7500	32500	13	7.16
	24			5	12500	2	5000			3	7500	3	7500	32500	13	7.16
	25			5	12500	2	5000			3	7500	5	12500	37500	15	8.27
	26			10	25000	2	5000			3	7500	5	12500	50000	20	11.02
	27			10	25000	2	5000			3	7500	5	12500	50000	20	11.02
	28			10	25000	2	5000			3	7500	5	12500	50000	20	11.02
	29			10	25000	2	5000			3	7500	5	12500	50000	20	11.02
	30			9.9	24750	2	5000			3	7500	8	20000	57250	22.9	12.62
	Total (A)	**69.75**	**174375**	**104.9**	**262250**	**16**	**40000**	**0**	**0**	**75**	**187500**	**90**	**225000**	**889125**	**355.65**	**195.96671**
Post mining (B)		10	25000	30	75000	4	10000	30	75000	10	25000	20	50000	260000	104	57.31
		10	25000	30	75000	4	10000	30	75000	10	25000	20	50000	260000	104	57.31
		10	25000	30	75000	4.89	12225	32.25	80625	10.55	26375	14.38	35950	255175	102.07	56.24
	Total (B)	**30**	**75000**	**90**	**225000**	**12.89**	**32225**	**92.25**	**230625**	**30.55**	**76375**	**54.38**	**135950**	**775175**	**310.07**	**170.85167**
Grand (A+B)		**99.75**	**249375**	**194.9**	**487250**	**28.89**	**72225**	**92.25**	**230625**	**105.55**	**263875**	**144.38**	**360950**	**1664300**	**665.72**	**366.81838**

CSR Works & Expenditure FY 2020-21*

(CSR Budget - ₹ 5.54 Crore)

Sl No	CSR Projects identified	District and State of Project		Amt. spent (₹ lakhs)		Direct or through agency
		District	State	Direct Exp	Overheads	
A	**Promoting education,including special education & employment enhancing vocation skills especially among children,women,elderly,and the differently abled & livelihood enhancement projects**					
1	Works in RBB School, Rajganj	Dhanbad	Jharkhand	27.57	--	Direct
B	**Rural Development Works**					
1	Construction of marriage hall at Ratanpur panchayat, Govindpur Block	Dhanbad	Jharkhand	3.73	--	Direct
2	Other Civil Works	Dhanbad	Jharkhand	1.69	--	Direct
C	**COVID-19 related initiatives**					
1	Procurement of bleaching powder	Dhanbad	Jharkhand	6.4	--	Direct
2	Procurement of face masks	Dhanbad	Jharkhand	0.16	--	Direct
3	Financial assistance to D.C. Dhanbad to combat COVID-19 situation in Dhanbad	Dhanbad	Jharkhand	200	--	Depository mode of work execution through Dhanbad district administration
	Total			**239.55**	--	

**** Figures unaudited for the FY 2020-21***

CSR Works & Expenditure FY 2020-21*

(CSR Budget - ₹ 5.54 Crore)

Sl No	CSR Projects identified	District and State of Project		Amt. spent (₹ lakhs)		Direct or through agency
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3	Financial assistance to D.C. Dhanbad to combat COVID-19 situation in Dhanbad	Dhanbad	Jharkhand	200	--	Depository mode of work execution through Dhanbad district administration
	Total			**239.55**	--	

**** Figures unaudited for the FY 2020-21***


DHANBAD
भारत कोकिंग कोल लिमिटेड
ल इंडिया परिवार
साथ सभी डॉक्टरों से
ए एवं सुरक्षित यात्रा
की कामना करता है।


DHANBAD
NW
Samsung Triple Camera
Shot with my Galaxy A70





Few CSR works done by BCCL during Covid 19 Pandemic

BHARAT COKING COAL LIMITED
Corporate Environment Policy

ENVIRONMENTAL POLICY STATEMENT:

Bharat Coking Coal Limited (BCCL) is committed to promote sustainable development by protecting the environment through integrated project planning & design, prevention / mitigation of pollution, conservation of natural resources, restoration of ecology & biodiversity, recycling/ proper disposal of wastes, addressing climate change and inclusive growth. It also aims to bringing awareness amongst its stakeholders for continual improvement in environmental performances following best practices.

OBJECTIVES:

Bharat Coking Coal Limited shall endeavour to:

1. Plan & design projects with due consideration to environmental concerns for Sustainable Development.
2. Conduct mining and associated operation in an environmentally responsible manner to comply with applicable laws and other requirements related to environmental aspects.
3. Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environment protection.
4. Implement Environment Management Plans in all our mines /projects/Clusters effectively to mitigate pollution, conservation of natural resources and restoration of ecology & biodiversity.
5. Ensure compliance of all applicable Environmental Clearance& Forestry Clearance conditions and other statutory conditions issued by regulatory agencies.
6. Recycling of wastes on the principle of REDUCE, REUSE and RECYCLE.
7. Put special thrusts on efficient energy utilization / renewable energy as a measure to reduce carbon foot-print.
8. Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.
9. Taking measures to render productive post mining land use.
10. Implementation of activities applicable to BCCL arising out of International Conventions.
11. Create environmental awareness among the employees and the local communities through pro-active communication and training

STRATEGIES FOR IMPLEMENTATION OF ENVIRONMENTAL POLICY:

BackGround:

Bharat Coking Coal Limited subscribes to the view of Sustainable Development. Unless the environment can sustain all the developmental activities, any pursuit of development in isolation can cause irreparable damage to the ecosystem and associated environmental attributes. Keeping this view in mind, Bharat Coking Coal Limited attaches top priority towards sustainable development and approved its 'Corporate Environmental Policy'. Based on CIL Environment Policy 2012, incorporating the Jharia Master Plan ,CEP of BCCL was approved by 285th BCCL board on 21.04.2012 and is complimentary to the National Environmental Policy, 2006. The Revised BCCL Policy, 2019 is the outcome of the experience gained since 2012, keeping in view the modifications / amendments made time to time in environmental policies and additional stipulation notified by MoEF&CC (Ministry of Environment, Forest& Climate Change), and other organisations concerning mine closure, reclamation of degraded land, environmental clearance etc. and also with the objective of revisiting the corporate policy. The Policy has a vision of Green Mining and mission of 100%

compliance of environmental statutes applicable to coal mining industry. This policy is prepared in line with that of CIL's policy with incorporation of prevailing local conditions.

STRATEGIES: Bharat Coking Coal Limited adopts the strategies appended below for effective implementation:

1. MINE/ PROJECT PLANNING & DESIGN FOR SUSTAINABLE DEVELOPMENT:

a) Coal being a non-renewal energy source, extraction shall be planned prudently to meet national requirement in a planned way. The projects shall be designed on the principle of Sustainable Development with due consideration to environment, mine closure, safety and aspirations of the stakeholders at the planning & design stage itself with due regard to mine closure plan.

b) While preparing the Mining plan/project reports, the effort shall be to incorporate latest mining technologies and equipment's with optimal capacity, which are more environment friendly

c) All Mining Plan/ project reports will be provided with detailed provisions for ensuring environmental compliances

2. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) & ENVIRONMENT MANAGEMENT PLAN (EMP)

a. All mine planning and design shall be environmentally acceptable and operation shall be carried out in such a way as to facilitate the compliance of stipulated environmental standards.
b. EIA& EMP for all projects/Clusters shall be formulated as per the approved ToR (Terms of Reference) and pubic consultations for obtaining Environmental Clearance (EC) from MoEF&CC. Similarly, in the existing projects needing enhancementof production capacities with or without increase in land, change of technology, renewal of lease and change in land use etc. fresh EC is required to be sought as per norms. The projects shall be operated after obtaining Consent to Establish (CTE)/ Consent to Operate (CTO) from State Pollution Control Boards (SPCB).
c. Detailed Mine Closure Plans shall be prepared for all existing and new mines as per the MoC (Ministry of Coal) guidelines.

3. COMPLIANCE OF THE STATUTORY REQUIREMENTS:

The implementation of EMP and fulfilment of all other statutory requirements like conditions of EC, FC and consents to establish & operate, including timely submission of returns to statutory bodies and various agencies, are to be ensured at all levels.

