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An ISO 9001, ISO 14001 & OHSAS 18001 Certified Company

SARDA ENERGY & MINERALS LTD.

क्र./SEML/SW/FC/21

दिनांक – 06.10.2023

प्रति,

1) वन मंडल अधिकारी
   सामान्य वन मंडल, दक्षिण शहडोल (म.प्र.)
2) वन मंडल अधिकारी
   सामान्य वन मंडल, उमरिया (म.प्र.)

विषय - वन मंडल दक्षिण शहडोल के परिक्षेत्र शहडोल के विभिन्न खसरों के रकबा 15.549 हे. राजस्व वनभूमि एवं वन मंडल उमरिया के परिक्षेत्र घुनघुटी के वन कक्ष RF-227 & PF-779 के रकबा 46.488 हे. तथा विभिन्न खसरो की रकबा 18.553 हे राजस्व वनभूमि कुल रकबा 80.59 हे. वनभूमि में शाहपुर पश्चिम कोल ब्लाक अंतर्गत भूमिगत कोयला उत्खनन तथा उपरिसतह उपयोग के व्यपवर्तन का – मेसर्स सारडा एनर्जी एंड मिनरल्स लिमिटेड, रायपुर (छत्ती) का प्रस्ताव ।

सन्दर्भ – अपर प्रधान मुख्य वन संरक्षक (भू- प्रबंध), मध्य प्रदेश, भोपाल का पत्र क्रमांक/एफ-/839/2023/10-11/4318 भोपाल, दिनांक 26/09/2023

महोदय,

उपरोक्त संदर्भित पत्र द्वारा चाही गई जानकारी टेब्युलर फॉर्म में तैयार कर परिवेश पोर्टल के भाग – 1 के एडिशनल डाक्यूमेंट्स में अपलोड करते हुए तीन प्रतियों में सादर संप्रेषित है । कृपया प्रकरण में अग्रिम कार्यवाही करने की कृपा करें ।

संलग्न – उपरोक्तानुसार

वास्ते, सारडा एनर्जी & मिनरल्स लिमिटेड,

6/X/2023

एस. एस. श्रीवास्तव
उपाध्यक्ष – कोल माइंस

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प्रतिलिपि-:

1) अपर प्रधान मुख्य वन संरक्षक (भू- प्रबंध), भोपाल, मध्य प्रदेश
2) मुख्य वन संरक्षक, शहडोल वृत्त, शहडोल, मध्य प्रदेश

Point wise reply to the observations dated 22.09.2023

S.No	Observation	Reply
i	The land use details as mentioned in the mining plan are not matching with the components proposed and mentioned in the online Part-I. Therefore; a clarification must be provided with justification.	The Modified Mining Plan for Sahapur West Coal Block was approved on 21.04.2022 wherein 24.299 Ha of land was provisioned for surface utilization. Out of this 24.299 Ha, 7.136 Ha of Revenue Forest Land was provisioned for Surface Utilization for Infrastructure Area (5.531 Ha), Green Belt (0.428 Ha), Embankment (0.282 ha) and Road (0.895 Ha) and the case for Forest Diversion involving the above was submitted online over Parivesh Portal. Forest Conservation Division, MoEF & CC, GoI, New Delhi vide letter dated 17.04.2023 opined to explore the possibility of shifting of 5.531 Ha Infrastructure Area from Forest Land to Non-Forest Land as it is not a site specific activity. Accordingly the surface layout was reframed by SEML and as per the revised layout the new component wise area has been mentioned in the online Part-I. As per the new layout total 16.709 Ha is provisioned for surface utilization which is in line with the components proposed and mentioned in the online Part-I. As per Clause 1.3 (B) of the Guidelines issued by Ministry of Coal, Govt. of India dated 29th May 2020 (Copy enclosed as **Annexure-I**), the Company Board of the project proponent is empowered to make changes in the location of infrastructure within the leased area; Copy of certified Board Resolution was also added with the approved Revised Mining Plan and is uploaded in Additional Documents of Part I of Form A. The same has also been mentioned in the Reply of EDS raised by Nodal Officer dated 26.04.2023. It is once again enclosed as **Annexure-II**.
ii	It is not clear whether the Green belt is different from the safety zone or otherwise. This needs clarification along with submission of KML file.	The instant case is of Underground Coal Mine. Though the entire Mining Lease area is of 619.000 Ha, Surface Utilization is of only 16.709 Ha. As per Standard Industry Practice 33% of the area utilized for Surface Facilities is provisioned towards Green Belt whereas in the present case it is around 48 % which is towards better interests of the Environment.
iii	Further, area under road & infrastructure as mentioned in the mining plan is increasing from 14.875 to 14.905 ha and details in this regard shall be submitted.	As per the new layout total of 16.709 Ha is provisioned for surface utilization comprising of Topsoil Dump (0.03 Ha), Other Use (0.5 settling Pond and UG entry), Infrastructure Area (8.159 Ha Including Roads), Green Belt (8.02 Including Embankment). As per Clause 1.3 (B) of the Guidelines issued by Ministry of Coal, Govt. of India

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		dated 29th May 2020 (Copy enclosed as **Annexure-I**), the Company Board of the project proponent is empowered to make changes in location of infrastructure within the leased area; Copy of certified Board Resolution was also added with the approved Revised Mining Plan and is uploaded in Additional Documents of Part I of Form A. The same has also been mentioned in the Reply of EDS raised by Nodal Officer dated 26.04.2023. It is once again enclosed as **Annexure-II**.
iv	Progressive mine closure plan does not indicate the time and how much forest land will be biologically reclaimed at the end of mine life which needs submission.	The instant case is of Under Ground Coal Mining; no Mining Pits will be created hence no biological reclamation is required therefore not proposed in Mine Closure Plan. Out of 80.590 Ha Forest Land only 0.895 Ha is being utilized for Road, rest 79.695 ha Forest Land will remain undisturbed. At the end of Mine life, we undertake to plant adequate number of trees on above mentioned 0.895 Ha Forest Land under supervision of State Forest Department before returning the land back to the Forest Department.
v	As per the mining plan the proposal involves the construction of embankment, settling pond etc. and mining activity will be carried out at minimum depth of 72.15 meter to maximum depth of 141.73 meter from the surface. Therefore, the comments of the water resource department shall be submitted and if any, hydrological study has been carried out in the past shall also be submitted	**Embankment** - The embankment is proposed to be constructed on the private land to be utilized for Surface Infrastructure to prevent flood water from entering into the Mine premises. **Settling Pond**- Central Ground Water Authority vide condition no 28 of the NoC issued on 29.12.2022 (Copy Enclosed as **Annexure IV**) has provided for use of the advance dewatering technology (by construction of series of dewatering abstraction structures) *i.e. Settling Ponds in the instant case* to avoid Contamination of surface water and accordingly Settling Ponds have been provisioned. **Hydrological Study** - It has been carried out in the July 2022 and subsequently Central Ground Water Authority has also issued NoC for Ground Water Abstraction, both are enclosed herewith as **Annexure III & IV**.
vi	The user agency has uploaded an incorrect KML file indicating the different components of the projects vis-à-vis including the components proposed to be undertaken on the Non-forest land because as per the said KML file the area of forest land proposed for diversion is found 80.90 ha instead of 80.59 ha and the total area of components proposed over the Non-forest land is found 1.61 ha instead of 15.814 ha. Moreover, the	Correct KML file has been uploaded. The area of Forest Land has been measured in square meters and hectare, as well. In Google Earth software the area in square meters is tallying but it considers, by default, the area less than 500 square meters as 0 hectare and 501 to 999 square meters as 0.1 hectare. Hence when the area is measured in square meters and converted into hectare (dividing by 10000) exact area is derived, but difference is observed when the area is measured in Ha in Google Earth. The total area under surface utilization of Sahapur West Coal Block is 16.709 Ha, out of which 0.895 Ha is Forest Land for Road and remaining 15.814 Ha is Non-Forest Land.

	user agency has not given the attributes against each component KML file due to which it is impossible to segregate the KML files on the basis of their proposed components. Therefore a correct KML file for both forest and non-forest land showing the components shall be submitted.	The components under surface utilization area are Topsoil Dump - 0.03 Ha, Infrastructure Area - 5.378 Ha, Green Belt including Embankment - 8.02, Settling Pond - 0.2 Ha, UG Entry - 0.3 Ha and Road 2.781 - Ha. The Infrastructure Area 5.378 Ha involves Coal Stock Yard, Canteen, Workshop, Offices, Administrative Buildings, Lamp Room, VTC, Weigh Bridge, Electrical Sub-Station, Diesel Bunk, Time Office, Rest Shelter, ETP, Store, DG Room, Parking, First Aid Room, Rescue Room, Dispensary, Laboratory, Bunker, Hopper, Explosive Magazine, WTP, etc and the remaining area of the plots of Non Forest Land (i.e. the open spaces left after construction of above facilities).
vii	Examination of KML file showing coal evacuation plan through GIS-DSS tool revealed that the road does not exist on the ground. Further the total area of the proposed road calculated through the KML file is found 7.02 ha and as per the map showing the coal evacuation plan which has been uploaded by the user agency in Part-I, the proposed path of the road is passing through the Revenue Forest land and the forest area coming under this road has not been included in the present proposal. Therefore a complete proposal involving the total requirement of forest land shall be submitted.	The Coal Transportation Road is proposed to be constructed. As the instant case is of Underground Coal Mining, after obtaining EC, Final Approval under FCA, execution of Mining Lease, the construction activities will start which shall take around 24 months to reach to Coal Production and hence Coal Transportation Road will be required after around 2 years. Accordingly, the diversion of Revenue Forest Land will be sought separately and an undertaking affirming to non-utilization of such Revenue Forest Land beyond the mining lease area without obtaining its Forest Clearance is enclosed as **Annexure V**. Since other Milestones for development of Coal Block are to be completed within prescribed time limits, it is requested that both the FC cases may kindly be treated separately.
viii	The undertaking from the user agency to bear the 2% cost of project towards wildlife management plan and cost towards chain link fencing for the proposed forest land as recommend by the PCCF, Wildlife shall be submitted.	Undertaking is enclosed as **Annexure VI**.
ix	Earlier, it was noticed during the examination of the proposal through DSS that the user agency has not sought the diversion of forest land in the Compt No. 780, Block: Kathoutiya, Shahdol Range	To be complied by the State Forest Department.

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	located on the south-eastern corner of the Mining lease. But the State Govt. has now clarified that the said forest patch does not comes in the Mining lease. However the forest compartment boundaries available on DSS were submitted by the StateGovt. to the FSI, Dehradun for their uploading on the DSS portal and as per DSS analysis, a protected forest (PF) patch i.e. Compt No. 780, Block: Kathoutiya, Shahdol Range located on the south-eastern corner of the Mining lease has not been included in the instant diversion proposal. It has been directed that either boundaries on the DSS should be corrected or else the state should submit the revised proposal including the said forest patch.	

For, **Sarda Energy & Minerals Limited,**

6/7/2023

SARDA ENERGY & MINERALS LTD. RAIPUR

S.S. Shrivastava
Vice President – Coal Mines

F. No. 34011/28/2019-CPAM
Government of India
Ministry of Coal

Shastri Bhawan, New Delhi
The 29th May 2020

Office Memorandum

Subject: Guidelines for Preparation, Formulation, Submission, Processing, Scrutiny, Approval and Revision of Mining plan for the coal and lignite blocks.

Undersigned is directed to state that the guidelines for formulation of Mining plan and Mine Closure Plan has been amended. It has been decided by the Government that all coal (including lignite) mining operations in India shall henceforth be governed as per modified guidelines enumerated below.

1. **Mining Plan:** All coal (including Lignite) mining operation in India shall henceforth be governed as per these modified guidelines listed below and henceforth, the Mine Closure Plan and Final Mine Closure Plan shall be integral part of Mining Plan. Separate approval of Mine Closure Plan/ Final Closure Plan has been done away with. The Guideline/format for formulation of Mining plan is enumerated at **Appendix – I.**

1.1. **Implementation of the approved Mining Plans shall be sole responsibility of the mine owner.** Mining operations shall be undertaken in accordance with the duly approved mining plan. The mining plan once approved shall be valid for the balance life of the Mine, provided that any modification(s) of the mining plan is approved by the competent authority and such approval of the modified mining plan shall remain valid for the estimate balance life of the mining plan. Modification of the approved mining plan during the operation of a mining lease also requires prior approval.

1.2. The mining plan shall cover prescription for different phases of life of the mine as stage plan. The Stage plan for 1st year, 3rd year, 5th year, year of achieving rated capacity of the mine, Final year (i.e. at the end of mine life) and post closure shall be submitted at the time of initial submission of mining plan. The project proponent shall submit a **report/information** consisting **a.** compliance status with respect to approval condition of mining plan and grounds specified at para 1.3A; **b.** stage plan for next five years; **c.** revised balance life of the mine; and **d.** revised calculation of ESCROW amount with respect to revised balance life, to Coal Controller, CCO, Kolkata with a copy of the same to Administrative Section dealing with the allocation/allotment of the block and section dealing with approval of mining plan at MoC/CCO, **for information**. Such report/information must be submitted at least 180(one hundred eighty) days before the expiry of 5 (five) year, starting from the commencement of the Mineral Concession (Amendment) Rules, 2020 or the date of execution of the duly executed mining lease deed, whichever is later. Information desired above must bear certificate of **Qualified Person/ Accredited Mining Plan preparing Agency** and have approval of the respective company board. Non submission of such information during the stipulated time may result in withdrawal of mine opening permission or cancellation of the approved mining plan, as may be decided by CCO.

The Mining Plan approved prior to issue of this Guideline will qualify for submission of such report/information at least 180(one hundred eighty) days prior to expiry of 5 (five) year from the date of notification of the Mineral Concession Amendment Rules 2020.

1.3.**(A)** The mining plan may be modified for **a.** for change in method of mining; **b.** for facilitating increase in sanctioned peak capacity that is in excess of one hundred and fifty per cent of the

sanctioned rated capacity; **c.** change in leased area; **d.** in the interest of safe and scientific mining; **e.** conservation of minerals; **f.** for the protection of environment; **g.** addition of reserve by way of proving of reserve in the existing lease area; **h.** for changes in final mine closure conditions; or **i.** and such other change that may be determined by the Central Government. While submission of revision/ modification of mining plan the reason for revision/ modification shall be specified in writing by the lessee.

(B) Notwithstanding anything contained in clause (A) above, for other minor changes, the project proponent is empowered to make modification with the approval of the respective company board. These minor changes shall cover **a.** changes in land type within the leased area; **b.** changes in HEMM deployment plan; and **c.** changes in location of infrastructure within the leased area. The project proponent shall submit specific report of such minor changes to Coal Controller, CCO, Kolkata with a copy of the same to Administrative Section dealing with the allocation/allotment of the block and section dealing with approval of mining plan at MoC/CCO, for information.

1.4. The Mining Plan submitted for approval shall have prior approval of the concerned Board of the Company.

1.5. The base date of the Mining Plan should be taken as cut-off date on which the extractable reserve, balance life etc. has been quantified.

1.6. The proposed leased area in the Mining Plan shall include the area specified in the mining lease within which mining operations can be undertaken and includes the non-mineralized area required and approved for the activities falling under the definition of mine as referred in The Mines Act 1952.Evacuation route, R&R and Employee Township area outside the block will not be part of the Mining plan.

1.7. Pre-mining land ownership/land type furnished in the mining plan will be of indicative in nature along with data source at its footnote (viz. from topo sheet, cadastral plan etc.).

1.8. The excavation/ mining area envisages in the mining plan must be restricted within the allotted/vested geological block boundary/existing mining lease and if the project area is confined within the allotted block boundary/existing mining lease, a certificate to this effect is to be provided by the **Qualified Person/ Accredited Mining Plan preparing Agency** preparing the mining plan. The certificate must be made on the Conceptual Plan depicting Cardinal Point Co-ordinates (shape co-ordinates) of the project boundary, Lease boundary and Geological Block boundary (binding co-ordinates given in the vesting order).

1.9. Under provisions of Rule 16 of MCR 1960, State Government is custodian of the exploration data. As such in the cases, where the project area extends beyond the block boundary/existing mining lease the Mines and Geology Department of the concerned State Government shall issue a certificate specifying (a) intent of the State Government for grant of lease beyond the vested geological boundary; (b) non-existence of coal/ lignite in the area beyond the vested/allotted geological block boundary/existing mining lease to rule out the issue of encroachment. The application for issue of certificate from the Mines and Geology Department of the State Government must be supported with proof of the non-existence of coal/lignite in the area under reference (along with their Cardinal Point coordinates) duly certified by custodian agency viz. CMPDIL/ SCCL in case of coal and NLCIL in case of lignite.

Where the project area extends beyond the block boundary/existing mining lease, the certificate issued by the Mines and Geology Department of the concerned State Government must be attached in the Mining Plan.

1.10. In case of allotted/auctioned coal/lignite blocks, the mining plan may be revised for extraction of more coal on year to year basis.

Provided that the mining plan shall be revised for extraction of less coal on year on year basis only under following circumstances: a. if the remaining extractable reserve of the coal mine is less than

3(three) times of the rated Capacity of the current Approved Mining Plan; b. Change in method of mining from Opencast to Underground necessitated due to change in geo-mining conditions. However, revision of Mining Plan for extraction of less coal would be subject to prior approval of the Nominated Authority.

1.11. The approval of the revised Mining Plan shall not result in changes in the terms and conditions or efficiency parameters mentioned in the CMDPA/Allotment Agreement signed at the time of allotment/vesting for the auctioned/allotted blocks without prior approval of the nominated authority or Central Government, as the case may be. However, efficiency parameters mentioned in the CMDPA/Allotment Agreement shall be linked to the rated capacity of the mine.

1.12. The project proponent shall envisage the action plan for exploration and liquidation of the balance reserve yet to be projectised.

1.13. The project proponent shall take all necessary precautions regarding safety of mine workings and persons deployed therein and shall adhere to all the statutory clearances with regards to safety.

1.14. Proposed project area envisaged in the mining plan shall not encroach into any other adjacent coal block unless permitted to do so by the Ministry of Coal in writing.

1.15. The approval of the Mining Plan is without prejudice to the requirement of approvals from competent /prescribed authority under the relevant rules/ regulations etc.

1.16. The project proponent shall submit an undertaking that the mine shall be operated as per the Environment Clearance (EC) & Forestry Clearance (FC) for the project.

1.17. **Statutory Obligation:** The legal obligations, if any, which the lessee is bound to implement, like special conditions imposed while execution of lease deed, approval of Mining Plan, conditions imposed by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Central Pollution Control Board (CPCB),State Pollution Control Board (SPCB), Directorate General of Mines Safety (DGMS) or any other organizations describing the nature of conditions and compliance positions thereof, should be indicated in the Mining Plan.

2. Mine closure Plans: Mine Closure Plans will have two components viz. i) Progressive or Concurrent Mine Closure Plan, and ii) Final Mine Closure Plan. Progressive Mine Closure Plan would include various land use activities to be done continuously and sequentially during the entire period of the mining operations, whereas the Final Mine Closure activities would start towards the end of mine life, and may continue even after the reserves are exhausted and/or mining is discontinued till the mining area is restored to an acceptable level. The Mine closure details of the Mining Plan should be oriented towards the restoration of land back to its original as far as practicable or further improved condition.

2.1. Mining is to be carried out in a phased manner along with reclamation and afforestation work in the mined-out area.

2.2. Progressive mine closure plan shall be prepared for a period of every five years from the beginning of the mining operations. These plans would be examined periodically in every five years period and to be subjected to third party monitoring by the agencies approved by the Central Government, like Central Mine Planning and Design Institute Ltd. (CMPDIL), National Environmental Engineering Research Institute (NEERI), Indian Institute of Technology (IIT-ISM) or any other institutes/ organizations/ agencies specified from time to time for the purpose.

2.3. Various project specific activities viz. mined-out land details & their technical and biological restoration plan, water quality management, infrastructure to be retained and demolished, disposal of mining machinery, etc. shall be furnished in the relevant paras. Where the backfilling of the mine void is being carried out as part of regular mining operation, it shall not be included in the list of progressive mine closure activities. However, in case, where the backfilling of mine void is to be carried out specifically for closure of the mine, quantum of such overburden and the mine closure fund earmarked for the purpose must be included in the list of activities to be taken up for mine closure in the mining plan at the time of submission itself.

2.4. The Government may at any time before the closure of mine require certain activities to be included in the mine closure plans, which it may consider necessary for the safety and conservation of environment, or in compliance with any modification/ amendment in the relevant legislation.

2.5. **Abandonment cost:** The total cost for carrying out such activities shall be estimated for assessment of abandonment cost of the mine involving progressive and final mine closure activities such as barbed wire fencing all around the working area, dismantling of structures/demolition and cleaning of sites, rehabilitation of mining machinery, plantation, physical/biological reclamation, landscaping, biological reclamation of left-out overburden dump, filling up of de-coaled void, post environmental monitoring, supervision charges, power cost, protective and rehabilitation measures including their maintenance and monitoring, miscellaneous charges etc. for the specified post closure period.