4. MEASURES TO MITIGATE POLLUTION:

a) Air Pollution:

i) Generation of dust is to be controlled at the source to the possible extent with necessary control measures during drilling, blasting, loading, unloading, CHP transfer points etc.
ii) Deployment of eco-friendly mining technologies.
iii) Dust generation is to be minimized along coal/ waste transportation routes.
iv) Mechanized transportation of coal to be encouraged.
v) Green belt is to be created around the source of dust

b) Water pollution:

i) The mine water and other effluent shall be treated to ensure the discharge norms as per statute. The treated effluent shall be utilized to the extent possible with aview to achieve maximum water conservation.

ii) Oil & grease from the effluent shall be removed by Oil & Grease Traps for proper disposal.

c) Noise / ground vibration:

i) All measures to minimize noise pollution will be taken including maintenance of HEMM, equipment and provision of PPE where required.

ii) Suitable blasting techniques shall be followed to reduce ground vibration as well as noise pollution.

d)Land reclamation:

i) Progressive and concurrent reclamation of mined out areas will be carried out as per approved EIA/EMP and Mine Closure Plan (MCP).

ii) Slopes of external dumps are the important area to be suitably graded / terraced for effective reclamation and plantation.

iii) Preservation of top soil is required for future use. Old as well as existing nonactive dumps are to be technically and biologically reclaimed.

iv) Monitoring of reclamation work of all opencast mines will be done through Satellite Surveillance. The outcome shall be put in the websites.

e) Mine closure plans:

Mine Closure Plan (MCP) shall be prepared for each mine on which Mine closure guidelines are applicable. MCP are being delineated in two phases viz. progressive and final mine closure. Appropriate funds are set aside and deposited under a special Escrow fund every year as per MoC guidelines, to be utilized for proper and final mine closure.
For mines closed prior to issuance of MoC guidelines (i.e. 27th August, 2009) suitable action to be taken as per provisions of Mines Act 1952.

f) Mine fire& subsidence

BCCL shall endeavour to reduce occurrence of mine fire and subsidence due to mining activityfor safety and conservation purpose and, shall take steps for prevention and control of coal mine fire. Monthly report shall be submitted to top management of thesubsidiary and CIL and Quarterly to company board. Action Plan for mine fire control shall be implemented. Monitoring will be done through Satellite Surveillance/other suitable technology. Rehabilitation under Master Plan will be expedited to facilitate faster liquidation of fire. During the execution of the Master Plan since 2009, changes have occurred in the fire dealing methodology, the number of affected families and the infrastructure facilities to be provided to them. However, these modifications were executed in cognizance of HPCC committee for JMP.

BCCL is committed for implementation of the GOI approved Master Plan for Dealing with Fire, Subsidence and Rehabilitation in leasehold of BCCL (Jharia Master Plan) which is also required to be dovetailed with the implementation of EC conditions of various clusters of BCCL . Necessary steps shall be taken for implementation of Jharia master plan to deal with the problem of fire and subsidence in JCF along with R&R of affected people.

g) Monitoring:

All receptors in and around the mining projects/clusters shall be monitored regularly to assess the efficacy of the pollution control / mitigation measures within stipulated standards.
II. Effect of mining on the hydrology of the area will be monitored through measurement of water level and quality of nearby wells and bore holes provided for this purpose. Conservation of water through rainwater harvesting shall be taken up.

III. Area and Unit environmental cells shall have regular interaction with the people in and around the coal mines and other allied units on matters related to environment to take necessary and timely corrective actions.

V. Environmental initiatives and monitoring through self and third party environment audit shall be conducted for generating useful data for taking corrective actions and mitigation measures as per guidelines.

h) Other measures:

I. Special emphasis shall be given to undertake R&D related to various facets of coal mine environmental management in collaboration with Central Mine Planning and Design Institute (CMPDI) and other competent institutions.

II. Besides ensuring statutory compliance, the BCCL desires to set high standards and continual improvement.

III. Mines & establishments shall be ISO 14001 certified in phased manner.

IV. CSR and R&R policies of CIL are to be incorporatedby BCCL for better planning and implementation of the socio-economic issues of coal mining areas.

V. The coal mining environmental issues are complex and require multi-disciplinary approach to address the same. BCCL will endeavour to enter into MoUs with expert agencies of repute to assist in environment issues and also help in capacity building of BCCL executives.

VI. BCCL conduct periodical medical examination (PME) of its work force on routine basis in compliance of the requirement mining rules and regulation, additional test will be done as and when required.

5. PRESERVATION OF BIO-DIVERSITY:

BCCL has made the ecological restoration a flagship programme for restoration of degraded mined areas and adopting 3- tier plantation consisting of native species grasses, bushes and trees under the technical expertise of Forest research institute, Dehradun, a renowned institute in the field of forests and ecology. Ecological restoration has been widely accepted as one of the most effective means to restore the ecology and biodiversity.

BCCL is committed towards the conservation and restoration of the natural biodiversity of the region on the degraded mined out areas and restore back to forest like areas. BCCL will strive to restore the habitats for the native fauna of the region by restoring the areas through ecological restoration.

BCCL is committed towards the wellbeing and betterment of the living standards for the local community through establishment of the eco-parks in the reclaimed mined areas in the coalfield and promoting the eco-mining tourism in the coalfield areas and exploring the new opportunities to the local communities.This will start from mine planning including technically and biologically reclamation of mined out areas in collaboration with State Forest Departments, Wild Life Divisions, NGOs, FRI Dehradunetc. working in the fields of biodiversity conservation.

6. COAL BENEFICIATION / COALWASHERIES:

a) For beneficiation of Runoff Mines (ROM) coal, washeries are being set up in a phased manner as per requirement and statutes.

b) Slurry Management System (SMS) in all washeries shall be organized to ensure collection of fines, gainful utilization of rejects viz. power generation in Fluidized Bed Combustion (FBC) plants, selling to brick manufacturers or adopting other environmental friendly disposal options as feasible.

c) The reject dumps and tailings shall be suitably handled to avoid any contamination.

d) The effluent from washeries including tailings pond shall be suitably treated and reused to minimize water consumption with zero discharge concept.

7. CONSERVATION AND CLEAN TECHNOLOGY:

a) R&D projects shall be taken up to promote clean coal technology and improve the existing technologies.

b) Energy saved is energy produced. Voluntary energy audit to be done for corrective action to reduce carbon footprint.

c) Clean Development Mechanisms will be explored for reducing emission of Green House Gases by exploration, identification, preparation of projects reports for extraction of methane from Coal Bed, Coal Mine, Abandoned Mine, Ventilation Air, UG Coal Gasification, generation and utilization of renewable energy etc.

8. AWARENESS PROGRAMME:

a) Publicity to generate awareness through exchange & communication of information, newsletters and periodicals on environment, seminars, workshops, celebration of World Environment Day etc, at BCCL HQ, Areas & units to be undertaken. Regular training programs to be organized at various levels to inculcate awareness among employees.
b) Courses on environmental and forestry laws and Environmental Protection Measures and the Corporate Policy to be organized for project executives for improving knowledge.
c) BCCL will felicitate its workers for best practices in eco-restoration, land reclamation, conservation, compliance of statutes and innovative ways of sustaining environment.

9. WASTE MANAGEMENT:

BCCL will undertake appropriate action for safe handling, storage and disposal of solid waste and hazardous waste generated from its industrial set up and colonies as per relevant rules. The biomedical waste generated from hospitals and dispensaries will be collected and disposed in appropriate facilities created as per statutes. E-waste management and handling of various types of e-waste generated in its operations will be done as per rule.

10. CORPORATE ENVIRONMENT RESPONSIBILITY:

Corporate Environment Responsibility (CER) is mandatory for issuing environmental clearance for all the Greenfield and Brownfield projects as per directives of MoEFCC with effect from 1st May, 2018 (O.M.No.22-65/2017- IAIII dt. 19.06.2018). Budgetary provisions should be kept for implementation of provisions of CER for all the projects which will be submitted to MoEFCC for grant of environmental clearance.

11. INCORPORATION OF VIEWS OF STAKEHOLDERS:

BCCL will critically examine and incorporate the viewpoints of various stakeholders like PAPs/PAFs, Parliamentary Committees, Standing Sub-Committees, NGOs etc.

12.IMPLEMENTATION OF POLICY:

i) Manpower: BCCL shall have environmental divisions at decision making & operational levels in its structure. The environment department shall be set up and strengthened at:

i) BCCL HQ
ii)Areas / Units / Collieries / Workshops /Washeries

ii) Roles and Responsibilities: The environmental department, set up at company HQs, Areas and Unit levels with appropriate manpower and resources, shall be responsible for implementation of policy, obtaining EC, FC, consent to establish & operate, statutes requirements and undertaking mitigation measures besides preparation of action plan every year and also to intimate the status of implementation to the management regularly.

iii) Annual Environment Budget (Revenue &Capital): The Annual Environment Budget (revenue & capital) shall be prepared based on the action plan including monitoring of various bench marks and the budget utilization. The year wise funds earmarked for environmental protection measures shall be kept in separate accounts with Environmental cost code.

REVIEW OF ENVIRONMENTAL POLICY:

In view of the present fast changing social, economic and environmental scenario, the CIL Policy shall be reviewed every 5 years to incorporate the changes in the legal, technical, environmental, economic and social inputs prevailing at that time. Whenever, there is change in National Environmental Policy or other National / State relevant policies, Acts etc, the CILCorporate Environmental Policy would be reviewed and suitably revised. It will be followed by revision of this policy accordingly.

Place: Dhanbad
Date:

Chairman-cum-Managing Director
21/02/2020

Major Environmental measures cost for the year 2020-21

Sl. No.	Activity (20-21)	Approx Cost Incurred (In Lakhs)
1	Environmental Monitoring (Air, water and noise)	18.71
2	Procurement of 28 KL Water Tanker (3 Nos)	500.00
3	Ecological Restoration/Block Plantation/Green Park	143.0
4	Fire covering/blanketing/fighting	80.00
5	Water Sprinkling	75.00
6	Water treatment plant	35.00
7	Top soil Management	2.5
	Plantation by DFO	29.48
	Avenue Plantation (Gabion plantation)	2.58
Total Cost Incurred		**886.27**

Note:- Amount deposited in Escrow account for implementation of progressive mine closure Activity in the mines under cluster IV 5.66 Crores in the FY20-21.

(7)

Ph: 0326-2204933

झारखण्ड राज्य प्रदूषण नियंत्रण पर्षद्
Jharkhand State Pollution Control Board
HIG-1, Housing Colony, Dhanbad-826001

Letter No. 2650 Dated 6/7/13

From,

Regional Officer,
Dhanbad

To,

HOD (Envt.),
M/s. B.C.C.L.,
Koyla Bhawan, Koyla Nagar,
Dhanbad.

Sub: **Fixing up monitoring station/Sampling location of Air, Water & Noise.**

Sir,

With reference to you letter no. GM(Env.)/F-JSPCB/2013/783, dt. 06.07.2013 We have approved Air, Water & Noise monitoring Station/Sampling location after verification and return a copy of the map.

Encl-A/a.

Your's faithfully,

6/7/13

(Dinesh Prasad Singh)
Regional Officer.

Memo..... Dhanbad, dated.....

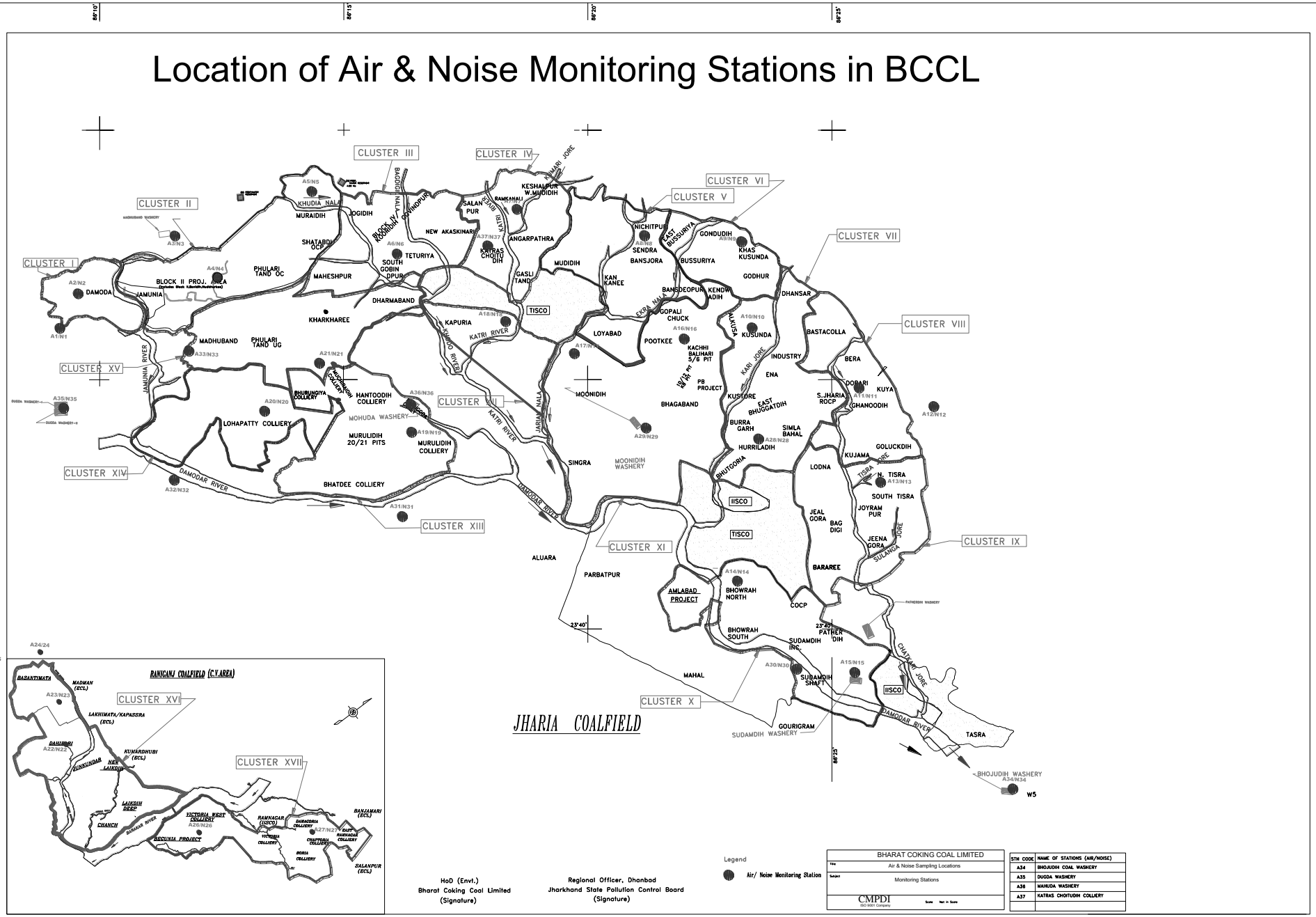
Copy to: The Member Secretary, Jharkhand State Pollution Control Board for information & enclose a copy of the map for necessary action.

Encl-A/a.