2.6. **Escrow Account Calculation:** In August 2009 it was estimated that typically closure cost for an opencast mine was around rupees six lakhs per hectare of the total project area and rupees one lakh per hectare for underground project area at the-then price level. Accordingly vide letter dated 7th January 2013 a guideline for mine closure was issued which needed modification in these rates based on the wholesale price index (WPI) as notified by Government of India from time to time while preparing the Mining plan and Mine Closure Plan. The escalated rate (based on the current base year i.e. 01.04.2019) is Rupees Nine Lakh per hectare in opencast and Rupees one lakh fifty thousand per hectare for underground Mine. These rates will be considered as Base Rate to be applicable from 01.04.2019, which may change as specified from time to time by the Government of India.

[Exemplary Calculation: {(Rs 6 lakhs x 1.561 linking factor for base year 2004-05 x WPI 121.1 as on April 2019) / (WPI as on August 2009)} = Rupees 8.75 lakh, rounded to Rupees 9 (nine) lakhs per hectare in case of Opencast project].

Henceforth, these rates will stand modified based on the wholesale price index (WPI) as notified by Government of India from time to time. Annual closure cost is to be computed considering the total project area of the mine multiplied by escalated rate (at the above mentioned rates) and dividing the same by the balance life of the mine in years. An amount equal to the annual cost is to be deposited each year throughout the mine life compounded @5% annually.

[For example if the annual cost works out to Rs 100, then in the first year the amount to be deposited will be Rs 100, in the second year 100x(1+5%)^1, in the third year 100x(1+5%)^2 and so on.]

Further, in case of the mine, where escrow account is already open, the annual closure cost is to be computed considering the total project area at the above mentioned rates minus the amount already deposited and dividing the same by the balance life of the mine in years and annual cost as arrived should be compounded @5% annually.

2.7. **Financial Assurance:** The Mining Company/ Mine Owner as a part of Financial Assurance will open a Fixed Deposit Escrow account, with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary prior to commencement of any activities on the land/project area of the mine and shall submit the same to Coal Controller Organization (CCO) before the permission is given for opening the mine. The mining company shall cause the payment to be deposited at the rate computed as indicated at Para 2.6. The owner of the company may select the Schedule Bank where the Escrow account is to be opened and inform the same to the Coal Controller, CCO, Kolkata.

2.8. Coal Controller, Kolkata shall get the WPI (used for escalation of closure cost at the time of formulation of Mining plan) updated, at the time of opening of Escrow account. The mine owner/ company including all public/ private sector companies shall deposit the yearly amount in a Schedule Bank in accordance with Para 2.6. Coal Controller, **Kolkata shall also get the**

information, submitted under to para 1.2, verified and get the yearly closure cost modified with respect to the latest WPI in accordance with para 2.6.

2.9. Final Mine Closure: The details of the Mining Plan (covering Final Mine Closure Plan envisaging the details of the updated cost estimates for various mine closure activities and the Escrow Account already set up, shall be submitted to the approving authority for approval at least five years before the intended final closure of the mine.

2.10. Final Mine Closure would be considered to be completed only after acceptance of the third-party audit report by the Coal Controller on the compliance of all provisions of Mine Closure Plan. Any Institute/ Organization/Agency as may be specified by the Government for this purpose may be engaged for Third Party audit to create a self-sustained ecosystem. Failure of restoration within the specified period may result in forfeiture of Escrow Account created as per Para 2.6& 2.7. The details of the Final Mine Closure Plan along with the details of the updated cost estimate for various mine closure activities and escrow account already set up shall be submitted at the time of approval of final mine closure plan.

2.11. **Time Scheduling for abandonment:** The Action plan for carrying out all abandonment operations (progressive and final mine closure) should be furnished in the form of bar chart for a period of life of the mine plus post closure period. Post closure period shall be taken as3 (three) years for Underground mines and Opencast mines having stripping ratio lesser than 6(six) MM^3/Te & 5 (five) years for mines having stripping ratio more than 6(six) MM^3/Te.

2.12. **Implementation of the approved Mine Closure Plan shall be sole responsibility of the mine owner.** Mining is to be carried out in a phased manner i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 50% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Para 2.2. The amount released should be equal to expenditure incurred on the progressive mine closure in past five years or 50% whichever is less. The balance amount shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.

2.13. **Responsibility of the mine owner:** It is the responsibility of the mine owner to ensure that the protective measures contained in the mine closure plan including reclamation and rehabilitation works have been carried out in accordance with the approved mine closure plan and final mine closure plan.

2.14. The owner shall submit to the Coal Controller a yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried cut as envisaged in the approved mine closure plans (Progressive and Final Closure Plans).

2.15. The money to be provided per hectare of total Project Area for the purpose is to be deposited every year on commencement of any development activity on the land for the mine after opening a Fixed Deposit Escrow Account prior to obtaining mine opening permission from Coal Controller. Mining company/owners including all Public Sector Undertakings shall deposit the yearly amount in a Scheduled Bank. If the Mine owners fail to deposit the required annual amount in accordance with Para 2.6, 2.7 & 2.8, the Government can withdraw the mining permission.

2.16. The funds so generated are towards the security to cover the cost of closure in case the mine owner fails to complete the relevant closure activities. The prime responsibility of mine closure shall always lie with the mine owner, and in case these funds are found to be insufficient to cover the cost of final mine closure including the areas covered in Para 2.3 2.6, 2.7, 2.8 & 2.9 above. The mine owner shall undertake to provide the additional fund equivalent to the gap in

funding before five years of Mine Closure failing which it may be recovered by such other methods as the competent authority may deem fit in this regard.

2.17. **Final Closure Certificate:** The Mine owner shall be required to obtain a mine closure certificate from Coal Controller to the effect the protective, reclamation, and rehabilitation work in accordance with the approved Mining plan covering final mine closure provisions/activities have been carried out by the mine owner for surrendering the reclaimed land to the State Government.

2.18. The balance amount at the end of the final Mine Closure shall be released to mine owner on compliance of all provisions of Closure Plan duly signed by the mine owner to the effect that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court etc. and duly certified by the Coal Controller. This should also indicate the estimated extractable coal reserves and coal actually mined out.

2.19. If the Coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan in respect of which financial assurance was given has not been or will not be carried out in accordance with mine closure plan, either fully or partially, the Coal controller shall give the mine owner a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days prior to the date of the order to be issued after giving an opportunity to be heard.

3. Formulation of Mining Plan by Qualified Person (QP) or Accredited Mining Plan Preparing Agency (MPPA):

3.1. System of granting Recognition to a person for preparation of mining plan u/s 22C of MCR 1960 & preparation of mining plan only by RQP u/s 22B of MCR 1960 shall be done away with, after commencement of the Mineral Concessions (Amendment) Rules, 2020.

3.2. After commencement of Mineral Concession (Amendment) Rule 2020, no mining plan shall be accepted unless it is prepared by Qualified Person (QP) or Accredited Mining Plan Preparing Agency (MPPA).

3.3. Quality Council of India (QCI) or National Accreditation Board for Education and Training (NABET) shall be engaged for accrediting following entities:

(i) Accredited Prospecting Agency (APA) for undertaking prospecting operations and preparation of geological reports for Coal and Lignite Mines, and

(ii) Mining Plan Preparing Agency (MPPA) for preparation of mining plan (for Coal, Lignite Mines and Sand for Stowing)

3.4. The Quality Council of India (QCI) or National Accreditation Board for Education and Training (NABET)shall grant accreditation in accordance with such standards and procedures as specified in schedule VI of Mineral Concession (Amendment) Rule 2020.

3.5. Qualified Agency (QP) or Mining Plan Preparing Agency (MPPA) who prepares mining plan for a block/mine, shall have recognition from the concerned company board that the qualification of the QP or accreditation of the MPPA has been duly verified and is in line with the relevant provision of the MCR 1960.

4 Submission, Processing and Scrutiny of Mining Plan

4.1 **<u>On and from the date of publication of order and upto the expiry of period of nine months from the commencement of the Mineral Concession (Amendment) Rules, 2020</u>**, every mining plan submitted for approval/modification shall be accompanied with a non-refundable application fee specified from time to time in this regard, for the project area specified in the mining plan.

4.2 **<u>On and from the expiry of period of nine months from the commencement of the Mineral Concession (Amendment) Rules, 2020</u>**, every mining plan submitted for approval/modification

shall be accompanied with a non-refundable application fee specified from time to time in this regard, for the project area specified in the mining plan and peer/expert review done by any accredited mining plan preparing or reviewing agency at their (applicant's) own cost. During examination of the Mining Plan by the internal committee of MoC, if it is felt that a review by expert or by specialized agency is required, the committee may recommend referring the mining plan to such expert/agency with the approval of the MP approving authority. Charges for the expert review shall be borne by the applicant.

4.3 All pages (including cover page, plates and Annexures) shall bear the signature & stamp furnishing details of the QP/Accredited Mining Plan preparing Agency (MPPA) in physical mode of submission and e-signature/digital signature during the online system of submission.

4.4 Ministry of Coal is in process of development of on-line portal for submission and approval of mining plan. system of acceptance of Physical copy shall be continued till the development/operationalization of online portal for submission and approval of mining plan.

4.4.1 **Submission to Physical Copy Mining Plan to Ministry of Coal:**

4.4.1.1 The project proponent shall submit one soft copy and four hard copies of Mining Plan (draft)- one each to the concerned Administrative Section of the Ministry of Coal for the concerned block, Section of MoC/CCO dealing with approval of Mining plan, Coal Controller, CMPDIL/ Extended office of CCO & the dispatch receipt of the speed post (confirming that the draft Mining Plan has been sent).The contact details and correspondence address of the section dealing with the approval of Mining plan, administrative section for the mine, members of the committee etc. shall be updated time to time, on the website of the Ministry of Coal/Coal Controller Organisation.

4.4.1.2 The project proponent shall incorporate the observation (if any) and submit the mining plan (after incorporating the compliance to the observation) to section of MoC/CCO dealing with approval of Mining plan, concerned administrative section of the Ministry of Coal, Coal Controller and CMPDIL/ Extended office of CCO.

4.4.1.3 **Submission of Mining Plan (after incorporating compliance) to Ministry of Coal:** The project proponent shall submit 04 (Four) hard copies & 01 (one) soft copy of modified Mining Plan and the compliance to the observations along with copy of the dispatch receipt of the Speed Post (confirming that the modified Mining Plan has been sent to section of MoC/ CCO dealing with approval of Mining Plan, concerned administrative section of the Ministry of Coal, Coal Controller, and CMPDIL/ Extended office of CCO).

4.4.1.4 The procedure of submission at Para 4.3.1 will be replaced by process of submission at para 4.3.2 on development of portal for online submission and approval of Mining Plan.

4.4.2 **Online System of Submission of Mining Plan for Approval:**

4.4.2.1 Project proponent shall register online, using registered official mail ID.

4.4.2.2 For the purpose of preparation of Mining plan through a QP or MPPA, project proponent shall share a temporary login with QP/MPPA. This temporary login shall be valid till the preparation and approval of mining plan only.

4.4.2.3 The QP/MPPA shall upload the Mining plan through the temporary login and submit it to the project proponent; QP/MPPA once submits the mining plan to the project proponent, he shall not be able to modify.

4.4.2.4 The Project Proponent shall make payment of processing charges/fees online as specified from time to time by Ministry of Coal;

4.4.2.5 The Project Proponent shall after incorporating relevant company board approvals submit the mining plan to the Approving Authority; The mining plan submitted to approving authority shall become visible to Administrative Section for the respective block, section of MoC/CCO dealing

with approval of Mining plan, members of the Internal Committee, Coal Controller, CMPDIL/ Extended office of CCO, simultaneously. System of SMS alerts shall be available at all stages;

4.4.2.6 Observations of the Committee Members shall be uploaded online and the project proponent shall also submit Mining Plan, after incorporating compliance, online

5 Scrutiny & Processing of Mining Plan

5.1.1 The current system of getting the mining plan scrutinized through CMPDI, Ranchi shall continue. Ministry of Coal is in process of creating an extended office of Coal Controller Organization at Delhi which shall be delegated with the work of processing and scrutiny of mining Plan. A letter to this effect shall be issued separately.

5.1.2 CMPDIL/Extended office of CCO at Delhi shall scrutinize the mining plan and submit comments to section of MoC/CCO dealing with approval of Mining plan within Fifteen (15) days of receipt of the Mining Plan. Non-submission of comments within the stipulated time may be presumed as "no comment" from CMPDIL/Extended office of CCO; CMPDIL/ Extended office of CCO at Delhi, if consider necessary to make a physical verification of the site/site visit for scrutiny of the mining plan, may make such site visit/physical verification of the site, however, no relaxation in the time line as specified above may be given.

5.1.3 Administrative Section of the Ministry of Coal (dealing with the block) shall scrutinize the mining plan with respect to Vesting order/ allotment order and CMDPA signed with allottee at the time of allotment and submit observations to section of MoC/CCO dealing with approval of Mining plan (till the development of portal for Mining plan approval) within Fifteen (15) days of receipt of the Mining Plan. Non-submission of comments within the stipulated time may be presumed as "no comment" from the administrative section;

5.1.4 Members of the Internal Committee shall examine the mining plan from Technical and administrative angle based on the observations of the Administrative Section (dealing with the respective block) and CMPDIL/Extended office of CCO and the peer/expert review report submitted with the mining plan and submit observations to section of MoC/CCO dealing with approval of Mining plan (till the development of portal for Mining plan approval) within Fifteen (15) days of receipt of the Mining Plan. Non-submission of comments within the stipulated time may be presumed as "no comment" from the administrative section. Members of the internal committee, CMPDIL/Extended office of CCO may raise observation twice only. The observation raised shall be communicated directly to the project proponent for incorporating the same in the mining plan. The project proponent shall make presentation in the meeting of the internal committee for scrutiny.

5.1.5 Section of MoC/CCO dealing with approval of Mining plan shall communicate the observation (if any) to the project proponent for compliance till the development of online system for submission, processing, and approval of mining plan.

5.1.6 Subsequent, to development of online portal for submission, processing, and approval the observations of the internal committee members shall be uploaded directly on the portal, which will be visible to the project proponent. A timeline of 15 days shall be available for the internal committee members to upload the comments. Non-submission of comments within the stipulated time may be presumed as "no comment".

6 Timeline for submission of Compliance:

Once the observation of the Scrutiny of the mining plan is communicated either in hard copy, mail or online, the Project Proponent is required to submit the mining plan after incorporating the compliance to the observation within a period of 15 days of the communication, failing which the mining plan submitted for approval shall be rejected.

Provided that any such application may be entertained after the said period of 15 Days, if the applicant satisfies the approving authority that he had sufficient cause for non-submission of mining plan (after incorporating the compliance) in time. However, in any case this period may not be extended beyond 30 days from the date of receipt of communication of the observation.

7 Approving Authority:

7.1 On and from the date of publication of order and up to the expiry of period of nine months from the commencement of the Mineral Concession (Amendment) Rules, 2020, the powers to approve mining plan for all categories of coal and lignite mines and sand for stowing shall be exercisable by Project Adviser, Ministry of Coal.

7.2 On and from the expiry of period of nine months from the commencement of the Mineral Concession (Amendment) Rules, 2020, the power to approve mining plan for all categories of coal and lignite mines including sand for stowing shall be exercisable by the Coal Controller, CCO, Kolkata, a subordinate office of Government of India in the Ministry of Coal.

7.3 The person delegated to approval of Mining Plan under sub-section (1) of section 26 read with clause (b) of sub-section (2) of section 5 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957) (hereinafter, the 'Act') may seek help of an Internal committee constituted for the purpose.

7.4 The approving authority shall dispose of the application for approval of the Mining Plans within a period of 30 days from the date of receiving of such application (The Mining Plan received on or before 30th of Current Month will be considered in the ensuing meeting). Provided that the aforesaid period of 30 days shall be applicable only if the Mining Plan is complete in all respect, and in case of any modifications subsequently suggested after the initial submission of the Mining Plan for approval, the said period shall be applicable from the date on which modified mining plan is re-submitted.

8 Internal Committee for Scrutiny of Mining Plan:

8.1 Members of the Internal Committee shall examine the mining plan from Technical and administrative angle based on the observations of the Administrative Section dealing with the respective block & CMPDIL/ Extended office of CCO.

8.2 The internal committee shall recommend the mining plan for "Approval" or "Rejection". In case of recommendation for Rejection, the committee shall record the reason for Rejection.

8.3 Till the opening of CCO office at Delhi, the internal committee shall consist of:

1. Director (Technical), MoC, Member Secretary
2. Director/ Deputy Secretary, MoC of the section dealing with the allocation/allotment of the respective block, Member
3. Coal Controller or his representative, Member
4. Director level officer of CMPDIL, Member
5. Director/Deputy Secretary, Nominated Authority, Member

8.4 After opening of CCO office at Delhi, the internal committee shall consist of:

1. Director level officer of CCO having relevant working experience., Member
2. Director/ Deputy Secretary of the section dealing with the respective block, Member
3. Head of Regional Coal Controller Office (having relevant working experience in mine planning), CCO Regional Office New Delhi, Member Secretary
4. Any other technical person having working experience of not less than 15 (fifteen) years in mine planning, Member

9 Communication of Approval:

9.1 In case of allotted/auctioned mine, section dealing with approval of Mining Plan shall communicate the decision of the approving authority within a period of 5 (five) working days in form of a letter confirming "in-principle approval" of the Mining Plan to the project proponent

with a copy of the same to the Nominated Authority, Govt. of India. Final approval of the Mining Plan in such cases shall be communicated by the section dealing with approval of Mining Plan, only on receipt of applicable payments and its confirmation from the Nominated Authority, Govt. of India.

9.2 While for mines other than auctioned/allotted mines, section dealing with approval of Mining Plan shall communicate the decision of the approving authority within a period of 5 working days.

10 Revision:

10.1 Any person aggrieved by any order made or direction issued in respect of mining plan by an officer competent to approval mining plans shall within 30 days of the communication of such order or direction, apply to the Secretary (Coal), Ministry of Coal for a revision of such order or direction thereon.

10.2 On receipt of any application for revision the authority shall give the aggrieved person a reasonable opportunity of being heard and may within 30 days confirm, modify or set aside the order or direction and his decision thereon shall be final.

11 **This Guideline** supersedes the previous orders and are without any prejudice to any other relevant rules and regulations, such as those issued by the State Governments, Ministry of Environment, Forest and Climate Change, Ministry of Labour and Employment, etc.

(Hitlar Singh)
Under Secretary to the Government of India

To,

All the existing Coal and Lignite block allocates

Copy to: -

1. All Joint Secretaries, MoC.
2. Coal Controller, Coal Controller's Office, 1- Council House Street, Kolkata.
3. CMD, CIL, Newtown, Rajarhat, Kolkata-700156, W.B
4. CMD, NLCIL, Cuddlore, Distt. Neyveli- 607801 (Tamil Nadu).
5. CMD, Singareni Collieries Company Limited (SCCL), Kothagudem Collieries, Khammam Distt.(A.P).
6. Tech. Director (NIC) - with the request to place it to Website of the Ministry of Coal.

Industrial Growth Center, Siltara
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An ISO 9001, ISO 14001 & ISO 45001
Certified Company

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SARDA ENERGY & MINERALS LTD.

CERTIFIED TRUE COPY of the resolution passed by the Board of Directors of the Company in its meeting held on 27th May 2023

"RESOLVED that subsequent to the approval of Modified Mine Plan for Sahapur West Coal Mine for 0.6 Million Tonne Per Annum by the Ministry of Coal, Govt of India, the consent of the Board be and is hereby accorded to modify the surface layout and use bare minimum land for surface infrastructure by shifting the Mine Infrastructure (excluding Road) from Revenue Forest Land to Private Land.