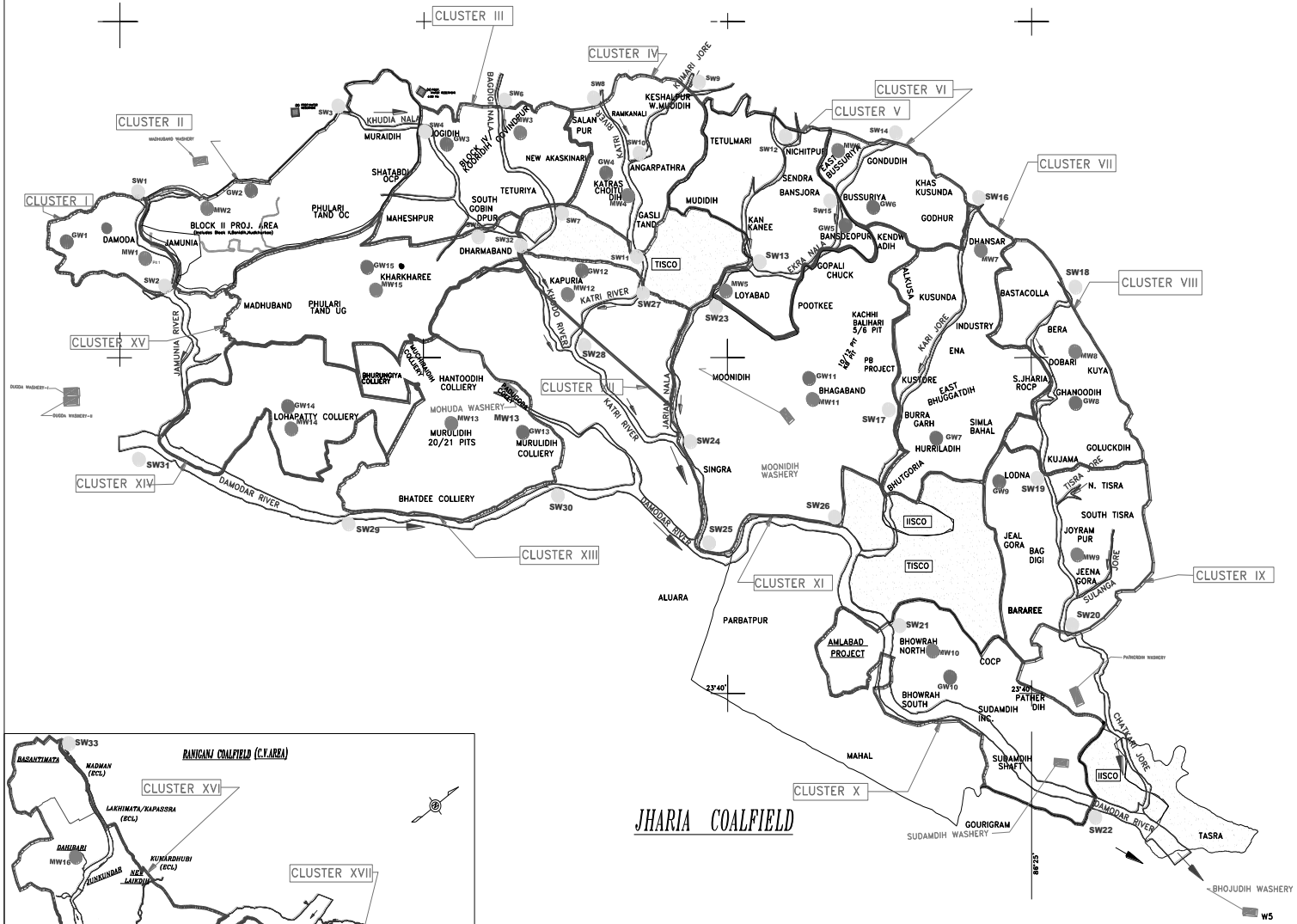
(Dinesh Pd. Singh)
Regional Officer.

Printed by Sandip

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

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.

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

(FOR THE MONTH MARCH, 2021)

E. C. no. J-11015/372/2010-IA.II (M) dated 23.10.2019.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

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4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

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_x). 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 Standards for Coal Mines, are within permissible limits.

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

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.

The Cluster IV is in the Northern part of the Jharia coalfield.It includes Salanpur colliery, KatrasChoitodih colliery(OC), Amalgamated Keshalpur – West Mudidih Mixed (OCP & UG) Mines, Amalgamated Ramkanali – Angarpathra UG mines, Gaslitand OC. The cluster– IV is situated about 25 – 30 kms from Dhanbad Railway Station. The mines of this cluster- IV 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 Katri Jore. The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 7.34 MTPA (normative) and 9.55 MTPA peak capacity of coal production vide letter no. J-11015/372/2013-IA.II (M) dated 23rd October, 2019

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) Govindpur Village (A7): Industrial Area

The location of the sampling station is 23^0 48'34" N, 86^0 18'22" E. The sampler was placed at 1.5 m above the ground level at AARC agent Office.

ii) Katras Chotudih (A37): Industrial Area

The location of the sampling station is at the roof top of the Manager Office.

II. BUFFER ZONE Monitoring Location

i) Block IV (A6) : industrial area

The location of the sampling station is 23^0 47.916' N 86^0 15.333' E. The sampler was placed at a height of 1.5 m above the ground level in Safety office of Block IV OCP.

ii) Nichitpur (A8): Industrial Area

The location of the sampling station is 23^0 48'20" N 86^0 21'30" E. The sampler was placed at roof top at Safety office of Nichitpur.

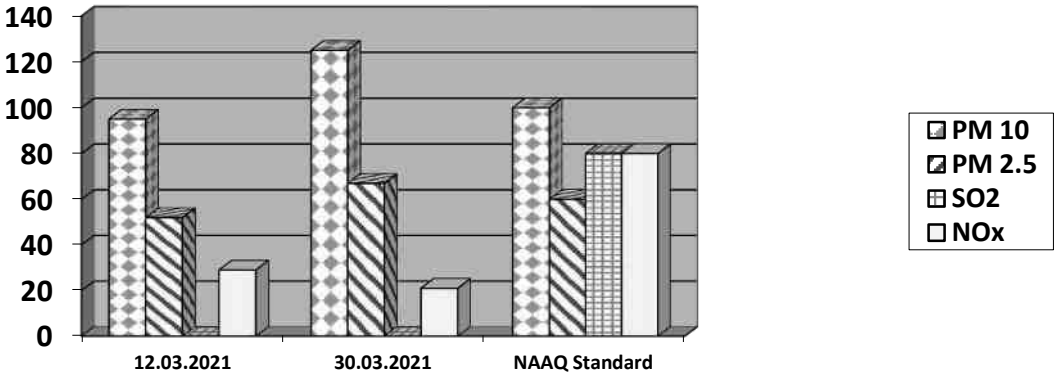
iii) Rudhi Basti(A18): **Residential Area**

The sampler was placed at a height of 1.5 m above the ground level at Rudhi Basti.

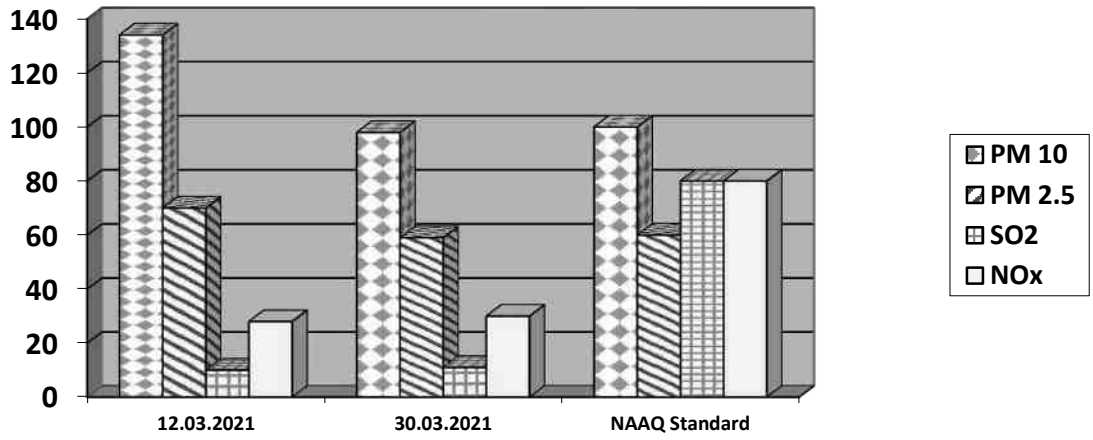
AMBIENT AIR QUALITY DATA

Cluster – IV, Bharat Coking Coal limited Month: **MAR 2021** **Year**: **2020-21.**

Station Name: A7, Govindpur		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_x**
1	12.03.2021	95	52	<10	29
2	30.03.2021	125	67	<10	21
	NAAQ Standard	100	60	80	80



Station Name: A37, Katras Chotudih		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_x**
1	12.03.2021	134	70	10	28
2	30.03.2021	98	59	11	30
	NAAQ Standard	100	60	80	80

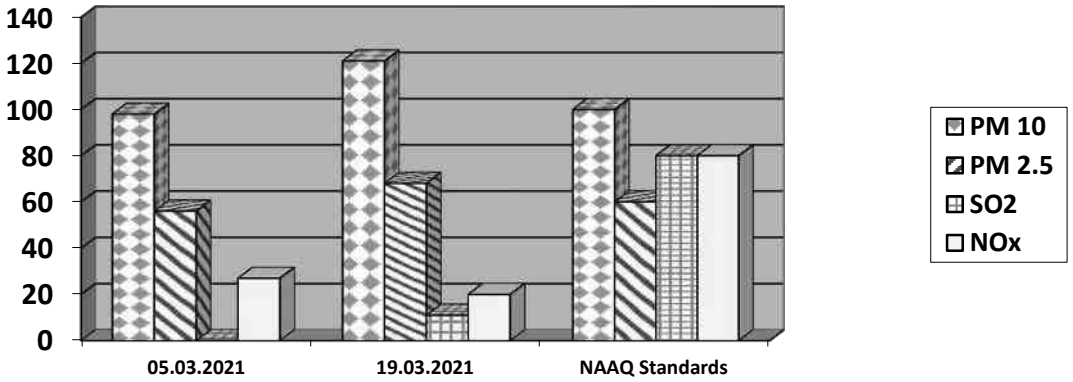


Analysed By
JSA/SA/SSA

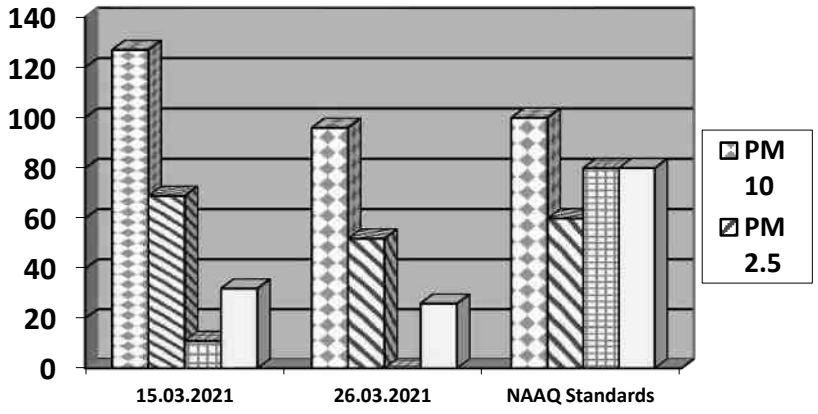
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name: A6,Block IV		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	05.03.2021	98	56	<10	27
2	19.03.2021	121	68	11	20
	NAAQ Standards	100	60	80	80



Station Name: A8,Nichitpur		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	15.03.2021	127	69	11	32
2	26.03.2021	96	52	<10	26
	NAAQ Standards	100	60	80	80

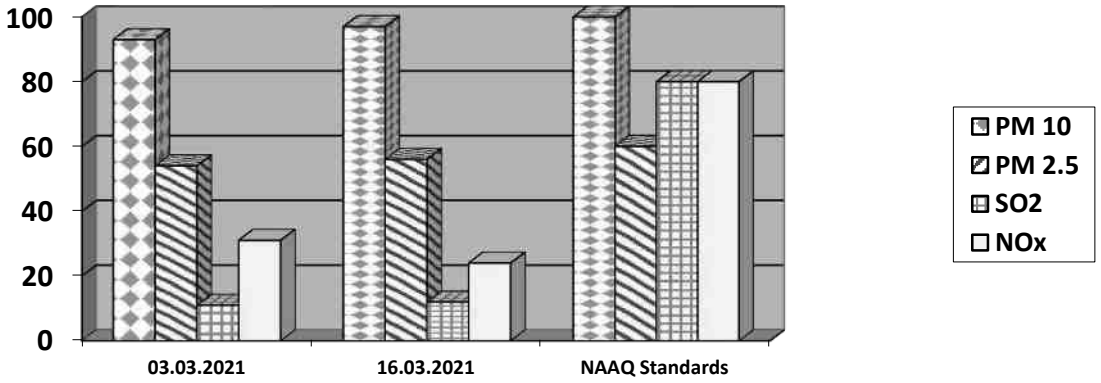


Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name: A18,Rudhi Basti		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	03.03.2021	93	54	11	31
2	16.03.2021	97	56	12	24
	NAAQ Standards	100	60	80	80



- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Chotudih (MW4)**

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

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 parmeters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -IV**		Month: **MAR 2021**	Name of the Station: **Mine Discharge of Chotudih**	
Sl. No.	**Parameters**	**MW4** First Fortnight	**MW4** Second Fortnight	**As per MOEF General Standards for schedule VI**
		15.03.2021	30.03.2021	
1	Total Suspended Solids	34	39	*100 (Max)*
2	pH	8.12	8.28	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	24	20	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Govindpur (N7)**
ii) K**atras Chotudih (N37)**
iii) **Block IV(N6)**
iv) **Nichitpur(N8)**
v) **RudhiBasti (N18)**

4.2 Methodology of sampling and analysis

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day 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.

NOISE LEVEL DATA

Name of the Project: **Cluster -IV**			Month: **MAR 2021**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Block IV(N6)**	**Industrial area**	05.03.2021	57.6	*75*
2	**Block IV**	**Industrial area**	19.03.2021	59.2	*75*
3	**Govindpur Village(N7)**	**Industrial area**	12.03.2021	61.2	*75*
4	**Govindpur Village**	**Industrial area**	30.03.2021	60.9	*75*
5	**Nichitpur(N8)**	**Industrial area**	15.03.2021	57.2	75
6	**Nichitpur**	**Industrial area**	26.03.2021	59.6	*75*
7	**Katras Chotudih(N37)**	**Industrial area**	12.03.2021	59.6	*75*
8	**Katras Chotudih**	**Industrial area**	30.03.2021	62.3	*75*
9	**Rudhi Basti(N18)**	**Residential area**	03.03.2021	50.7	*55*
10	**Rudhi Basti**	**Residential area**	16.03.2021	53.1	*55*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM,**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

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/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it MAY exceed but not on two consecutivedays.

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.

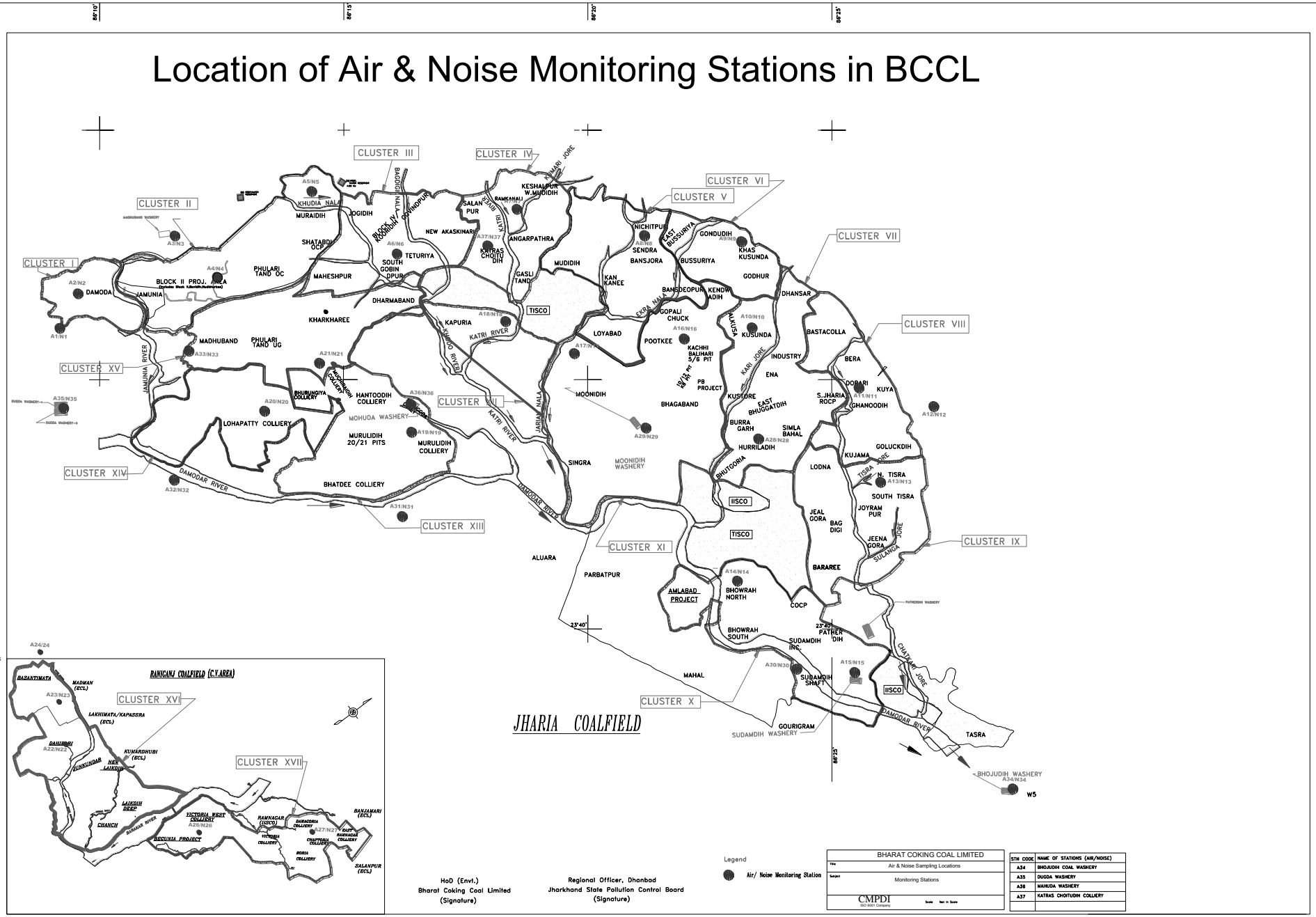
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet 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.