RESOLVED FURTHER that due to change in location of proposed Mine Infrastructure (excluding Road) from Revenue Forest Land to Private Land & further modifications in the layout, the table 1.5.25 of the approved Modified Mine Plan be and is hereby revised as under:

1.5.25	Land use pattern "Ha"			
S.No	Component	As per approved Modified Mining Plan dated 21.04.2022	As proposed	Remarks
1	Excavation Area	0.0000	0.0000	
2	Topsoil Dump	0.0300	0.0300	
3	External Dump	0.0000	0.0000	
4	Safety Zone	0.0000	0.0000	
5	Other Use	1.3760	0.5000	Components viz Embankment, Settling Ponds and UG entry were included in Other Use in Modified Mining Plan, whereas components viz Settling Ponds and UG entry are included in Other Uses in proposed changes. Embankment has been considered along with Green Belt.
6	Infrastructure Area	14.8750	8.159	Including Roads
7	Green Belt	8.0180	8.0200	
8	Undisturbed Area	594.7010	602.2910	
Total		619.000	619.000	

RESOLVED FURTHER that as certified by the Revenue Authorities of Shahdol and Umaria, the total Revenue Forest involved in Sahapur West Coal Block be changed to 34.102 Ha and the total Forest Land in Sahapur West Coal Block be taken as 80.590 Ha. The table mentioned under Clause 6.1 of the modified mining plan be and is hereby modified as under:

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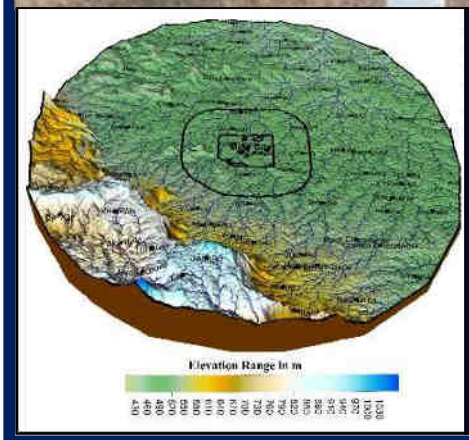
Land Type		Area in Ha.
Tenancy	Agriculture (Includes few residential houses)	511.220
	Township	-
	Grazing	-
	Barren	-
	Water Bodies	-
	Road	-
	Community/Other	-
Govt. Non-Forest	Agriculture	2.191
	Township	-
	Road	3.583
	River/Nallah	10.112
	Water Bodies	9.100
	Grazing	-
	Community/Other	2.898
	Barren	-
Forest	Revenue Forest	34.102
	Reserve	34.240
	Protected	12.248
Free Hold		-
Total		619.000

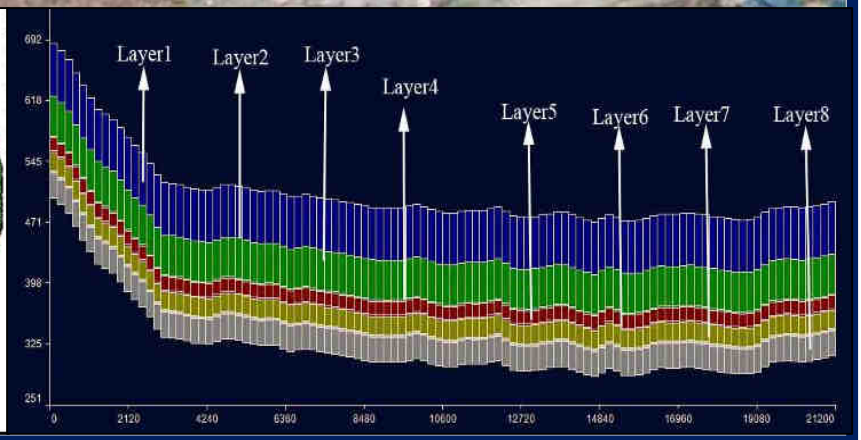
	S.No	Land Type	Existing/Pre- Mining Use	Area
Break up of pre-mining land type (indicative) and source of data.	1	Total	Total (Ha)	619.000
	2	Private	Agriculture (Includes few residential houses) (Includes few residential houses)	510.930
	3	Government	Surface Water Bodies	18.518
	4	Government	Other (Ha)	8.672
	5	Forest	Revenue, Reserved, Protected (Ha)	80.590

For Sarda Energy & Minerals Ltd.

Company Secretary

Comprehensive Hydrogeological Report with Groundwater Modeling as per CGWA Guidelines for Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Block, Umaria & Shahdol Districts, Madhya Pradesh State, India





Applicant

SARDA ENERGY AND MINERALS LIMITED,
73A, Central Avenue,
Nagpur, Maharashtra 440018, India

Report Prepared by

V. Pugazhendi, A6, Balaji Arcade,140 Arcot Road,
Viurgambakkam, Chennai – 600 092

July - 2022

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Comprehensive Hydrogeological Report with Groundwater Modeling as per CGWA Guidelines for Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Block, Umaria & Shahdol Districts, Madhya Pradesh State, India

1. SALIENT FEATURES OF THE PROPOSAL

1.1	*Application No.*	
1.2	*Accredited by*	**CGWA / RGI**
1.3	*Date of Accreditation*	**15-Feb-2021**
1.4	*Validity upto*	**14-Feb-2026**
1.5	*Work Order Date (Attach copy of the Work Order with masking details of charges)*	**Attached in Annexure -1**
1.6	*New/ Existing Project*	**New**
1.7	*CTE issued date*	
1.8	*Alluvium/ Non-alluvium*	**Non-Alluvium**
1.9	*Block Name & Category (GWRA, 2020)*	**Sohagpur & Pali - Safe**
1.10	*Ground water requirement*	**1804 cu.m / day (Proposed Dewatering quantity 1772 cu.m / day + 32 cu.m / day from borewell for domestic uses)**
1.11	*Ground water Modelling Required (Yes/No)*	**Yes**
1.12	*In case the report is prepared jointly by accredited Institute and Individual consultant, name/details of chapters prepared by the Individual consultant*	**Report Prepared by V. Pugazhendi**
1.13	*Signature of the Consultant(s)*	 Digitally signed by PUGAZHENDI Date: 2022.07.25 16:15:09 +05'30' **V. Pugazhendi**

2. ABOUD THE PROJECT

Project Details

In order to augment coal production to meet the growing demand for the generation of power, the Government of India has allotted Shahpur West Coal Block covering an area of **619 Ha** under Government dispensation route to M/s Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Tehsil, Umaria & Shahdol Districts, Madhya Pradesh.

The proposed mining block comprises majorly of private land and small portions of Govt, land and Forest land. There is habitation of three villages namely, Kosmaha, Khamaria Kalan Khamaria Khurd, lying within the block boundaries. No relocation and rehabilitation of village has been proposed. The coal from the mine is proposed to be evacuated by conveyor belts, which will discharge into 3x 150 tonner bunker to be installed at surface. Coal from this bunker will be loaded on to the trucks of 35t capacity and transported to the nearest siding

Need for the Study

As per the guidelines issued on 24-09-2020 and subsequent amendment for ground water withdrawal, it is mandatory to study the detailed Impact assessment report along with ground water modeling for the projects drawing ground water more than 500 cu.m/day. In order to adhere to the CGWA guidelines, for obtaining the NOC, the Impact assessment with ground water modeling in buffer zones 10 Km radius for Industrial and infrastructure projects.

The amendment also states that Impact assessment reports along with modelling study shall also be required to be submitted in Semi Critical, Critical category, over exploited category where ground water withdrawal is >500 cu.m/day in hard rock and >1000 cu.m/day in soft rock/alluvium. In Saft category, the ground water withdrawal >500 cu.m/day in hard rock and >2000 cu.m/day in soft rock/alluvium, the impact assessment report along with modeling is mandatory. **The firm is presently applying fresh NOC. As per the new notification, mining projects which are drawing the quantity of more than 500**

cu.m/day needs to submit comprehensive hydrogeology report along with ground water modeling.

The notification / guidelines also states that a Detailed project report for rainwater harvesting and ground water recharge plan in the project premise and / or same watershed/ assessment unit, should accompany the request for ground water withdrawal prepared by an accredited consultant.

The Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Tehsil, Umaria & Shahdol Districts, Madhya Pradesh. Umaria & Shahdol blocks are Safe block as per the assessment of CGWA 2020. Geologically the area is underlain by the non-alluvial formation.

Since the Mine site is falls in non-alluvial formation and the yield / seepage is non- alluvial formation and the ground water drawl quantity is more than **500 cu.m/day**, it is mandatory to undertake Comprehensive hydrogeology study along with ground water modeling as per CGWB Guidelines.

Accordingly, the company entrusted the work of "Comprehensive Hydrogeology report along with ground water modeling study" as per CGWA Guidelines to **V. Pugazhendi** (CGWA Accredited Consultant- Ground Water Modeling).

Scope of Study

Present study is a Comprehensive Hydrogeological study along with ground as per the **CGWA guidelines and SOP issued on February-2022.** Broad scope of the present study are as follows.

The sub-surface lithology, aquifer characteristics, ground water level, ground water quality, long term ground water level and quality changes, availability of ground water in and around the mine area [Core (2 km radius) and buffer zones (10 km radius) from the mine boundary].

2) Estimation of the quantum of mine dewatering to be required during mine operations and appraisal of its impact on the local Hydro-geological regime and gainful reuse of water available through dewatering of mine.

3) Socio-economic aspects of the study area and corporate social responsibility, estimation of the ground water recharge possibility in and around the area

4) To evaluate the efficacy of the rainwater harvesting done by the project proponent in and around the mine lease area.

Ground Modeling Studies include ground water mass balance (input and output from various sources), the ground water heads changes, and the impact of the withdrawal of ground water for the mine operation purposes.

The specific scope is as follows:

- To study the aquifer geometry.
- To study the ground water flow pattern.
- To study the Hydraulic Head gradient.
- To simulate the impacts on water table due to mine dewatering/ pumping.
- The Prediction Model includes:
    - Short – term drawdown interference between pumping wells and in the aquifer – 5 Year.
    - Long – term drawdown interference between pumping wells and in the aquifer – 10 Year.
- Water Mass Balance – 5^{th} and 10^{th} year.

Methodology

To achieve the above scope the following methodology has been adopted:

- Collection of satellite data, maps and literature about the aquifer characteristics etc.,
- Collection of rainfall data for a period of 25 years.
- Collection of legacy pre- and post-monsoon ground water level data for the period of 10 years.
- Preparation of base map, drainage and water body map, topography map, geology map, geomorphology and structure map, land use map using satellite imagery, from the field data and from the available literature.

- Collection of Piezometer ground water level data and assess the ground water level variations over a period of time.
- Collection of water consumption data recorded from the flow meter and assessing the water consumption pattern.
- Geophysical survey to decipher the sub-surface lithology in selected locations.
- Pumping test to understand the aquifer characteristics.
- Field verification of rock type, lithology, type of aquifer such as shallow / deep aquifer, ground water withdrawal.
- Field verification of land use pattern, geomorphic features and structures such as fold, fault, fractures and fissures.
- Collection of well inventory data & measurement of well depth, water level, yield and ground water quality.
    - Preparation of maps based on the well inventory data such as, ground water level zone, fluctuation, ground water table contour (pre- and post-monsoon) and ground water flow pattern, ground water quality.
    - Interpolation and superimposition of the observed data using statistical and standard hydrogeological methods.
    - Estimation of ground water seepage into the mine.
    - Estimation of rainwater collection in the mine.
    - Ground water impact assessment due to the pumping of water from the mine.
    - impact of the recharge structures already created by the Project Proponent.
    - Suggest suitable recharge structures, if required.

Location of the Project

The proposed mining lease area is located towards to the north western part of Sohagpur Coal. The mine is located in Shahpur and Khamariya Khurdh of district Umariya and Kathautiya, Khamariya Kalan for Shahdol district, Madhya Pradesh. Mine has an aerial extent of **619 Ha.**

The proposed project site is well connected by road and rail. The Shahdol townships are close to the area connected through metalled road. The Shahdol town is located on National highway No. 78 is only 12 KM from the site. The nearest railway station is Shahdol (4 km

aerial and 12 km by road) connected from Jabalpur and Bilaspur in South Eastern Railway. The nearest airport is Dumna Airport of Jabalpur, which is about ~ 200 km from mine site.

The administrative units within the study area from the project boundary (10 Km radius) comprises of 45 **Villages.** Khamaria is the nearest village in the study area of 10 Km radius.

The study area (covering 10 Km radius) lies in between North Latitude 23° 09'30" and 23°20'30" and East Longitude of 81°12'05" and 80°24'05". The study area of 10 Km from Mine boundary covers in **Topo Sheets: 64E/3,4,7,8 &** (4 Survey of India Topo sheets). The Mine site falls in Survey of India Toposheet No. **64E/7&8.** The total aerial extent of the study area covering 10 Km radius from the Mine site boundary is **379.25 Sq.km.** The details of Mine area are given in Table**1.**

Table 1: The details of Mine area

Feature	Details
Site Location	Shahpur and Khamariya Khurdh of district Umariya and Kathautiya, Khamariya Kalan for Shahdol district, Madhya Pradesh
Latitude	23° 14'30.30" and 23°15'30.45"
Longitude	81°17'10.15" and 81°18'45.10"
Area of the Mine	**619 Ha Ha**
Topography	Site is located in Fallow land and forest land. Crop land and Forest land is predominant in 10 Km radius area.
SOI Toposheet	**64E/7&8**
Above Mean Sea level	10 Km Buffer Zone elevation: **Highest point 1077 m amsl and Lowest point 407 m amsl** 2 Km Core zone elevation: **Highest point 545 m amsl and Lowest point 464 m amsl.** **Mine Site elevation: Maximum and Minimum elevation 512 m amsl and 479 m amsl respectively.**
Nearest habitation	Khamaria Village ~ 1 Km East
Nearest Water body	No Major water body / Dam / Reservoir nearby the Mine site
Nearest River	**Tanki Nala mine lease area, Ghinauchiha Ghoghira and other minor nala**
Protected wetlands	No Protected wetlands (Certificate Enclosed)
Geology of the Area	**Sandstone, Shale with Coal and Ferruginous Sandstone**

Index map, High resolution satellite imagery showing the Mine site and the SOI topo maps are presented in **Plates 1, 2 & 3.**

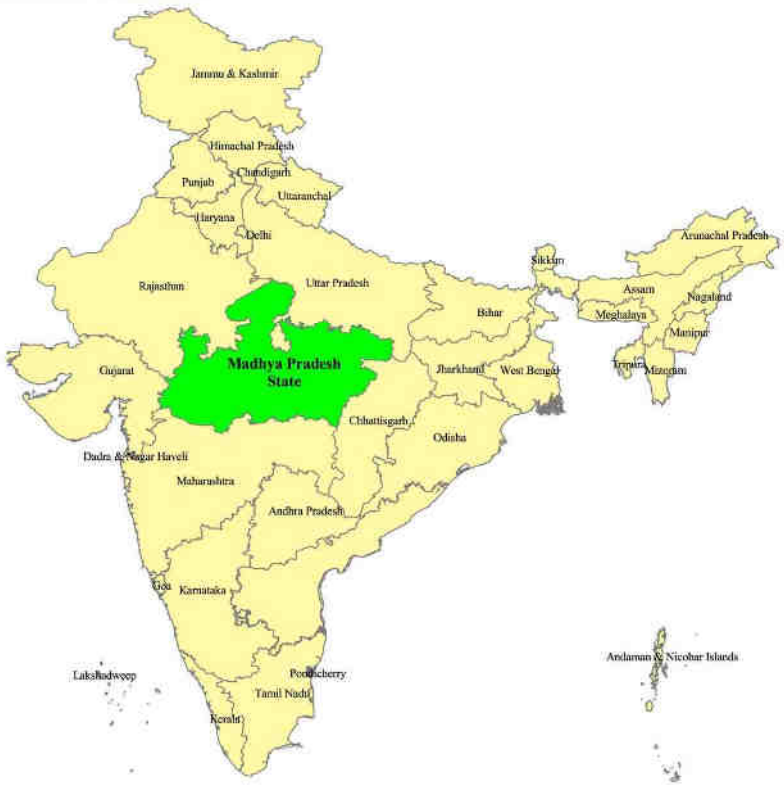
Study Area - Index Map

SARDA ENERGY & MINERALS LIMITED, COAL MINES

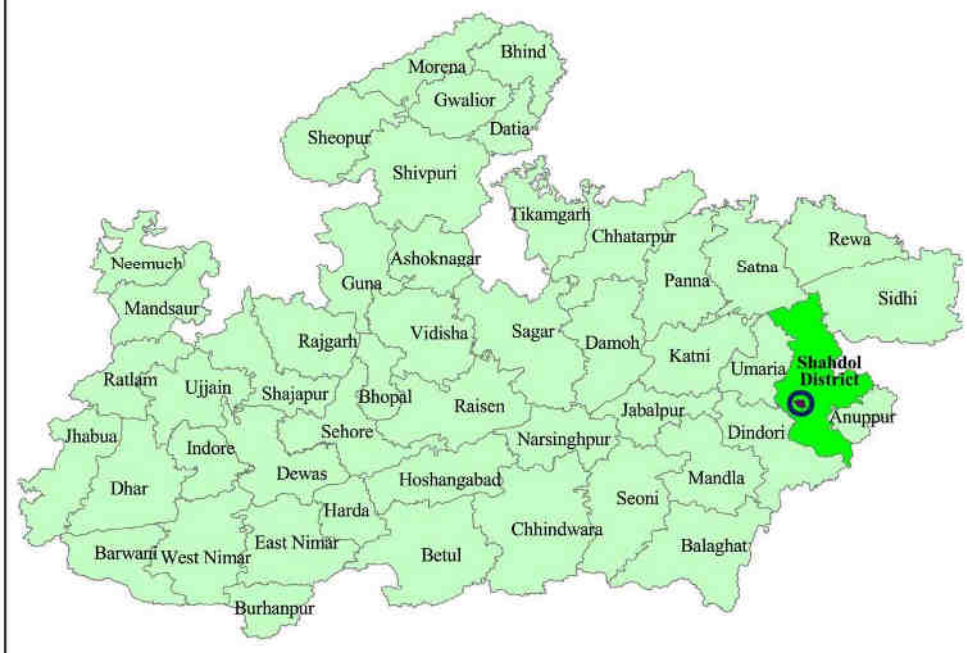
Sohagpur Coalfield, Shahdol District, Madhya Pradesh State, India

N W E S

India States



Madhya Preadesh State - Districts



Shahdol District,showing the Blocks and Sarda Coal Mines Location

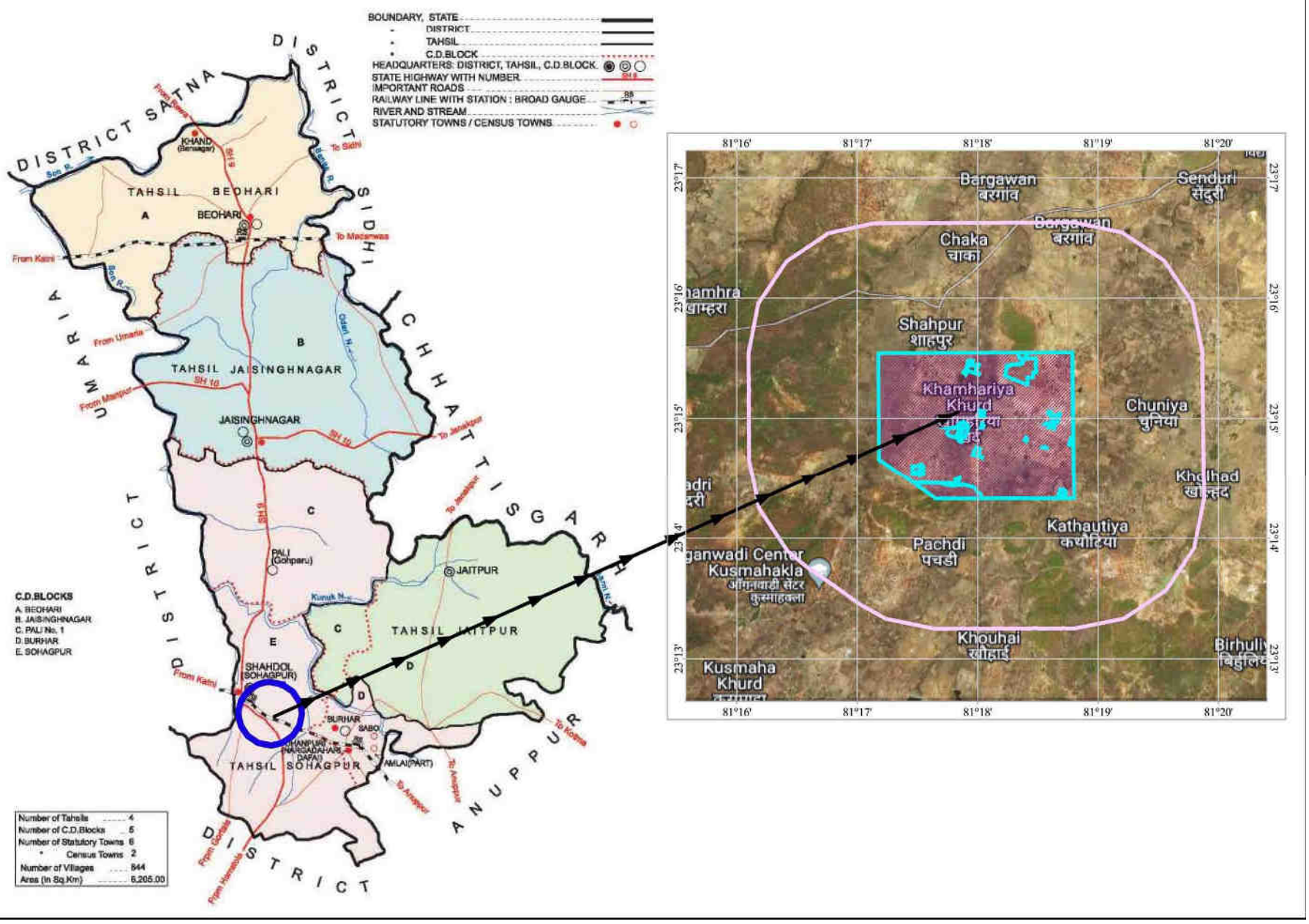
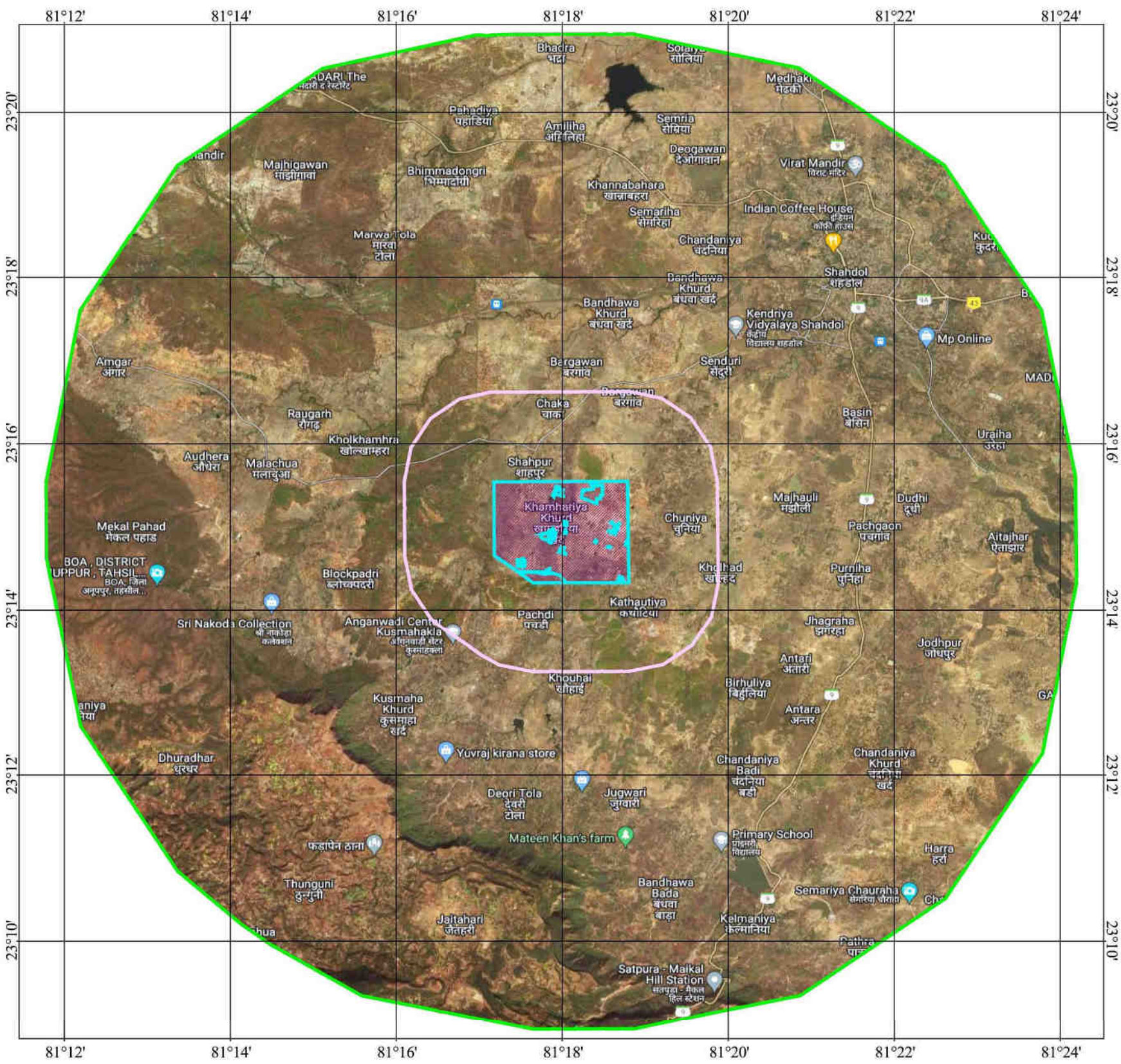