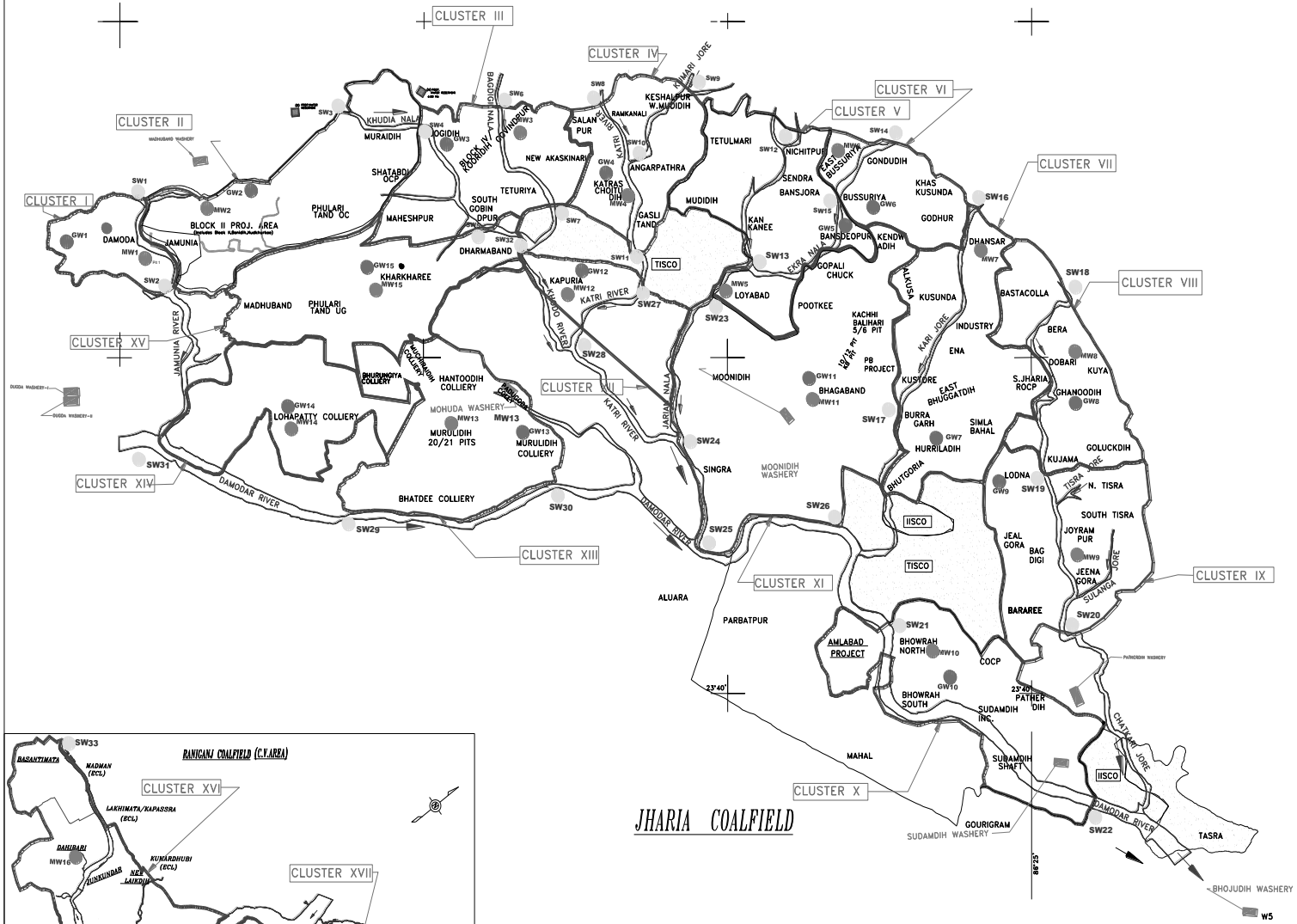
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they MAY exceed the limits but not on two consecutive days of monitoring.

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

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WATER QUALITY REPORT OF BHARAT COKING COAL LIMITED, CLUSTER – IV

(FOR THE Q.E. DECEMBER, 2020)

E. C. no. J-11015/372/2010-IA.II (M) dated 23.10.2019

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - IV

(FOR THE Q.E. DECEMBER, 2020)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
	Plates:	
4.	PLATE NO. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

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WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED
CLUSTER – IV

(FOR THE Q.E. DECEMBER, 2020)

E. C. no. J-11015/372/2010-IA.II (M) dated 23.10.2019

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

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, drinking water supply, well/ Hand pump water & also surface water samples.

2.2 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 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis. The drinking 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

3.2 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) & fine particulates for PM 2.5 sampler were used for sampling PM 10 & PM 2.5 respectively. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environmental Laboratory of 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 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

4.2 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 guide-lines stipulated by Ministry of Environment, Forests and Climate Change (MoEF&CC), Govt. of India.

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 MoEFCC 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.

The Cluster IV is in the Northern part of the Jharia coalfield.It includes SalanpurOCP, KatrasChoitodihUG, Amalgamated Keshalpur – West Mudidih OCP & UG Mines, Amalgamated Ramkanali – Angarpathra OCP & UG mines, Gaslitand UG. The cluster– IV is situated about 25 - 30kms from Dhanbad Railway Station. The mines of this cluster- IV 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 KatriRiver and Kuaprili Jore.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 7.34Mtpa (normative) and 9.55 Mtpa peak capacity of coal production vide letter no. J-11015/372/2013-IA.II (M) dated 23rd October, 2019.

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

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.2 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Govindpur Village (A7): Industrial Area

The location of the sampling station is 23^0 48'34" N, 86^0 18'22" E

ii) **Katras Chotudih (A37): Industrial Area**

The location of the sampling station is at the roof top of the Manager Office.

II. BUFFER ZONE Monitoring Location

i) Block IV (A6) : industrial area

The location of the sampling station is 23^0 47.916' N 86^0 15.333' E.

ii) Nichitpur (A8): Industrial Area

The location of the sampling station is 23^0 48'20" N 86^0 21'30" E.

iii) Rudhi Basti(A18): **Residential Area**

The sampler was placed at a height of 1.5 m above the ground level at Rudhi Basti.

2.3 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.

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year : **2020-21**

Name of the Cluster : **Cluster -IV** PERIOD: **Q. E. December – 2020.**

AREA: Katras

Heavy Metal Analysis report of Ambient Air Quality

SAMPLE	Cadmium(Cd) (µg/m3)	Mercury(Hg) (µg/m3)	**Arsenic(As) (ng/m3)**	Chromium(Cr) (µg/m3)	Nickel (Ni) (ng/m3)	Lead (Pb) (µg/m3)
Block IV (A6)	<0.001	<0.001	<0.005	<0.01	0.17	0.005
Govindpur Village (A7)	<0.001	<0.001	<0.005	<0.01	<0.1	0.009
Nichitpur (A8)	<0.001	0.015	<0.005	<0.01	<0.1	<0.005
Rudhi Basti(A18)	<0.001	<0.001	<0.005	<0.01	<0.1	0.021
Katras Chotudih (A37)	<0.001	<0.001	<0.005	<0.01	<0.1	<0.005

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

CHAPTER – III

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking water quality at **Kankanee Village (DW4)**

ii) Surface water quality at **U/S of Katri River (SW8)**

iii) Surface water quality at **D/S of Katri River (SW11)**

iv) Surface water quality at **U/S of Kumari Jore (SW9)**

v) Surface water quality at **D/S of Kumari Jore (SW10)**

vi) Mine Effluent quality at **Chotudih (MW4)**

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis. The drinking 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

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 parmeters are within the permissible limits.

2.3 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.

WATER QUALITY

(SURFACE WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2020-21**

Name of the Cluster : **Cluster - IV** Month: **Q. E. DEC, 2020**

Area : Katras **Project:** Chotudih

Stations: **Date of Sampling:**

1. Upstream in Katri River SW-8 28/12/2020
2. Down stream in Katri River SW-11 14/12/2020
3. Upstream in Kumari Jore SW-9 14/12/2020
4. Down stream in Kumari Jore SW-10 14/12/2020

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW-08 28.12.2020	SW09 14.12.2020	SW10 14.12.2020	SW11 14.12.2020			
1	Arsenic (as As), mg/l, Max	<0.006	<0.006	<0.006	<0.006	0.2	0.006	IS-3025,part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
2	BOD (3 days 27ºC), mg/l, Max	<2.0	<2.0	<2.0	2.0	3.00	2.00	IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C
3	Colour	Colourless	Colourless	Colourless	Colourless	300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	38	48	56	60	600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2	<0.2	<0.2	1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	7.7	8.0	7.8	8.1	4	0.10	IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.77	0.69	0.77	0.87	1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01	<0.01	0.010	0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	<0.2	50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	<0.005	0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	1.77	5.62	6.63	2.6	50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	8.29	7.84	7.81	7.92	6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002	<0.002	<0.002	0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Selenium, mg/l, Max	<0.007	<0.007	<0.007	<0.007	0.05	0.007	IS-3025,part 56:2003, R-2019/ APHA 23rd Edition, AAS-VGA
15	Sulphate (as SO_4) mg/l, Max	51	53	43	107	400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	443	468	444	576	1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	<0.1	15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

All values are expressed in mg/lit unless specified

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(DRINKING WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2020-21.**

Name of the Cluster : **Cluster - IV** Month: **Q. E. Dec, 2020**

Area : Katras **Project:** Chotudih

Stations: Kankanee Village DW-4 **Date of sampling: 23-11-2020**

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		DW 04 23.11.2020					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	58			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	76			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA,23rd Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.98			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2			0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02			0.02	0.1	APHA, 23rd Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	4.68			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	8.03			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium, mg/l, Max	<0.007			0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	339			10	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_aco_3),, mg/l, Max	78			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	**Total Arsenic (as As), mg/l,Max**	<0.006			0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23rd Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23rd Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	849			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_aco_3), mg/l, Max	855			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	3			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1			0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01			0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23rd Edition, AAS-GTA

Analysed By
JNA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

WATER QUALITY

(MINE EFFLUENT- 27 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2020-21.**

Name of the Cluster : **Cluster - IV** Month: **Q. E. DEC, 2020**

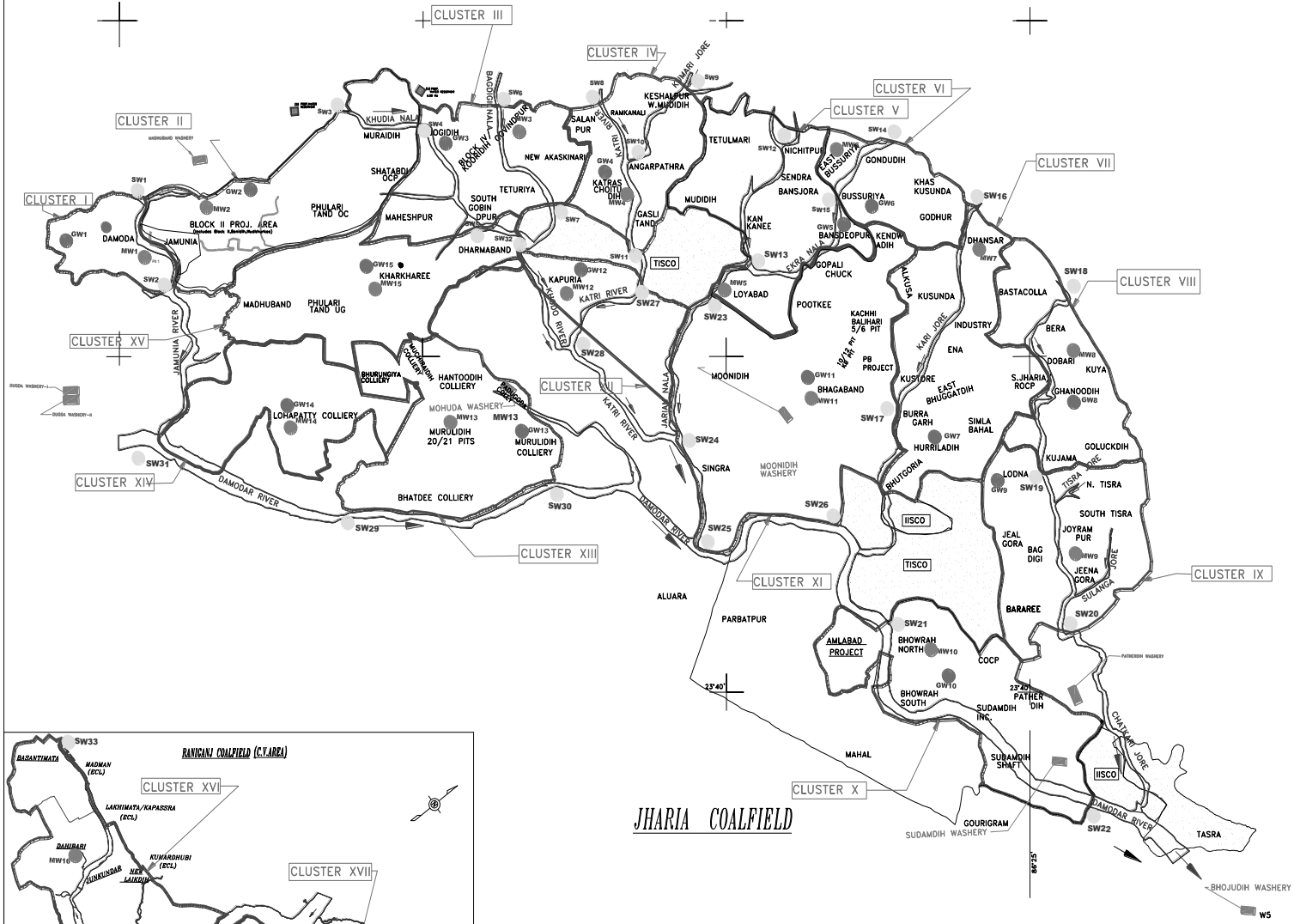
Effluent water of BCCL Mines					**Date of Sampling:**
Sample Code :MW04					14.12.2020
Sl.No.	**Parameter**	**Results MW-04**	**Detection Limit**	**MOEF -SCH-VI STANDARDS Class 'A'**	**BIS Standard & Method**
1	Ammonical Nitrogen, mg/l, Max	<0.02	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Arsenic (as As), mg/l, *Max*	<0.006	0.006	0.2	IS 3025, part 37:1988, R-2019/ APHA 23rd Edition AAS-VGA
3	B.O.D (3 days 27ºC), mg/l, Max	<2.0	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	Colourless	Qualitative	Qualitative	Physical/Qualitative
5	COD, mg/l, Max	20	4.00	250.0	APHA 23rd Edition 5220 C Titrimetric Method
6	Copper (as Cu), mg/l, *Max*	<0.2	0.2	3.0	IS 3025(Part42): 1992 R : 2019, AAS-Flame
7	Dissolved Phosphate (as P), mg/l, Max	<0.3	0.30	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, *Max*	0.88	0.2	2.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0	IS:3025/34:1988, Nesseler's
10	Hexavalent Chromium, mg/l, Max	<0.01	0.01	0.1	IS 3025 (Part 52) : 2003,Reaffirmed 2019
11	Iron (as Fe), mg/l, *Max*	<0.2	0.2	3.0	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1	APHA, 23rd Edition, AAS-GTA
13	Manganese(as Mn), mg/l, Max	<0.2	0.2	2.0	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame
14	Nickel (as Ni), mg/l, *Max*	<0.1	0.1	3.0	IS-3025(Part 54):2003, R:2019 AAS-Flame
15	Nitrate Nitrogen, mg/l, *Max*	1.12	0.50	10.0	APHA, 23 rd Edition,UV-Spectrphotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	8.21	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0	APHA, 23rd Edition 4-Amino Antipyrine
19	Selenium, mg/l, Max	<0.007	0.007	0.05	IS 3025, part 56:2003, R-2019/APHA 23rd Edition, AAS-VGA
20	Sulphide (as S^{2-}) mg/l Max.	<0.005	0.005	2.0	APHA 23rd Edition Methylene Blue Method
21	Temperature (°C)	19.2	Shall not exceed 5^0 C above the receiving temp.		IS-3025/09:1984, Thermometeric
22	Total Chromium (as Cr), mg/l, *Max*	<0.1	0.1	2.0	IS-3025(Part 52):2003, R:2019 AAS-Flame
23	Total Kjeldahl Nitrogen, mg/l, Max	1.2	1.00	100.0	IS:3025/34:1988, Nesseler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	27	10.00	100.0	IS 3025/17:1984, R :2017, Gravimetric
26	Zinc (as Zn), mg/l, *Max*	<0.1	0.1	5.0	IS 3025 /49 : 1994, R : 2019, AAS-Flame
27	Odour	Agreeable	Agreeable	Qualitative	APHA, 23rd Edition, , 2150-C