Plate 1: Study area – Index Map

Google Image - High Resolution Stellite Imagery

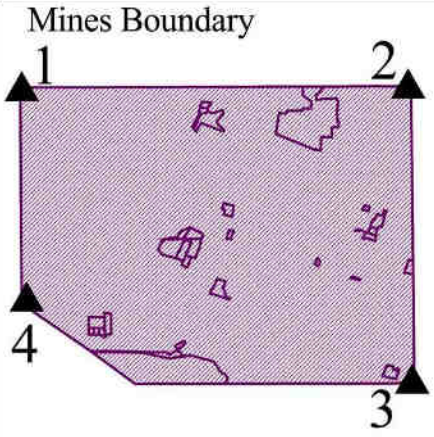
SARDA ENERGY & MINERALS LIMITED, COAL MINES

Sohagpur Coalfield, Shahdol District, Madhya Pradesh State, India



Source: Google Image - High Resolution Image & Field Survey

Mines Boundary



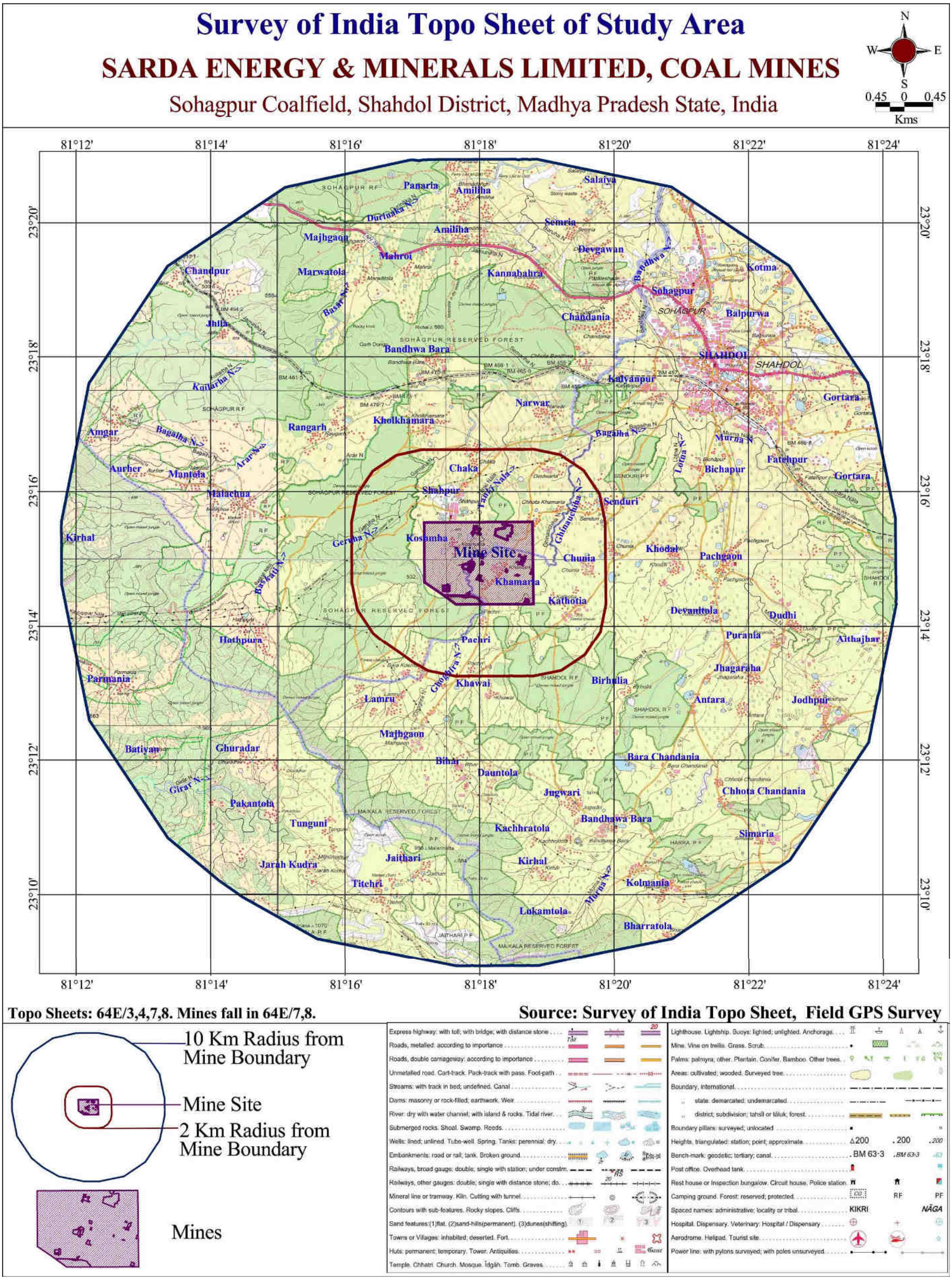
Sl.No	Latitude	Longitude
1	23°15'32.25"N	81°17'10.72"E
2	23°15'32.40"N	81°18'47.02"E
3	23°14'19.52"N	81°18'48.10"E
4	23°14'39.41"N	81°17'10.55"E

Plate 2: High Resolution Satellite Imagery

Survey of India Topo Sheet of Study Area

SARDA ENERGY & MINERALS LIMITED, COAL MINES

Sohagpur Coalfield, Shahdol District, Madhya Pradesh State, India



Topo Sheets: 64E/3,4,7,8. Mines fall in 64E/7,8.

Source: Survey of India Topo Sheet, Field GPS Survey

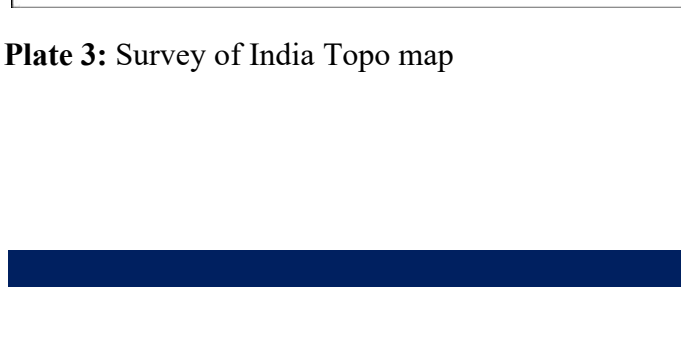


Plate 3: Survey of India Topo map

2.1 LANDUSE / LAND COVER OF THE SURROUNDING AREA

The land use in the village reflects the socio-economic conditions of the people in addition to the natural environmental factors. The land use is also one of the prime parameters to be considered for the ground water estimation. Primarily, 10 Km radius from the Mine site forms part of **Crop Land (about 53.95 %).** The second major land use is Forest Land. Majority of the area is irrigated by open well.

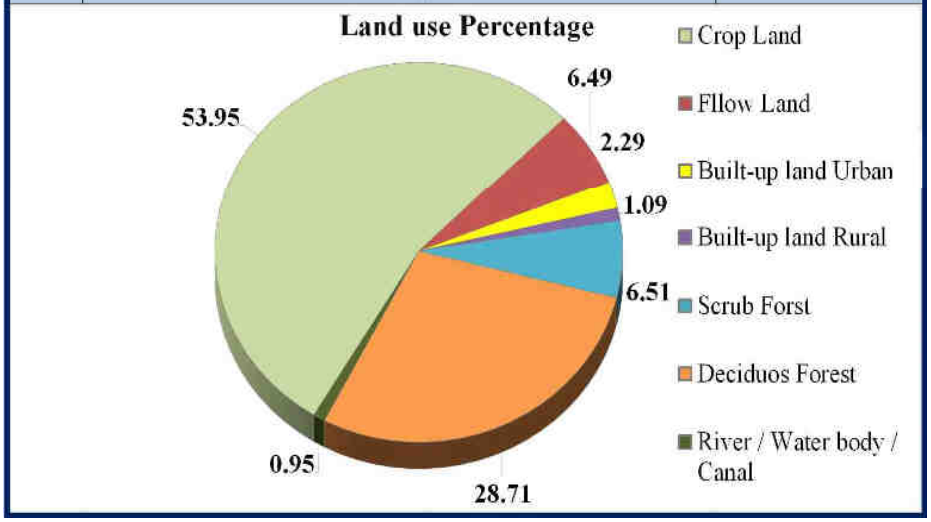
Buffer Zone: The majority of Buffer zone of 10 Km radius from mines boundary occupies Crop land followed by Deciduous Forest.

Core Zone: Mines and Forest Land.

The land use and percentage of coverage in the study are is presented in **Table-2.** The Mine layout Plan, Satellite imagery and the Land use map are presented in **Plate – 4 to 6.** The following land use has been depicted from the satellite imagery and compared and updated with NRSA interpreted land use available in Bhavan web site.

Table 2: Land use Classification

S.No	Land use	Percentage	Area in Sq.km
1	Crop Land	53.95	204.60
2	Fllow Land	6.49	24.60
3	Built-up land Urban	2.29	8.70
4	Built-up land Rural	1.09	4.15
5	Scrub Forst	6.51	24.70
6	Deciduos Forest	28.71	108.90
7	River / Water body / Canal	0.95	3.60
	Total	**100.00**	**379.25**



Land use of the Mines area

Crop Land

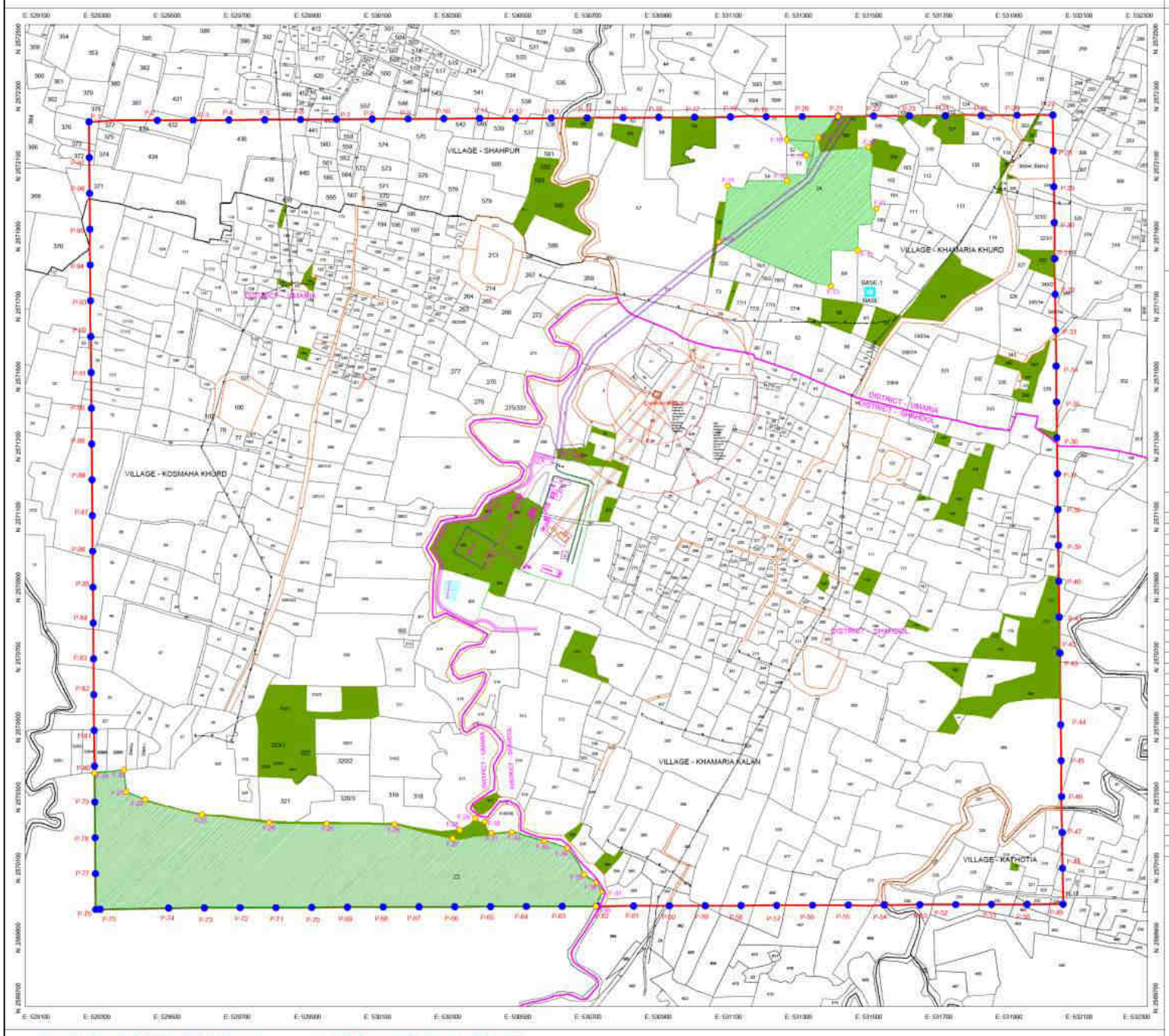
Fallow Land

Deciduous Forest

Built-up Land

Stream in the Study area

Georefered DGPS Cadastral Plan For Coal Block area held by SARDA ENERGY AND MINERALS LIMITED
in Village -Khamaria Kalan, Khamaria Khurd, Kosmaha Khurd, Shahpur & Kathotia, Tehsil - Pali & Sohagpur, District - Umaria & Shahdol, State - Madhya Pradesh.
SAHAPUR WEST COAL BLOCK - AREA - 619.000 Ha.



Scale 1:5000

DATUM : WGS 84 PROJECTION : UTM ZONE 44

LOCATION MAP

State - Madhya Pradesh | District - Umaria & Shahdol | Village -Khamaria Kalan, Khamaria Khurd, Kosmaha Khurd, Shahpur & Kathotia | Tehsil - Pali & Sohagpur

LEGEND

- Mining Lease Boundary (619.000 Ha.)
- Revenue Plot With No. (510.526 Ha.)
- Reserved Forest Land (34.240 Ha.)
- Protected Forest Land (12.248 Ha.)
- Revenue Land (Govt.) (34.102 Ha.)
- Gov. Non Forest Land (Govt.) (27.884 Ha.)
- Road / Cart Track
- Nalla / River
- Village Boundary
- District Boundary
- DGPS Boundary Pillar
- Forest Pillar

LIST OF DGPS BOUNDARY PILLAR CO-ORDINATE

SR.NO.	POINT ID	LONGITUDE	LATITUDE	EASTING	NORTHING
1	P-1	81°17'10.594"	23°15'13.470"	530281.621	2572222.754
2	P-2	81°17'17.447"	23°15'32.585"	529476.528	2572236.737
3	P-3	81°17'21.042"	23°15'32.606"	529578.669	2572237.340
4	P-4	81°17'24.613"	23°15'32.626"	529680.812	2572237.975
5	P-5	81°17'28.232"	23°15'32.633"	529782.955	2572238.579
6	P-6	81°17'31.826"	23°15'32.646"	529885.069	2572239.184
7	P-7	81°17'35.421"	23°15'32.659"	529987.212	2572239.790
8	P-8	81°17'39.016"	23°15'32.673"	530089.355	2572240.397
9	P-9	81°17'42.611"	23°15'32.686"	530191.498	2572241.035
10	P-10	81°17'46.205"	23°15'32.699"	530293.613	2572231.642
11	P-11	81°17'49.800"	23°15'32.712"	530395.756	2572232.251
12	P-12	81°17'53.395"	23°15'32.725"	530497.899	2572232.860
13	P-13	81°17'56.990"	23°15'32.738"	530600.042	2572233.470
14	P-14	81°18'0.584"	23°15'32.751"	530702.156	2572234.081
15	P-15	81°18'4.179"	23°15'32.764"	530804.299	2572234.692
16	P-16	81°18'7.774"	23°15'32.777"	530906.442	2572235.305
17	P-17	81°18'11.369"	23°15'32.790"	531008.585	2572235.917
18	P-18	81°18'14.964"	23°15'32.803"	531110.728	2572236.531
19	P-19	81°18'18.558"	23°15'32.815"	531212.843	2572237.135
20	P-20	81°18'22.153"	23°15'32.829"	531314.986	2572237.760
21	P-21	81°18'25.748"	23°15'32.842"	531417.129	2572238.375
22	P-22	81°18'29.343"	23°15'32.855"	531519.272	2572238.992
23	P-23	81°18'32.937"	23°15'32.868"	531621.386	2572239.609
24	P-24	81°18'36.532"	23°15'32.881"	531723.529	2572240.227
25	P-25	81°18'40.127"	23°15'32.893"	531825.672	2572240.815
26	P-26	81°18'43.722"	23°15'32.906"	531927.815	2572241.434
27	P-27	81°18'47.317"	23°15'32.919"	532029.958	2572242.054
28	P-28	81°18'47.355"	23°15'29.593"	532031.259	2572139.777
29	P-29	81°18'47.393"	23°15'26.267"	532032.559	2572037.501
30	P-30	81°18'47.432"	23°15'22.941"	532033.888	2571935.225
31	P-31	81°18'47.470"	23°15'19.615"	532035.188	2571832.948