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

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

भारतकोकिंगकोललिमिटेड
(कोलइंडियालिमिटेडकाएकअंग)
BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited)

Civil Engineering Department, Koyla Nagar, Dhanbad – 826 005 (JH), India
, e-mail: gmcivil.bccl@coalindia.in

NIT Ref. No.: BCCL/CED/TC/eNIT-18/2020-21/968 **Date:10.03.2021**

E – Tender Notice

Open E-Tender invited vide BCCL/CED/TC/eNIT-18/2020-21/968; Date: 10.03.2021 for the work of "**Drilling and installation of 23 nos of piezometric wells in the command area of BCCL**"

Estimated Value: Rs. 2,16,19,913.33 **Period of Work:175 days**

The tender documents can be downloaded from **11.03.2021to29.03.2021.** All prospective bidders are advised to visit website **https://coalindiatenders.nic.in** for further details and to participate against this tender. Full details of this tender are also available on website "**eprocure.gov.in**".

GM(Civil/Welfare), BCCL

Copy to:-

1) D (T) OP/D(P)/CVO, BCCL ..... for kind information
2) GM (Civil/Ind.), BCCL.
3) GM All Area.
4) Chief Manager (Civil), CED HQ, BCCL.
5) GM (Geology)/HOD(Environment)/GM(P&P).
6) Area Manager (Civil), All Area
7) Assistant Manager (Civil), TC, CED.
8) IEMs.

Bharat Coking Coal Ltd.
(A Subsidiary of Coal India Limited)
Office of the General Manager, Katras Area
P.O. KATRAS, P.S.- Jogta, Dhanbad-828121
CIN: U1010JH1972GOI000918
Phone/Fax No.: 0326-2371213
Email ID: cgmkatras@bccl.gov.in

Ref- BCCK/KA/IV/GM/ 1588(A) **Dated- 30/11/2020**

To
The Director,
Ministry of environment, forest and climate charge
Regional office (ECZ)
Bungalow office no.42, Shyamali colony
Ranchi-834002

Sub:-Six monthly EC compliance report on implementation of environmental measures for the period from April 2020 to Sept 2020

Dear Sir
Kindly find enclosed herewith the six monthly EC compliance report on implementation of environmental measures for the period from April 2020 to Sept 2020 in respect of cluster IV group of mines under Katras Area, BCCL.

Sir, This is for your kind information and necessary action please.
Hope you will find in order.

Enclosed:-As Above.

Yours Faithfully
30/11/2020
General Manager
Cluster-IV, BCCL
Pitesh Kr

Copy:-
1.The Director,IA Monitoring cell,Paryavaran Bhawan,CGO Complex, New Delhi-110003
2. Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032, INDIA
3. The Director,(S) Ministry of Environment & Forest,Govt.of India –Bhuneshwar751023
4.The Member Secretary, Jharkhand state Pollution Control Board,Ranchi-834004
5. The Regional Officer, Jharkhand state Pollution Board,Dhanabad-826001
6.Dy.GM(ENV),BCCL,Koyla Bhawan,Dhanbad
6.Office Copy

Scanned with CamScanner

भारत कोकिंग कोल लिमिटेड

'एक मिनीरत्न कम्पनी'

(कोल इण्डिया लिमिटेड का एक अंग)

सभी संबन्धित व्यक्तियों को यह सूचित किया जाता है की 'क्लस्टर चार' जो बीसीसीएल के 5 मिश्रित खदानों का समूह है, को पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय (Ministry of Environment Forest & Climate Change) द्वारा पर्यावरणीय स्वीकृति (Environment Clearance) प्राप्त हुई है। विवरण निम्न है :।

समूह (Cluster) का नाम	स्वीकृत आदेश संख्या एवं तिथि
क्लस्टर चार– (धनबाद जिले में स्थित भारत कोकिंग कोल लिमिटेड के पांच मिश्रित कोयला खादानों का समूह– सलानपुर कोलियरी, कतरास चोइटुडिह कोलियरी, अमलगमेटेड केशलपुर पश्चिम मुडीडीह कोलियरी, अंगारपथरा और रामकानली कोलियरी, गजलीटांड़ कोलियरी) जिसका कुल क्षेत्र 1123.79 हैकटेयर है और बढ़ी हुई सामान्य क्षमता 7.34 एमटीपीए है और अधिकतम क्षमता 9.55 एमटीपीए है।	ज–11015/372/2013 – आईए–II (एम) दिनांक 16th जुलाई 2018

पर्यावरण स्वीकृती की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण विभाग के पास उपलब्ध है एवं पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय की वैबसाइट www.environmentclearance.nic.in एवं कंपनी की वैबसाइट www.bcclweb.in पर भी उपलब्ध है।

26.07.2018.

Administrative

भारत कोकिंग कोल लिमिटेड

(एक मिनीरत्न कम्पनी)

(कोल इंडिया का एक उपक्रम)

सभी संबन्धित व्यक्तियों को यह सूचित किया जाता है कि 'क्लस्टर चार' जो बीसीसीएल के 5 मिश्रित खदानों का समूह है, को पर्यावरण वन एवं जलवायु परिवर्तन मंत्रालय (Ministry of Environment Forest & Climate Change) द्वारा पर्यावरणीय स्वीकृति (Environment Clearance) प्राप्त हुई है। विवरण निम्न है:

समूह (Cluster) का नाम	स्वीकृति आदेश संख्या एवं तिथि
क्लस्टर चार-(धनबाद जिले में स्थित भारत कोकिंग कोल लिमिटेड के पांच मिश्रित कोयला खादानों का समूह-सलानपुर कोलियरी, कतरास चोइटुडिह कोलियरी, अमलगमेटेड केशलपुर पश्चिम मुडीड़ीह कोलियरी, अंगारपथरा और रामकानली कोलियरी, गजलीटांड कोलियरी) जिसका कुल क्षेत्र 1123.79 हैकटेयर है और बढ़ी हुई सामान्य क्षमता 7.34 एमटीपीए है और अधिकतम क्षमता 9.55 एमटीपीए है।	ज-11015/372/2013-आईए- II (एम) दिनांक 16th जुलाई 2018

पर्यावरण स्वीकृति की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण विभाग के पास उपलब्ध है एवं पर्यावरण वन एवं जलवायु परिवर्तन मंत्रलाय की वेबसाईट www.environmentclearance.nic.in एवं कंपनी की वेबसाईट www.bcclweb.in पर भी उपलब्ध है।

PR-188890 (Health Med Edu and Family Welfare) 2018-19