LIST OF DGPS BOUNDARY PILLAR CO-ORDINATE

SR.NO.	POINT ID	LONGITUDE	LATITUDE	EASTING	NORTHING
32	P-32	81°18'47.509"	23°15'16.289"	532036.517	2571730.672
33	P-33	81°18'47.547"	23°15'12.963"	532037.818	2571628.396
34	P-34	81°18'47.586"	23°15'9.636"	532039.147	2571526.089
35	P-35	81°18'47.624"	23°15'6.310"	532040.447	2571423.813
36	P-36	81°18'47.662"	23°15'2.984"	532041.748	2571321.537
37	P-37	81°18'47.701"	23°14'59.658"	532045.076	2571219.260
38	P-38	81°18'47.739"	23°14'56.332"	532044.377	2571116.984
39	P-39	81°18'47.778"	23°14'53.006"	532045.706	2571014.708
40	P-40	81°18'47.816"	23°14'49.680"	532047.006	2570912.432
41	P-41	81°18'47.855"	23°14'46.354"	532048.335	2570810.156
42	P-42	81°18'47.893"	23°14'43.028"	532049.636	2570707.880
43	P-43	81°18'47.931"	23°14'43.028"	532050.716	2570707.882
44	P-44	81°18'47.970"	23°14'36.376"	532052.265	2570503.327
45	P-45	81°18'48.008"	23°14'33.050"	532053.566	2570401.051
46	P-46	81°18'48.047"	23°14'29.724"	532054.895	2570298.775
47	P-47	81°18'48.085"	23°14'26.397"	532056.195	2570196.498
48	P-48	81°18'48.125"	23°14'23.071"	532057.496	2570094.192
49	P-49	81°18'48.162"	23°14'19.745"	532058.825	2569991.916
50	P-50	81°18'44.577"	23°14'19.758"	531956.808	2569991.481
51	P-51	81°18'40.989"	23°14'19.771"	531854.620	2569991.047
52	P-52	81°18'37.399"	23°14'19.723"	531752.803	2569990.583
53	P-53	81°18'33.803"	23°14'19.716"	531650.786	2569990.150
54	P-54	81°18'30.214"	23°14'19.708"	531548.798	2569989.687
55	P-55	81°18'26.624"	23°14'19.701"	531446.781	2569989.255
56	P-56	81°18'23.034"	23°14'19.693"	531344.765	2569988.793
57	P-57	81°18'19.445"	23°14'19.686"	531242.778	2569988.363
58	P-58	81°18'15.855"	23°14'19.678"	531140.760	2569987.900
59	P-59	81°18'12.265"	23°14'19.671"	531038.743	2569987.474
60	P-60	81°18'8.674"	23°14'19.663"	530936.755	2569987.016
61	P-61	81°18'5.086"	23°14'19.656"	530834.738	2569986.588
62	P-62	81°18'1.496"	23°14'19.648"	530732.721	2569986.131
63	P-63	81°17'57.907"	23°14'19.641"	530630.733	2569985.674
64	P-64	81°17'54.317"	23°14'19.633"	530528.716	2569985.248

LIST OF DGPS BOUNDARY PILLAR CO-ORDINATE

SR.NO.	POINT ID	LONGITUDE	LATITUDE	EASTING	NORTHING
65	P-65	81°17'50.727"	23°14'19.625"	530426.709	2569986.794
66	P-66	81°17'47.138"	23°14'19.617"	530324.731	2569986.339
67	P-67	81°17'43.548"	23°14'19.609"	530221.695	2569985.885
68	P-68	81°17'39.066"	23°14'19.6"	530095.355	2569985.350
69	P-69	81°17'37.099"	23°14'21.035"	530039.338	2570027.359
70	P-70	81°17'35.131"	23°14'22.47"	529983.343	2570071.368
71	P-71	81°17'33.164"	23°14'23.904"	529927.347	2570115.377
72	P-72	81°17'31.197"	23°14'25.339"	529871.352	2570158.585
73	P-73	81°17'29.229"	23°14'26.774"	529815.357	2570203.594
74	P-74	81°17'27.262"	23°14'28.185"	529758.787	2570246.662
75	P-75	81°17'24.268"	23°14'30.226"	529674.154	2570309.270
76	P-76	81°17'22.253"	23°14'31.61"	529616.819	2570351.695
77	P-77	81°17'20.239"	23°14'32.992"	529559.511	2570394.099
78	P-78	81°17'18.226"	23°14'34.375"	529502.203	2570436.498
79	P-79	81°17'16.211"	23°14'35.757"	529444.895	2570478.898
80	P-80	81°17'14.198"	23°14'37.14"	529387.587	2570521.298
81	P-81	81°17'12.184"	23°14'38.522"	529330.279	2570563.698
82	P-82	81°17'10.068"	23°14'39.957"	529291.670	2570589.304
83	P-83	81°17'10.045"	23°14'42.477"	529294.815	2570691.396
84	P-84	81°17'10.021"	23°14'45.997"	529293.052	2570793.489
85	P-85	81°17'10.098"	23°14'49.517"	529291.077	2570895.581
86	P-86	81°17'10.075"	23°14'52.037"	529292.222	2570997.674
87	P-87	81°17'10.051"	23°14'55.956"	529291.539	2571099.735
88	P-88	81°17'10.028"	23°14'59.276"	529290.484	2571201.828
89	P-89	81°17'10.005"	23°15'2.596"	529289.629	2571303.921
90	P-90	81°17'10.741"	23°15'5.916"	529268.745	2571408.015
91	P-91	81°17'10.758"	23°15'9.236"	529287.890	2571508.106
92	P-92	81°17'10.734"	23°15'12.556"	529287.007	2571610.198
93	P-93	81°17'10.711"	23°15'15.876"	529286.152	2571712.291
94	P-94	81°17'10.688"	23°15'19.196"	529285.297	2571814.384
95	P-95	81°17'10.664"	23°15'22.516"	529284.414	2571916.476
96	P-96	81°17'10.641"	23°15'25.836"	529283.559	2572018.569
97	P-97	81°17'10.618"	23°15'29.156"	529282.704	2572120.661

LAND DETAILS

ABSTRACT OF LAND DETAILS INDICATING PVT. LAND, GOVT. LAND, FOREST LAND ETC IN VILLAGES - KHAMARIA KALAN, KHAMARIA KHURD, KOSMAHA KHURD, SHAHPUR AND KATHOTIA, TEHSIL - PALI & SOHAGPUR , DIST - UMARIYA & SHAHDOL OF MADHYA PRADESH STATE

SAHAPUR WEST COAL BLOCK

ABSTRACT IN HECTARE

S. NO	NAME OF VILLAGE	TYPE OF LAND					GRAND TOTAL
		PRIVATE LAND	GOVT. LAND	REVENUE FOREST/JUDPI JUNGLE	RESERVED FOREST	PROTECTED FOREST	
1	SHAHPUR	36.666	0.308	2.425	0.000	0.000	39.399
2	KOSMAHA KHURD	185.411	10.008	6.054	84.240	0.000	285.828
3	KHAMARIA KHURD	71.519	4.349	10.054	0.000	12.248	98.150
4	KATHOTIA	8.715	0.955	0.040	0.000	0.000	10.710
5	KHAMARIA KALAN	207.909	11.495	15.503	0.000	0.000	234.913
	TOTAL	511.220	27.190	34.3102	84.240	12.248	619.000

SURVEYING REFERENCE NOTES :-

MAIN BASE STATION POINT (ON ROCK STONE AT THAKUR BABA TEMPLE & ON FOREST PILLAR IN KHAMARIA KHURD VILLAGE) IS CONNECTED WITH SURVEY OF INDIA (SOI) GCP PILLAR. THIS GCP PILLAR IS SITUATED IN THE PLAY GROUND OF GOVERNMENT RAGHUNAJ EXCELLENCE HIGHER SECONDARY SCHOOL SHAHDOL, TEHSIL - SOHAGPUR, DISTRICT - SHAHDOL (M.P.)

Proposed Land use during Mining (in Ha)

S.No	Component	Total
1	Topsoil dump	0.030
2	Other support infra including office, workshop, store, CHP, Canteen, Deisel Bunk and area between the building	9.884
3	Ventilation shaft	0.170
4	Coal stack yard	0.630
5	Magazine	0.185
6	Green Belt	8.020
7	Embankment	0.880
8	Settling Ponds	0.200
9	UG Entry	0.300
10	Roads (Including Approach Road)	4.005
11	Undisturbed Area	594.696
	Total	**619.000**

Prepared For

SARDA ENERGY AND MINERALS LTD.

ADDRESS :-1st Floor, Vanijya Bhavan, Jail Road, Devendra Nagar Square, Raipur-492001 (C.G.)

GEOREFERED DGPS CADASTRAL PLAN
SAHAPUR WEST COAL BLOCK
AREA - 619.000 Ha

Survey & Prepared by

SOHAM FERRO MANGANEASE Pvt. Ltd.
OFFICE : Block No.16&17, Ground Floor,N.K.V. Towers
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Ph. : (0) 0712 2239664, 3262221
E-mail : soham.ferromagnese@gmail.com, sohamcad@rediffmail.com

SURVEYED BY : RAHUL RUTHE (CIVIL ENGINEER)

CHECKED BY : NITIN SELUKAR (MINING ENGINEER)

Plate 4: Mine Layout Plan

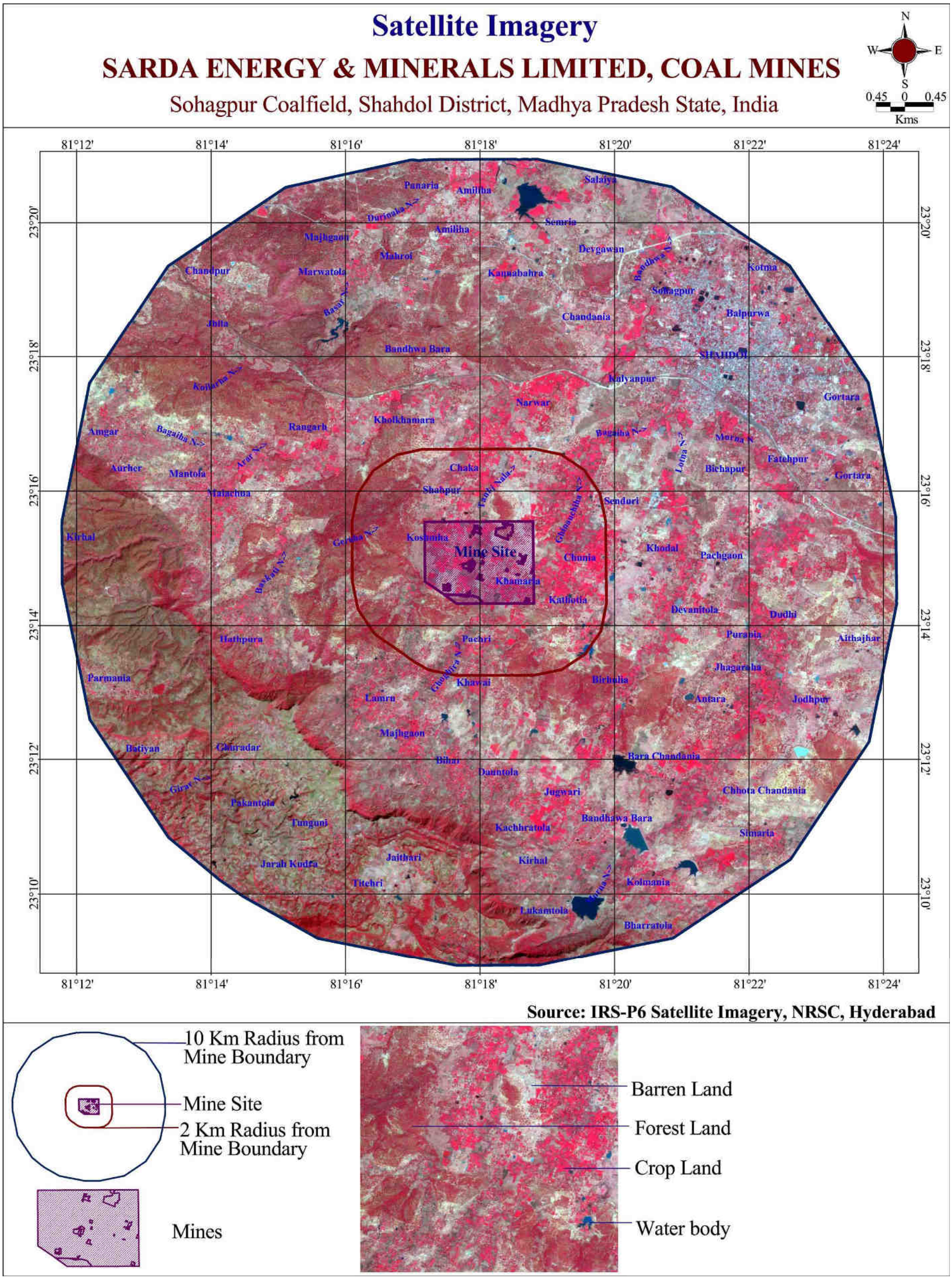


Plate 5: Satellite Imagery

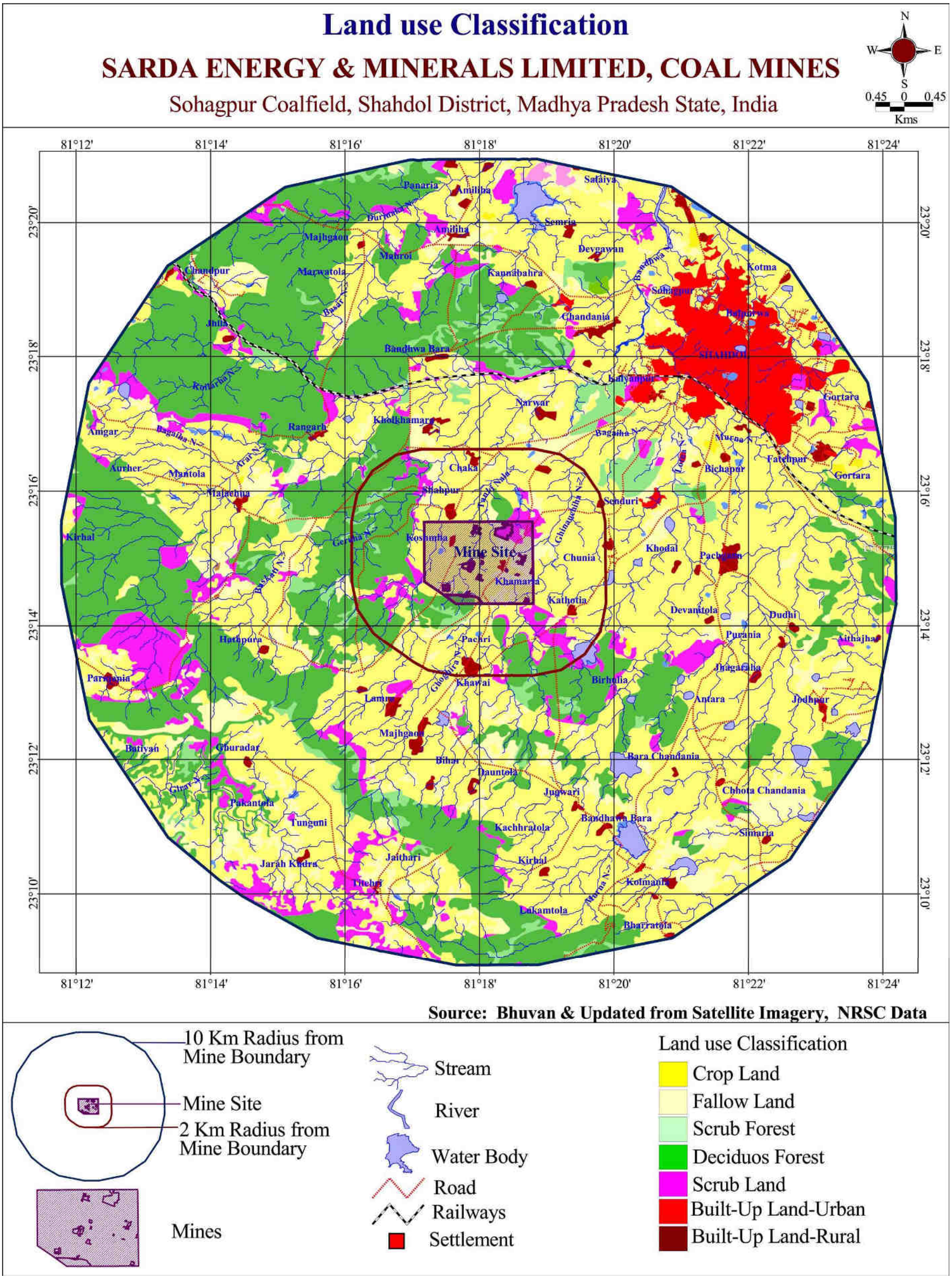


Plate 6: Land use Classification

2.2 DEM / TOPOGRAPHY

Physiographically, structural landforms, represented by plateau and low-lying plains with average altitude of 450m to 500m above MSL, are developed in northern, northeastern and northwestern and central parts of the district. In the southern part of the district, hills and highlands of Maikal Range and high to medium level **The Terrain elevation (Topography) is derived from the Carto-DEM data.**

The Study area (10 km radius from the Mine site boundary – buffer zone) elevation ranges from **407 m to 1077 m amsl**. The maximum elevation is observed in the South western part of the study area.

Core Zone: The elevation of the core zone of 2 km radius, ranges between **464 and 545 m amsl.** The maximum elevation is noticed in the south western part of the core zone. The core zone is sloping towards North.

The maximum and minimum elevation of the Mine site is **479 m and 512 m amsl** respectively. The study area sloping towards North. The Mine site is located in the moderately elevated area. Topography map of the study area is presented in **Plate-7.**

2.3 GEOMORPHOLOGY AND DRAINAGE

The land forms / geomorphic units and structures such as fractures, fissures and faults have been interpreted from the recent satellite image. All the landform / geomorphic units and structures occurring in the study area are mapped. The district is located in the north-eastern part of the Deccan Plateau.

The geomorphology and structures of the area plays the vital role in identifying the ground water potential zones. The majority of the study area covering 10 Km radius from the Mine boundary underlined by Pediplain.

Geomorphologically, the study area has been divided into following unit

Pediplain	Hill
Pediment	Plateau Remnant
Pediment – Corestone-Tor Composite	Ridge
Bench	Scarp

The occurrence and movement of ground water is controlled by the Secondary porosity. The Mine is located Pediplain.

The Geomorphology and structure maps are presented in **Plate 8.**

Drainage and Water Bodies

The entire district is drained by Son River and its tributaries. Thus, the area falls in the Ganga Basin. The river Son flows due north till the northern extent of the district, marking the western boundary of the district Shahdol with Umaria District. The buffer zone lies towards the left side of Son River and hence the slope of the buffer zone is in the north direction out falling to Son River. The following nalla /nadi are noticed in the study area of 10 Km radius. **Table-3**

Table 3: Streams in the Study area

Sl.No	Name of Nalla	Distance from Mines boundary	Direction from Mines boundary	Flow direction
1	Ghoghira Nala		Middle of Mine Lease area	North
2	Ghinauchiha	1.2 Km	North	North
3	Tanki Nala		Mine lease area	North
4	Geruha Nala	1.8 Km	West	North
5	Arar Nala	6.8 Km	West	East
6	Bagaiha Nala	7.4 Km	West	East
7	Koilarha Nala	7.8 Km	North West	East
8	Basar Nala	8.1 Km	North	North
9	Durinaka Nala	9.1 Km	North	East
10	Bandhwa Nala	9.3 Km	North East	North
11	Lotna Nala	7.6 Km	North East	North
12	Murna Nala	8.6 Km	South	North

1) From the Mine site the surface water flow towards north.
2)

There are no major reservoirs / Dam or irrigation tanks in the 10 Km radius study area. However, number of small to medium water bodies are noticed in the study area.

The study area is irrigated by bore well. River based irrigation is also observed in the study area. The return flow from the irrigation land maintains the ground water level at moderately deeper depth in the bore well. The Drainage map is presented in **Plate-9**

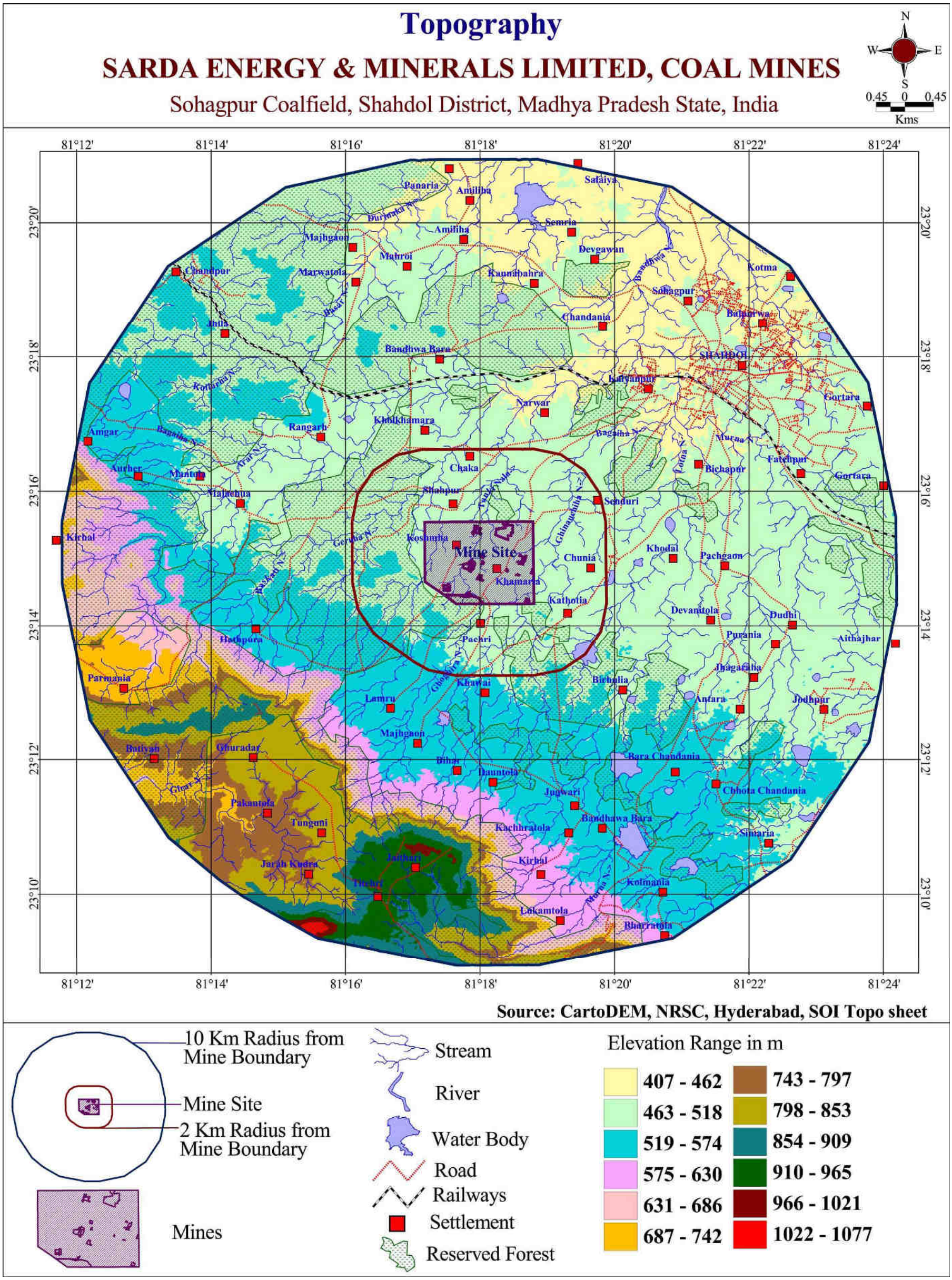


Plate 7: Topography of the Study area

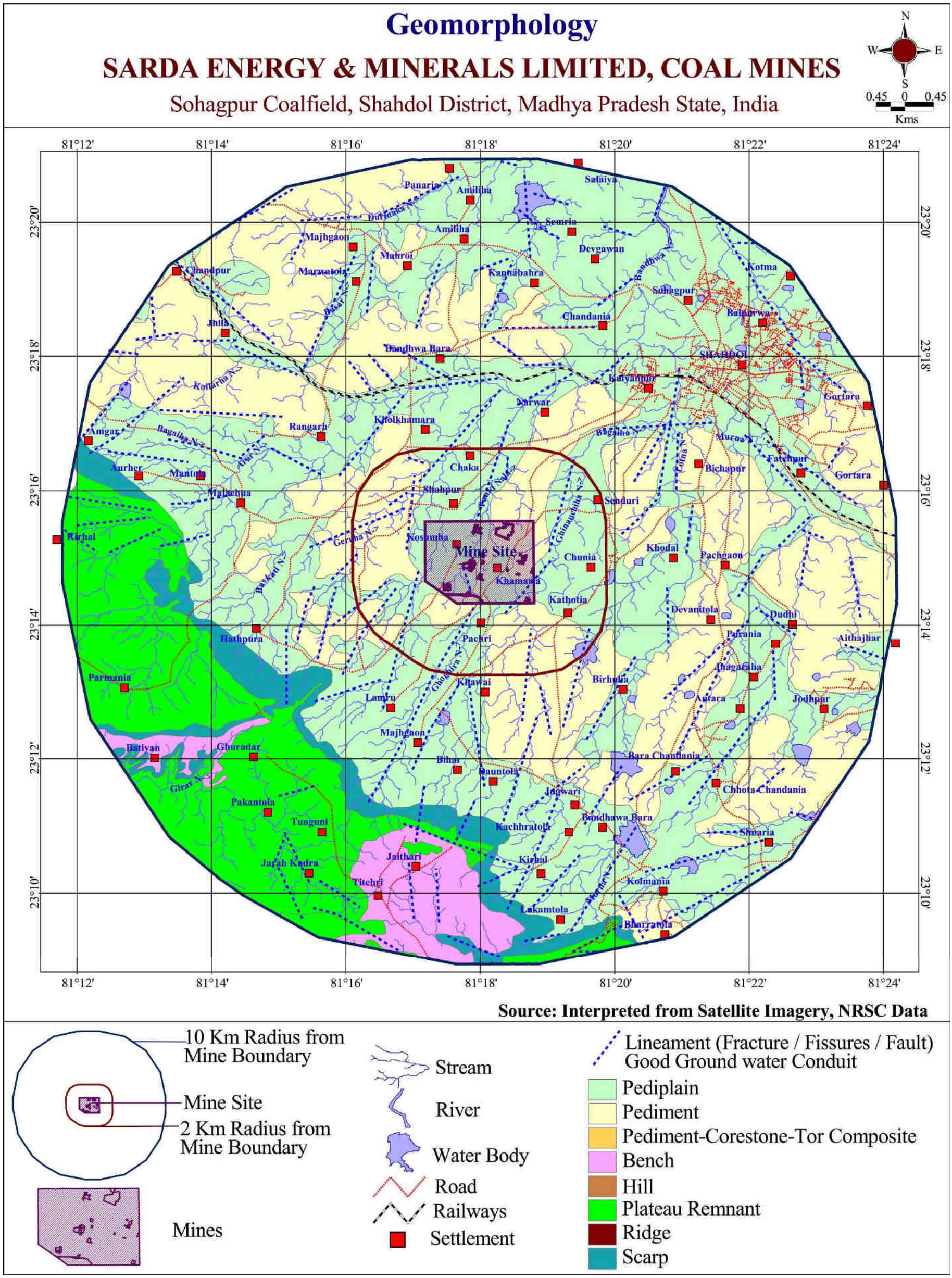


Plate 8: Geomorphology

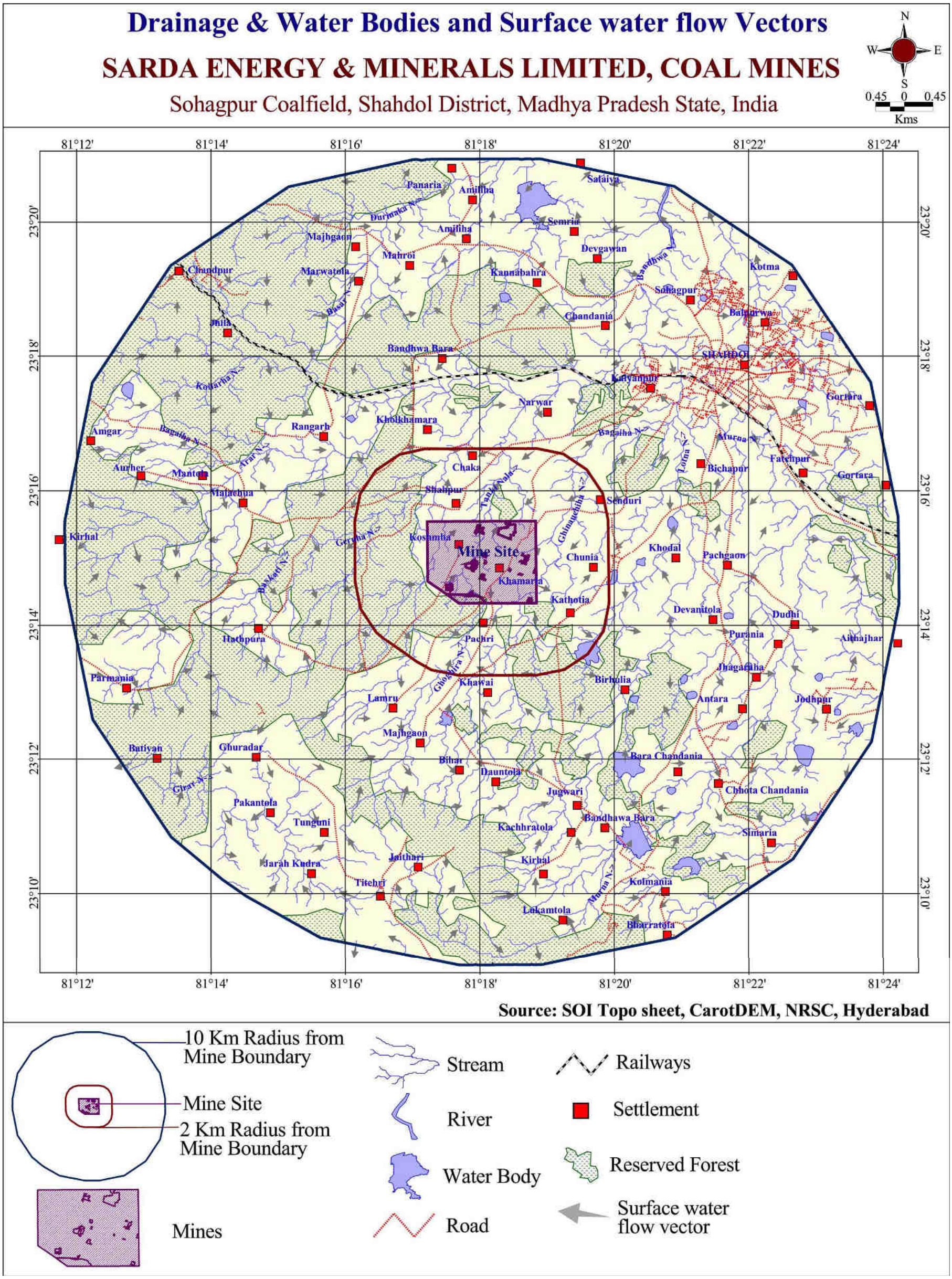


Plate 9: Drainage and Water bodies and surface water flow vectors

2.4 DETAILS OF WETLANDS / MAJOR WATER BODIES

A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen-free processes prevail. Any wetland site which has been listed under the Ramsar Convention that aims to conserve it and promote sustainable use of its natural resources is called a Ramsar Site. The total number of Ramsar sites in India is **46**. The nearest Wetland is located in **Samaspur Bird Sanctuary** which is about **305 Km in the North from the Mine's boundary.** The Mine site is located **500 m**. away from The Ramsar site map is given in **Figure -1.** An Affidavit regarding the same is presented in **Annexure – 3.**

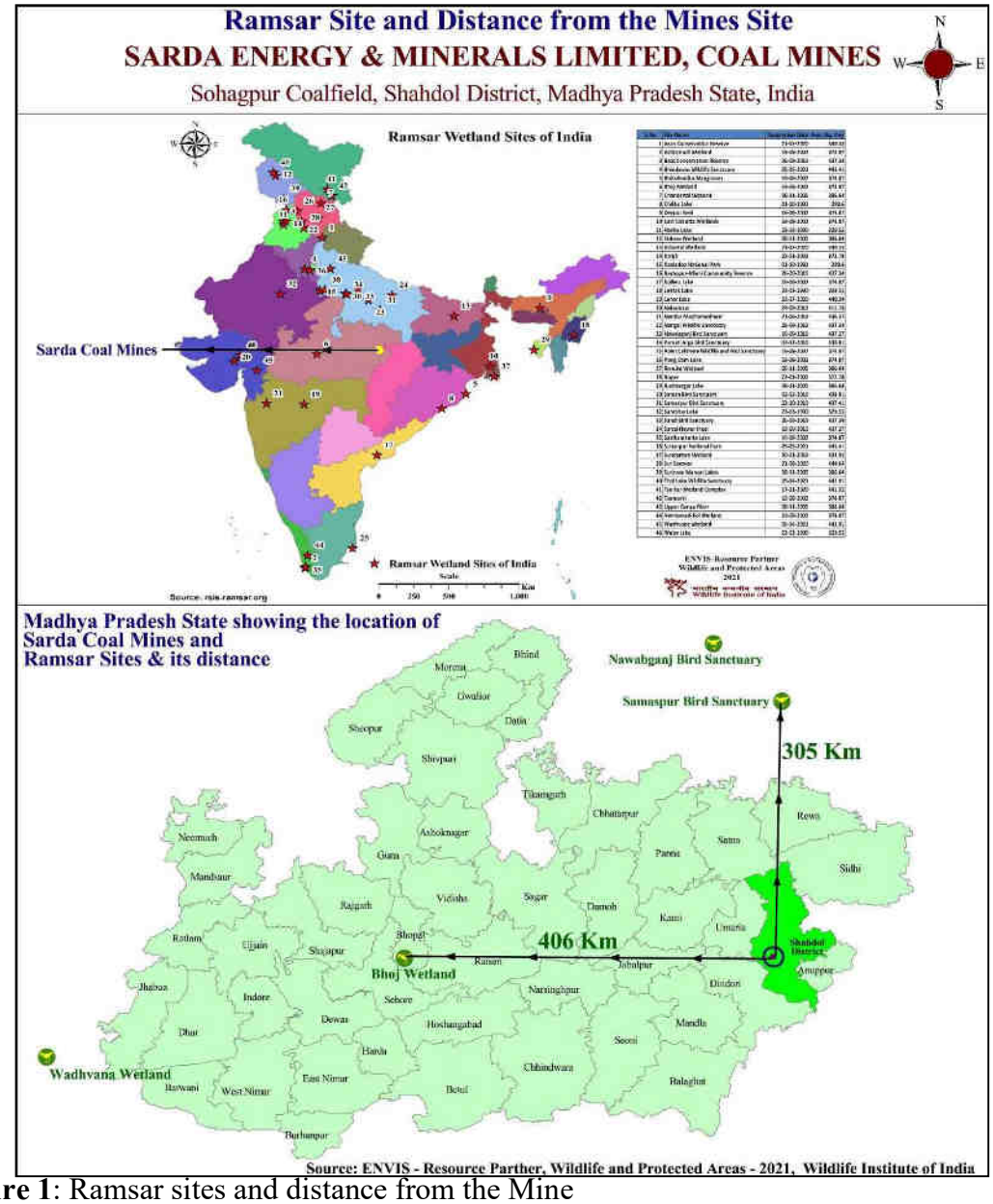


Figure 1: Ramsar sites and distance from the Mine

Climate and Rainfall

The normal annual rainfall of Shahdol district is **1122.9 mm (25 year Normal)**. District received maximum rainfall during south west monsoon period i.e., June to September. About **90 %** of the annual rainfall received during south west monsoon season. Only **10 %** of the annual rainfall takes place between October to May period. The Yearly rainfall for the period 1997 -2021 is given in **Table-4** and Monthly Rainfall in **Table-5.**

Table 4: Yearly Rainfall for 25 Years

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Rainfall in mm	1357	1286	1123	882	1250	814	1543	1021	1265	1143	854	1077	826	837	1334	1279	1453	1123	887	1374	827	1016	1318	1078	1105

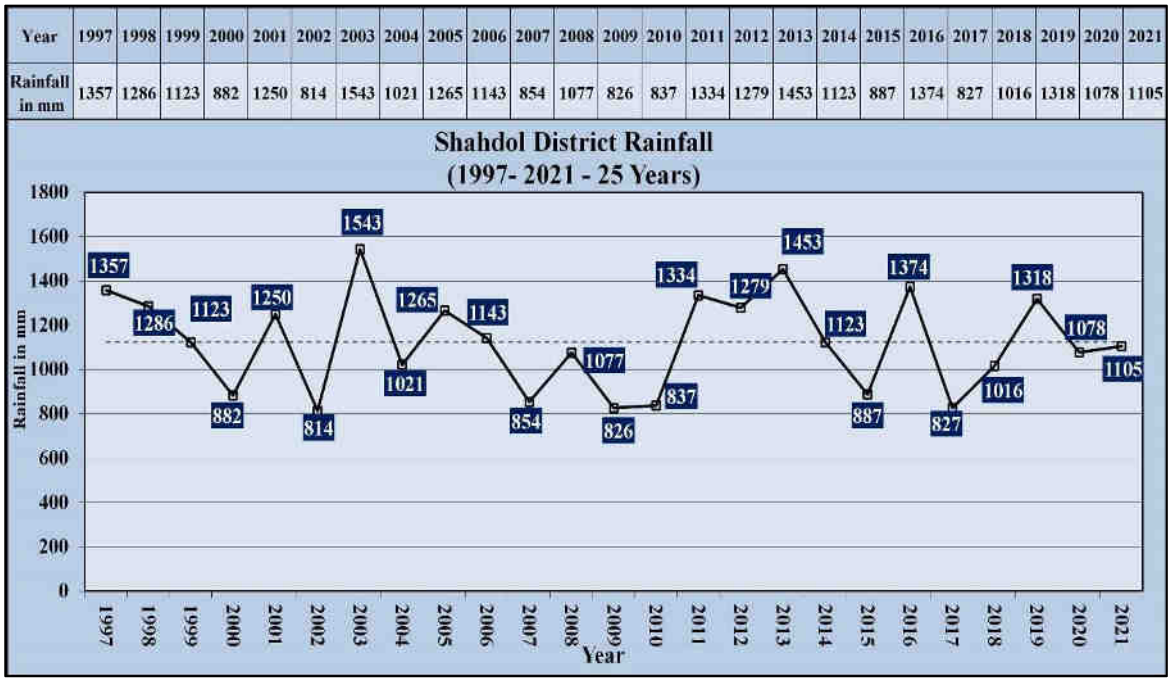
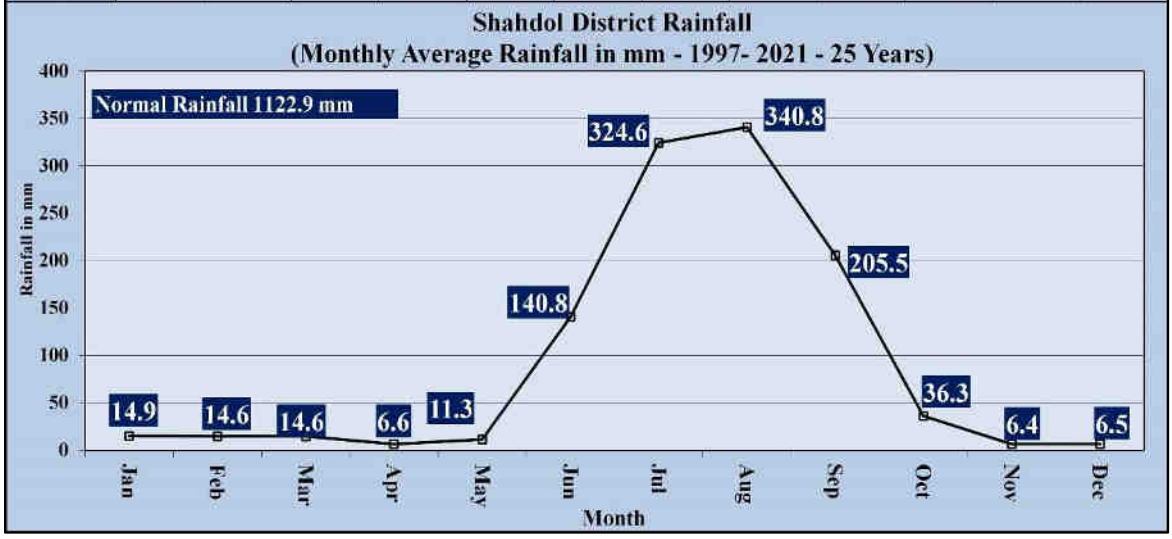


Table 5: Monthly average Rainfall

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall in mm	14.9	14.6	14.6	6.6	11.3	140.8	324.6	340.8	205.5	36.3	6.4	6.5



3. HYDROGEOLOGY

3.1 GEOLOGICAL SETUP

The rocks of Sohagpur Coalfield, located within Son Valley, exhibit a general E-W trend with a low northerly dip and is bounded by latitudes 23°05' and 23°30' & longitudes 81°13' and 82°12'. The Sahapur West Block falls in the north-western part of Sohagpur Coalfield. The southern margin of the Sohagpur Coalfield runs close to the junction of Kewai and Tipon rivers with the Son while eastern and north-eastern boundaries imperceptibly merge with the Sonhat-Jhilimili Coalfields. Towards north, it runs upto the Upper Gondwana formations and in the west, post Barakar sediments are present. In the south-west, the coal measures are separated from the Deccan Traps of Maikal range by narrow outcrops of Lameta beds.

The Sohagpur basin is composed of three well defined sub-basinal structures. These include (1) Jharkhand sub-basin to the east (2) Kotma-Jamuna sub-basin in the middle and (3) Burhar–Amlai sub- basin in the west, separated generally by faulting. BamniChilpa fault which runs along the middle part of the coalfield, is the most important of the faults, separating these sub basins. A generalized stratigraphic sequence observed in the area is as **Table - 6.**

Table 6: Stratigraphic Succession of Study area

Age	Formation	Lithology
Recent		Soil & Alluvium
Eocene to Upper Cretaceous	Deccan Trap	
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~		
Upper Cretaceous	Lameta Beds	Reddish and greenish sandstones and nodular limestones
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~		
Upper Triassic (Upper Godwana group)	Supra Barakars/ Mahadeva	Pink, buff & red sandstone, red shales etc.,
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~		
Lower Permian		Coarse to medium grained sandstone, subordinate shales and coal seams
Lower Permian to Upper Carboniferous (Lower Gondwana group)	Barakar	Diamictite sandstone siltstones and needle shales
~~Unconformity~~~~~~~~~~~~~~~~~~~~~~~~~~		
Precambrian	Metamorphosis	Porphyritic granite gneiss with aplite and Pegmatite Veins

Source: Approved Review of Mining Plan

In Shahpur west coal block, Barakar formation of Lower Permian age is predominant formation. Barakar Formation is overlain by ferruginous sandstone and shales of Barren measures. The horizon is found about 25m to 40m above the youngest coal horizon i.e., Seam IV of Barakar Formation. It is characterized by fine to medium grained and occasionally coarse-grained feldspathic sandstones, grey carbonaceous shale and inter bedded coal seams in shales.

Structures: The whole block is covered by Barren Measures formation and hence devoid of coal seam exposures. Barakar formations are marked by various sedimentary structures like ripple marked bedding planes etc. The Shahpur west block has generally a simple structure as deciphered on the basis of surface geological mapping, as well as drilling data. In general, the strike of coal seam is NW-SE shifting to EW. The dip is generally very low i.e., 1o to 2o towards north-east in general shifting to south-east in the southern part. Beside that there are four sets of faults recorded in prospecting bore holes. These are in (1) N W - S E dipping in S W direction, (2) E-W dipping Southerly (3) WNW -ESE and (4) NE-SW directions. with 5º to 25º of throws

The sequence of coal seams: Detailed exploration of Shahpur West block has revealed the existence of 8 coal horizons. Out of these, four correlatable seams IV, Ill, Il & I in descending order have been established along with a few local coal seams; Seam lll is split into 3 sections: IIIA, IIIB & IIIL. Seam II is the thickest and most potential seam whereas seams IIIB, IIIL, I & L1 are thin & partially developed seams in the block. The sequence of coal seams, their thickness ranges and range of intervening partings are given in **Table-7**

Table 7: A generalized sequence of seams with their intervening parting in Shahpur coal block

Seam No	Minimum Thickness (m)	Maximum Thickness (m)
IV	0.15	1.57
Parting	41.03	51.39
L2	0.55	3.16
Parting	9.58	23.24
IIIA	0.35	2.84
Parting	0.30	2.93
IIIB	0.46	1.78
Parting	0.72	1.32
IIIL	0.62	1.40
Parting	12.75	20.32

Seam No	Minimum Thickness (m)	Maximum Thickness (m)
II	0.92	4.16
Parting	23.32	39.38
I	0.10	0.94
Parting	10.50	25.76
L1	0.21	1.66

Source: Approved Review of Mining Plan

Geology of the Study Area

The study area (10 Km buffer) including the Mine site is comprising of Sandstone, Siltstone, Shale with Coal. The availability of ground water in this formation is moderately poor. The geology map generated from GIS data base is presented **Plate - 10.** The geological formation of as per Geological Survey of India (GSI) is given in **Table-7.**

Table 8: Geological Formation of the study area

Age	Lithology
Late Cretaceous - Paleocene	Dolerite
Late Cretaceous - Paleocene	Basalt
Late Cretaceous	Clay
Late Cretaceous	Limestone
Late Permian	Sandstone, Shale with Coal
Late Permian	Ferruginous Sandstone
Paleoproterozoic	Granite

Geology of the Mine area

The Mine area is underlined by Late Permian formation. In general, the top soil of the Mine area 2-4 m.

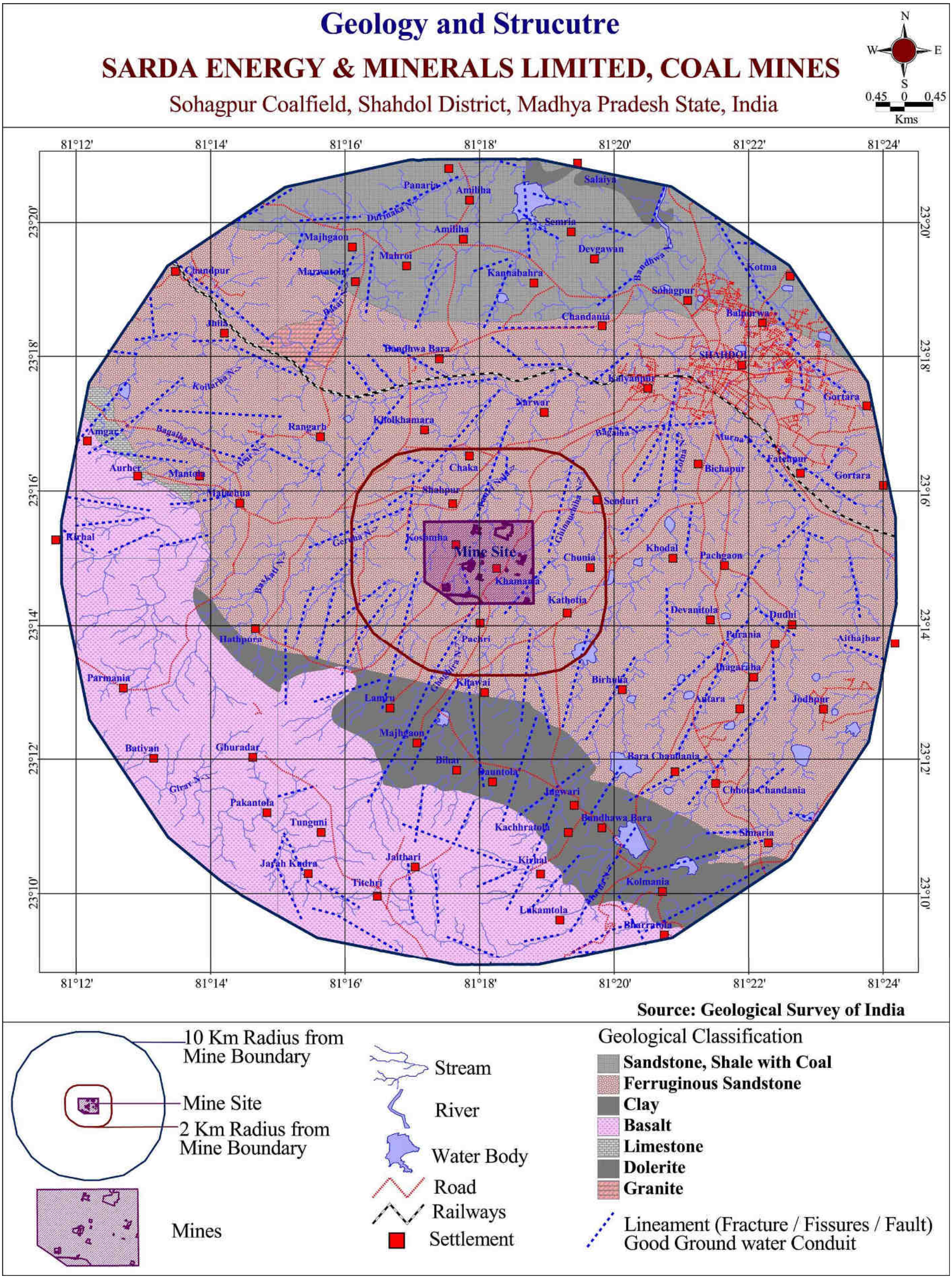


Plate 10: Geology and Structure

3.2 GEOPHYSICAL STUDIES

The geophysical survey is carried out in the core area provides an idea of the geoelectrical characteristics of the study area. The electrical resistivity or specific resistance of a medium is the resistance offered by a unit cube of it, when a unit current passes normal to the surface of the cross-sectional Area 'A'. It is given by Ohm's law:

$$\rho = RA/L$$

where

ρ = Resistivity

R = Resistance offered by the medium of length L

A = cross-sectional area

In Schlumberger arrangement of electrodes methods, the electrical resistance determined by applying an electric current (I) to the ground through a pair of current electrodes A and B and the potential difference (Δv) created in the medium between another pair of potential electrode's M and N is measured. The resistivity of the formation is given by:

$$\rho = K \frac{\Delta v}{I}$$

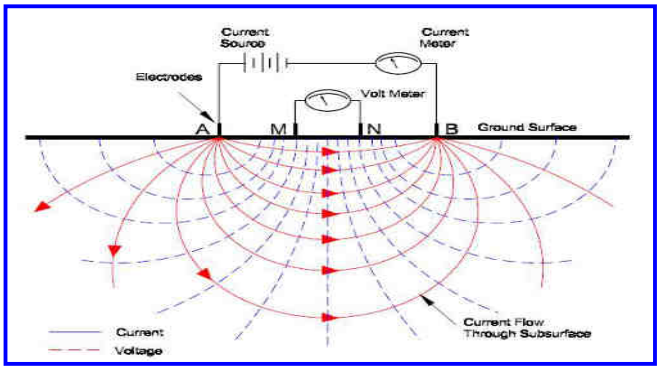
K is termed the geometric factor of the electrode arrangement, and is computed as

$$K = \frac{(AB/2)^2 - (MN/2)^2}{MN} * JI$$

Where AB and MN are distances between the designated electrodes.

The apparent resistivity (ρa) is given by "ρa = R * K"

where R = V/I therefore 'V' is the potential difference created between the pair of potential electrodes P1 and P2 and 'I' is the current sent into the ground through the current electrodes C1 and C2



Based on the Geology, Hydrology, Resistivity Survey using Schlumberger method of configuration was carried out in order to identify the Hydro geological conditions and the data obtained were analyzed.

In the study area 3 locations in the Mine areas has been identified for conducting resistivity survey based on the site condition and hydrogeological conditions. The resistivity survey has been conducted to a depth of 240 m Below Ground Level (BGL) to decipher the subsurface lithology.

Table 9: Abstract of Resistivity Survey

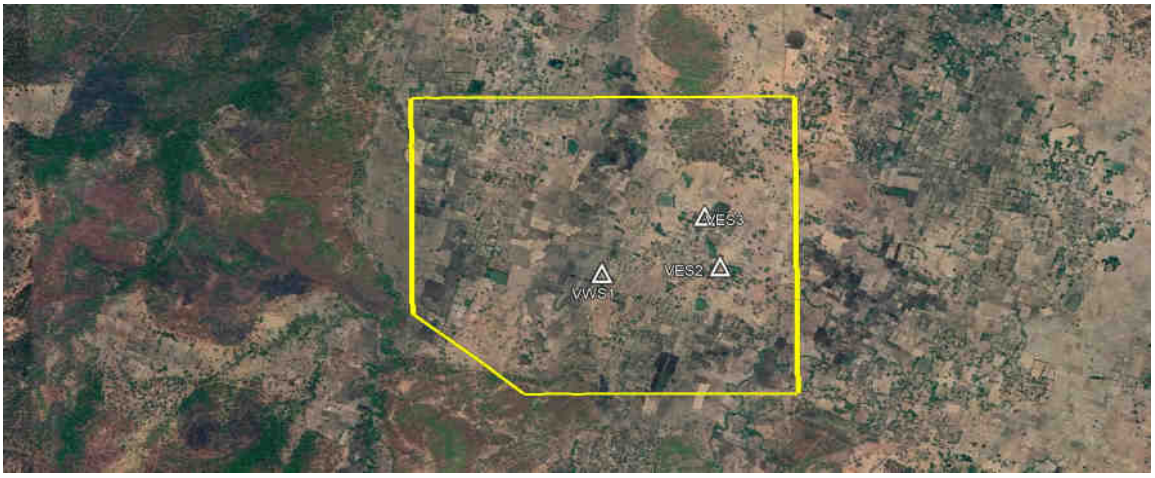
S.NO	DESCRIPTION	DETAILS
01	Area of Investigation	Non-Alluvial area.
02	Topography of the Area	Plain topography.
03	Geology	The area is covered by the Late Permian formation
04	General Hydrogeological Conditions.	Ground water occurs mainly under phreatic conditions in the weathered and jointed formations. The ground water potential mainly confines to the weathered and jointed formations
05	**HYDRO GEOELECTRICAL INVESTIGATION**	
	Resistivity Meter Used	IDDR 3 Resistivity Meter
	Electrode Configuration Adopted	Schlumberger.
	Software used for Interpretation & Analysis of VES Data	IPI2WIN- Software.

The resistivity survey data has been interpreted using IPI2WIN- Software.

Resistivity Survey – Vertical Electrical Sounding (VES) Location longitude and latitude

Table 10: Resistivity survey conducted location

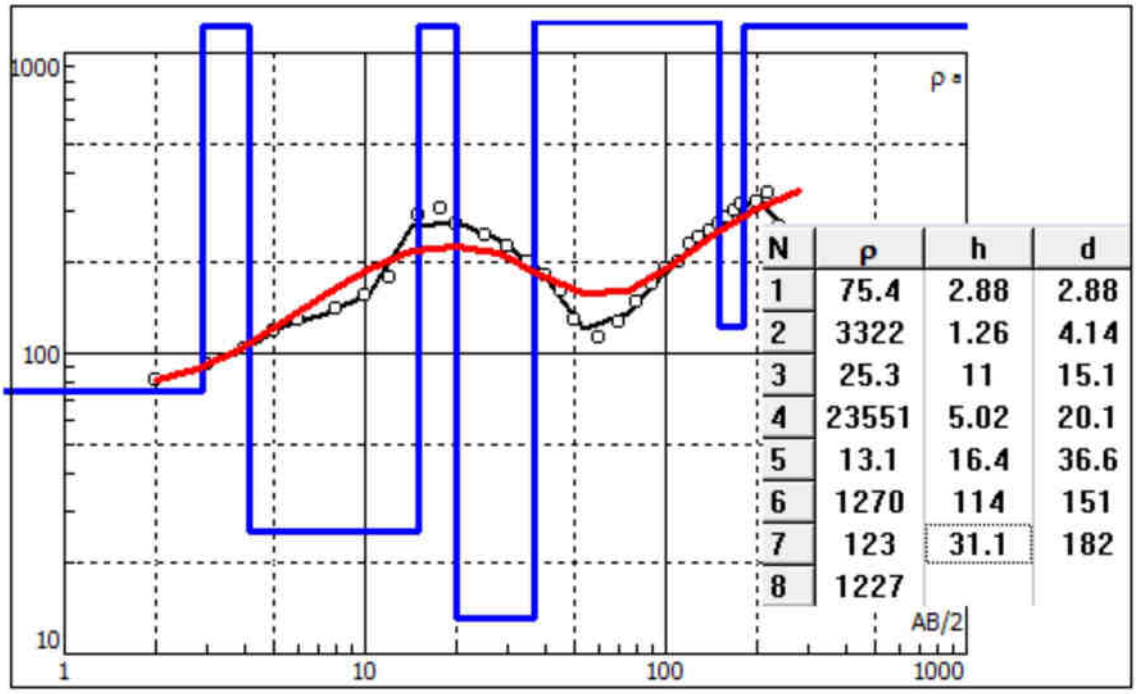
Location	Latitude	Longitude
VES 1	23°14'49.38"N	81°17'58.78"E
VES 2	23°14'51.02"N	81°18'28.60"E
VES 3	23°15'3.50"N	81°18'24.70"E



Interpretation of Resistivity Data

Location - VES 1

The interpreted results and the inferred Geo-Electric Section are presented in **Figure 2**



N	ρ	h	d
1	75.4	2.88	2.88
2	3322	1.26	4.14
3	25.3	11	15.1
4	23551	5.02	20.1
5	13.1	16.4	36.6
6	1270	114	151
7	123	31.1	182
8	1227		

Figure 2: Interpreted results of VES-1

Location - VES 2

The interpreted results and the inferred Geo-Electric Section are presented in **Figure -3**

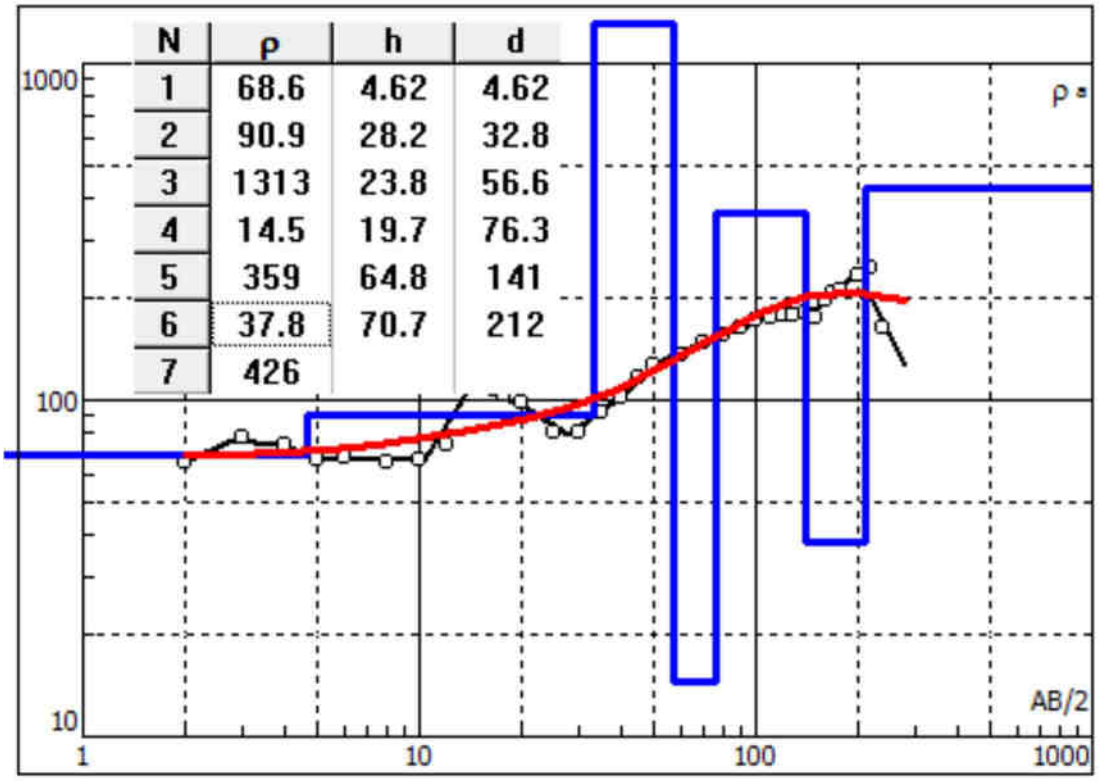


Figure 3: Interpreted results of VES-2

The interpreted results and the inferred Geo-Electric Section are presented in **Figure 4**

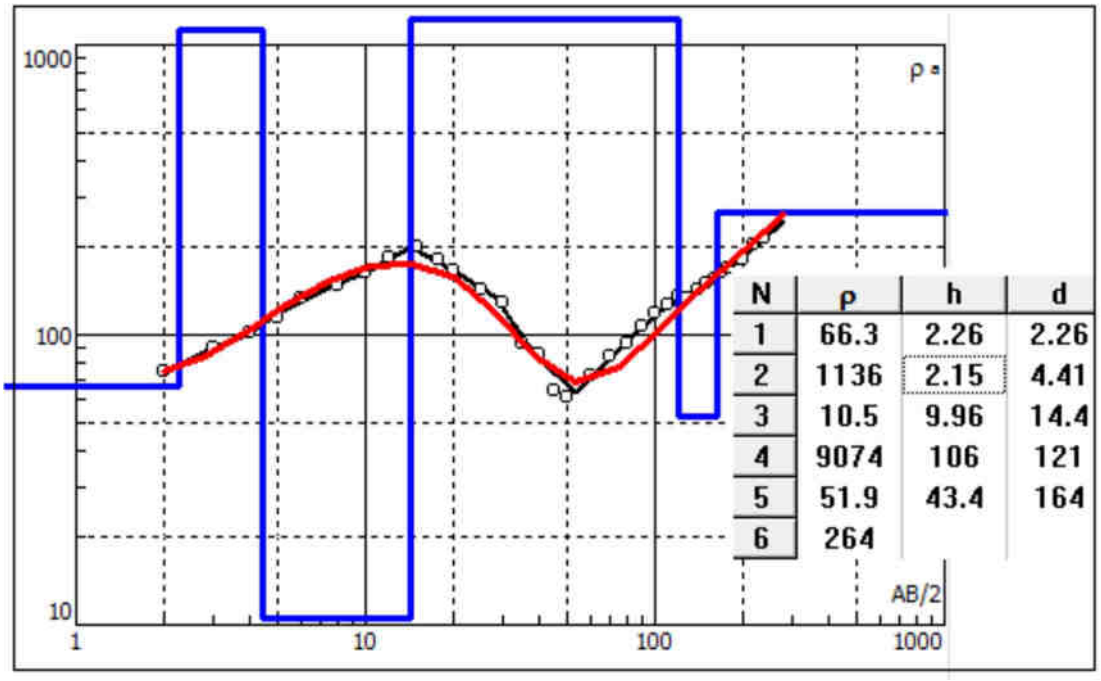


Figure 4: Interpreted results of VES-3

VES	Apparent Resistivity of layer (In ohm-m)								Thickness of layer (in m)						
	ρ1	ρ2	ρ3	ρ4	ρ5	ρ 6	ρ7	ρ8	h1	h2	h3	h4	h5	h6	h7
VES	75.	332	25.3	2355	13.	127	12	122	2.8	1.2	11	5.0	16.	114	31.
VES	68.	90.9	131	14.5	359	37.8	42	-	4.6	28.	23.	19.	64.	70.	-
VES	66.	113	10.5	9074	51.	264	-	-	2.2	2.1	9.9	106	43.	-	-

Inference of Resistivity Survey

- The thickness of top soil varies from 3 meter to 5 meters
- The last layer is massive formation which shows high.
- The above geophysical results are confirming with the mines cross sections.

3.3 HYDROGEOLOGICAL SETUP

The occurrence and movement of ground water by and large, depends on the hydrogeological condition of the sub-surface formation. These natural deposits vary greatly in their lithology, thickness of weathering, texture and structure which in turn influence their hydrogeological characteristics. Depending upon the geological setup of the study area, water bearing and water yielding properties of semi consolidated sandstones have been identified in the area.

The entire buffer zone is mainly underlain by rocks of Barakar formations of Gondwana super group comprising sandstone and shale along with coal seams. Sandstone on weathering gives rise to loose sandy products. Groundwater occurs under water table condition in the shallow aquifers and in semi confined to confined conditions in deeper. aquifers.

The Barakar formation due to mild hardness and compactness in nature it has developed primary as well as secondary porosity in form of poorly developed joints and fractures etc. These sandstones are fine to medium grained which are cemented with clay materials. Fine grained sandstones due to its cemented materials, shales and coal seams act as aquicludes and are not productive. Medium grained sandstones dispositioned vertically at places only form moderate aquifers which are moderately productive.

Hydrogeology / Ground water prospects of the Study Area

Hydrogeology / Ground water prospects of the study area have been assessed. Based on the NRSA ground water prospects mapping, 10 Km radius details have been collected and presented in **Plate -11.**

The ground water prospects of the study area covering 10 Km radius are classified in the 5zone. The zones of ground water prospects depict the depth and yield range is given in the **Table-10**

Table 11: Ground water prospects

Depth range	Yield range (LPM- Liters / Minutes)
Zone with 30-80 m Deep well	100-200 LPM Yield
Zone with 30-80 m Deep well	50-100 LPM Yield
Zone with 30 – 80 m Deep well	30-50 LPM Yield
Zone with > 80 m Deep well	30-50 LPM Yield
Zone with >80 m Deep well	Very Limited Yield

Source: Ground water prospects map, NRSA, Hyderabad. – For Details Refer Map

The Mine site falls part in 30- 80 m Deep well zone with a yield range of 100-200 LPM. The presence of lineament (fracture system) in the Mine area which may yield moderate quantity.

Hydrogeology - Ground water Prospects

SARDA ENERGY & MINERALS LIMITED, COAL MINES

Sohagpur Coalfield, Shahdol District, Madhya Pradesh State, India

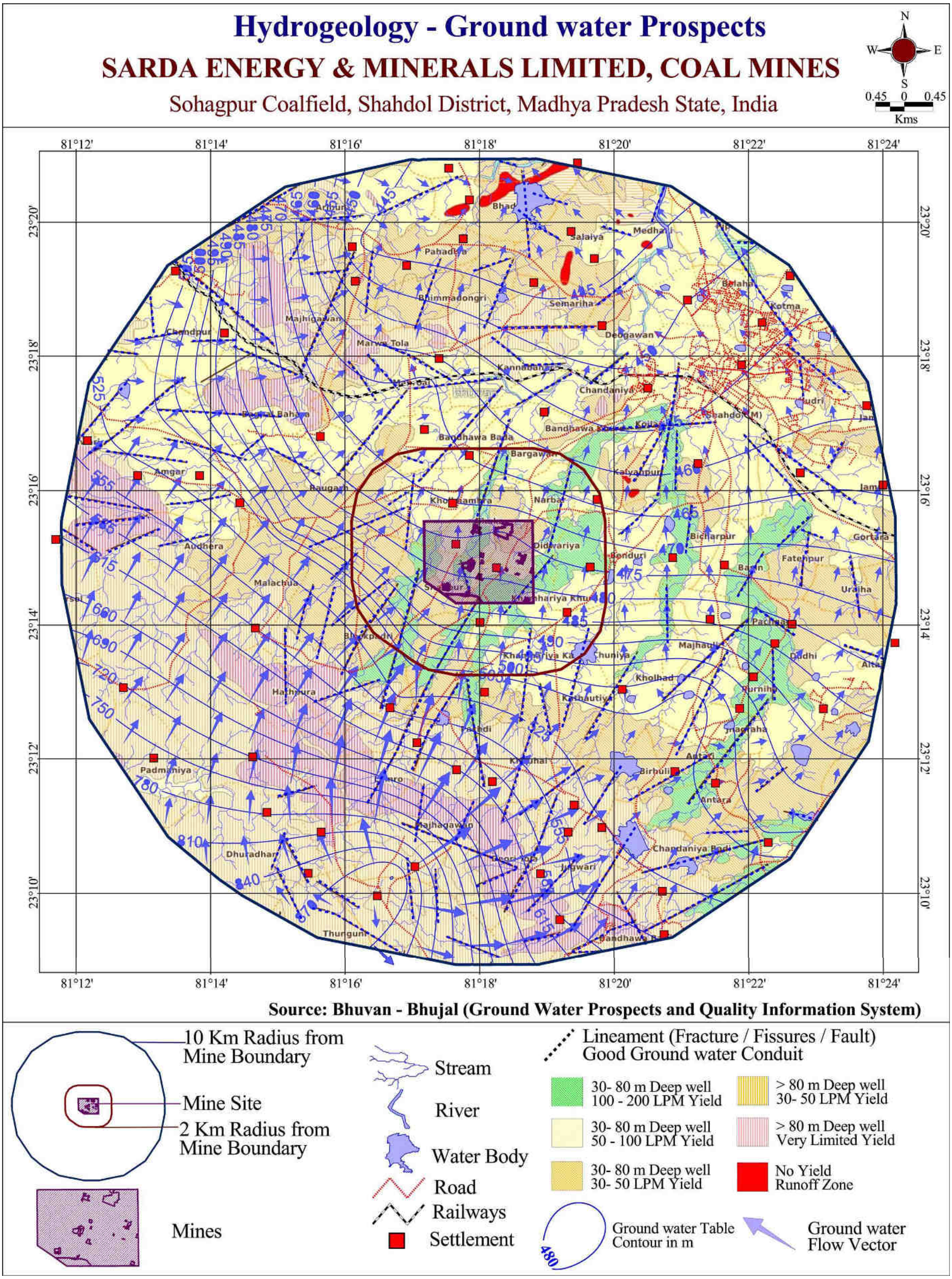


Plate 11: Hydrogeology and Ground Water Prospects.

3.3.1 Aquifer Characteristics

The principal aquifers in the study area have been delineated as Late Permian formation. The dug wells are generally restricted up to 20 m whereas bore wells are 88 to 300 m deep. **The CGWB details have been collected. The details reveals that the storativity of the formation of the district is 4.93×10^{-4} and transmissivity ranges from 12 to 186 m^2 /day. Discharge (Yield) of ranges from 0.4-28 lps.**

The exploratory Bore well details for Shahdol District with same hydrogeological Environs have been collected from CGWB and analysed. The following are interpreted from the exploratory Bore well results. **Table-11**

Table 12: Details of CGWB Exploratory Bore well (Shahdol District)

Description	Detail
Number of wells drilled by CGWB	**Total 27 (Exploratory wells 16, Observation wells 7, PZ 4**
Depth (Minimum and Maximum)	**60 to 202 m. bgl**
Zone encountered	**Range Varies between 88.85-303 m**
Static Water level (Minimum and Maximum)	**3.03 – 13.57**
Yield in LPS (Range)	**0.4-28 lps**
Drawdown in m (Range)	**8 -45 m**
Transmissivity (m^2/day)	**12 to 186 m^2 /day**
Storativity	**4.93×10^{-4}**
Ground water quality	**EC-175-1440 µS/cm,**

Aquifer Parameters

Pumping test is the most accurate, reliable and commonly used method to evaluate the hydraulic parameters of an aquifer, efficiency of a well / bore well, safe operational rates of pumping and selection of suitable pump. The methods of a pumping test are highly varying in its application. The main objective of pumping test is to determine the aquifer parameters such as Transmissivity (T), Storage co-efficient (S) Hydraulic Conductivity (K), well performance and safe yield for execution of water supply.

In order to evaluate the aquifer characteristics and safe yield to match the ground water requirement, constant discharge test has been conducted in the Bore well located in Khamaria village.

Pumping test Methodology

- The constant discharge test has been carried out with the help of the motors fitted in the Bore well & electronic water level indicator etc.,

- During the pumping test, discharge has been measured by volumetric methods and ground water level has been measured using electronic indicator.
- Draw down and recovery have been measured from the pumping well.

In order to assess the aquifer parameter, the recovery data has been used. Both drawdown and recovery measurement have been taken in the wells. After stopping the pump recovery measurements were taken, the principle behind the estimation of Transmissivity of deeper aquifer of a Bore well is that the recovery of water level in a well after the pump is shut off can be simulated by continuing pumpage as before, and recharging by an imaginary recharge well at the same rate during the recovery period. Under such conditions the residual drawdown s', i.e. the difference between the drawdown component due to continued pumpage and the recovery component due to recharge is given by Theis (1935):

$$s = \frac{Q}{4\pi T}\left[\log_e\left(\frac{4Tt}{r_w^2 S}\right) - \log_e\left(\frac{4Tt'}{r_w^2 S'}\right)\right]$$

Where Q = constant discharge, s' = residual drawdown

rw = effective radius of well in which the water level recovery is measured.

t = time since pumping started and t' = time since pumping stopped

If storage coefficient remains constant and equal (S during pumping = S' during recovery) and $u = r^2S/4Tt'$ is sufficiently small, the above equation is simplified to

$$s = \frac{2.303Q}{4\pi T}\log_{10}\frac{t}{t'}$$

The procedure for data analysis is to plot s^1 against t/t' in semi- logarithmic paper, with s^1 on the arithmetic scale and t/t' on the log scale. After the value of t' becomes sufficiently large, the observed data should fall on a straight line. The slope of this line gives the value of $\log_{10}$ t/t'. For convenience, the value of t/t' is chosen on log cycle apart, so that its logarithm becomes unity. The above equation is simplified to:

$$T = \frac{2.303Q}{4\pi\Delta s'}$$

Where Q = constant discharge, in cu.m/day and

Δs' = change in residual drawdown in meters per log cycle of t/t'.

Storage coefficient is calculated based on equation

$$S = \frac{2.25Tt^0}{r^2}$$

Where T = Transmissivity,

t^0 = intercept of the straight line at zero drawdown in days

r = radius of the well / distance from observation well in m

Pumping tests carried out in Bore well-constructed in the consolidated formation of Limestone. The data and graphs pertaining to pumping tests are shown as below:

Results of the Pumping test

The drawdown and recovery data have been fed in to **AqiferTest-2016** Software and the same is presented in **Table – 13-15**. The Time vs Drawdown Plot is given in **Figure-10**

Table 13: Results of Pumping Test – Bore well

Particulars	Details	Particulars	Details
Location	Khamaria	Pumping water level in m	23.66
Formation	Sandstone	Drawdown in m	13.16
Depth in m	107	Residual Drawdown in m	11.90
Water level in m (bgl)	10.5		
Duration of pumping in min	240	Transmissivity m^2/day	**31.2**
Discharge cu.m/hr	210 lpm 12.6 cu.m/hr	Storage Coefficient	**2.56×10^{-05}**

Table 14: Bore well – Pumping Data

Time since pump started (min) t	Main Well		Observatory Well at 32.4 m Distance	
	DTW (m)	DD (m)	DTW (m)	DD (m)
2	15.45	4.95	11.24	0.44
3	16.52	6.02	11.32	0.52
4	17.22	6.72	11.42	0.62
5	17.68	7.18	-	-
6	18.2	7.70	11.56	0.76
7	18.42	7.92	-	-
8	18.86	8.36	11.65	0.85
9	19.12	8.62	-	-
10	19.37	8.87	11.72	0.92
12	19.75	9.25	11.81	1.01
15	20.24	9.74	11.85	1.05
18	20.65	10.15	-	-
20	20.82	10.32	11.93	1.13
25	21.25	10.75	11.99	1.19
30	21.68	11.18	12.06	1.26
35	22.15	11.65	-	-
40	22.3	11.80	12.14	1.34
45	22.48	11.98	12.24	1.44
60	22.75	12.25	12.3	1.5
75	22.88	12.38	12.36	1.56
90	23.08	12.58	12.39	1.59

Time since pump started (min) t	Main Well		Observatory Well at 32.4 m Distance	
	DTW (m)	DD (m)	DTW (m)	DD (m)
105	23.32	12.82	12.47	1.67
120	23.42	12.92	12.54	1.74
150	23.56	13.06	12.57	1.77
180	23.61	13.11	12.61	1.81
210	23.65	13.15	12.64	1.84
240	23.66	13.16	12.64	1.84
Note: For observatory well, DTW= 10.8mbmp and MP= 0.5 magl				

Table 15: Bore well –Recovery data

Time since pump started (min) t	Time since pump stopped (min) t'	t/t'	DTW (m bmp)	RDD (m)
241	1	241.0	20.08	9.58
242	2	121.0	18.35	7.85
243	3	81.0	18.02	7.52
244	4	61.0	17.45	6.95
245	5	49.0	17.00	6.50
246	6	41.0	16.82	6.32
247	7	35.3	16.45	5.95
248	8	31.0	16.22	5.72
249	9	27.7	16.00	5.50
250	10	25.0	15.90	5.40
252	12	21.0	15.75	5.25
254	14	18.1	15.62	5.12
256	16	16.0	15.40	4.90
258	18	14.3	15.25	4.75
260	20	13.0	15.02	4.52
265	25	10.6	14.83	4.33
270	30	9.0	14.64	4.14
275	35	7.9	14.36	3.86
280	40	7.0	14.03	3.53
285	45	6.3	13.83	3.33
300	60	5.0	13.63	3.13
315	75	4.2	13.48	2.98
330	90	3.7	13.32	2.82
345	105	3.3	12.84	2.34
360	120	3.0	12.46	1.96
390	150	2.6	12.30	1.80
420	180	2.3	12.10	1.60
450	210	2.1	11.96	1.46
480	240	2.0	11.90	1.40

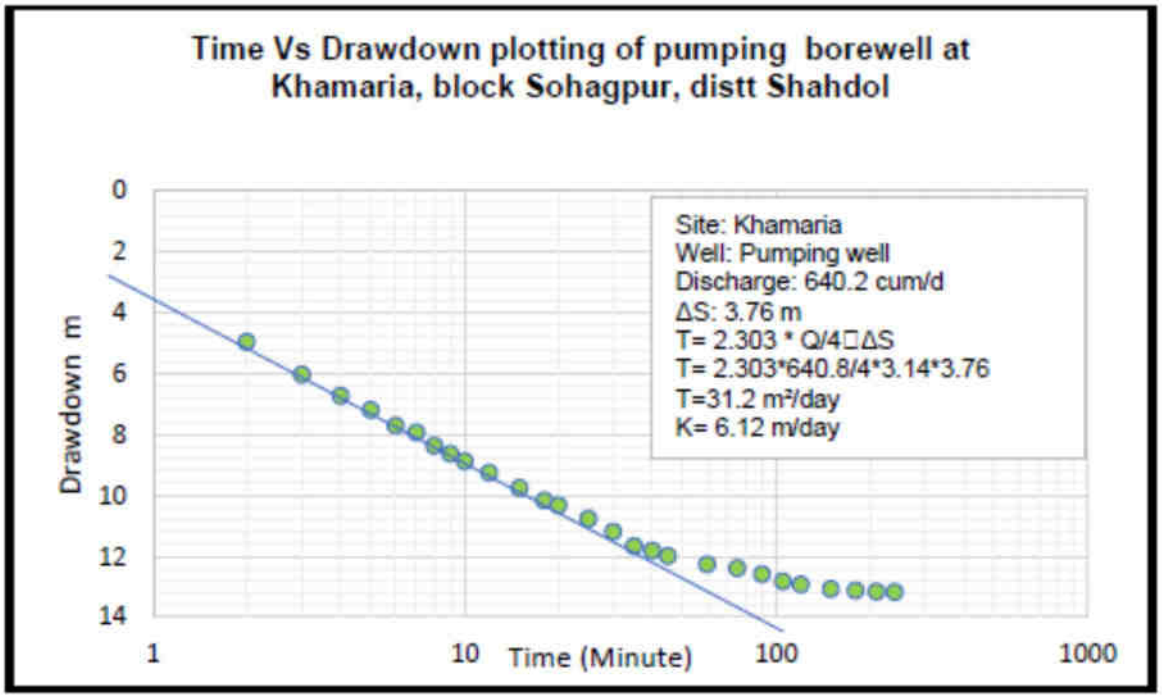


Figure 5: Time Vs Drawdown in the Pumping Well

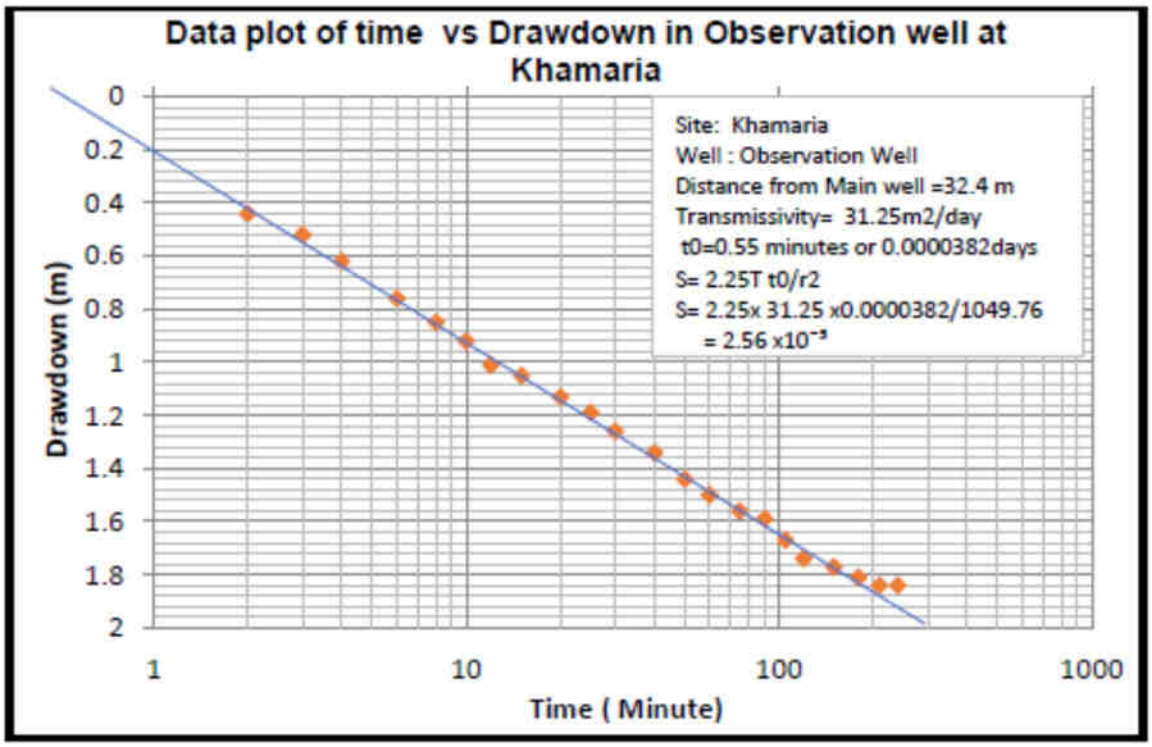


Figure 6: Time Vs Drawdown in the Observatory Well

Inference of Pumping Test

Based on the pumping test the following aquifer parameters area derived.

Transmissivity of the study area	**31.2**	**m^2/day**
Storativity Average of the study area	**$2.56X10^{-5}$**	
Average Hydraulic Conductivity of the study area	**6.12**	**m/day**

The effective aquifer thickness is 30 m. The above values are compared with CGWB exploratory Bore well drilled for Shahdol district and found to be matching.
The above Aquifer parameters are used for seepage calculation.

3.3.2 Ground water flow and aquifer interaction with surface water bodies

The ground water table is generated from the ground water level data generated from the ground water level data collected during the field visit.

The ground water table generated using the pre and post monsoon data indicates that there is 2 different flow pattern is observed in the study area.

1) From the mines lease area, the Ground water flow towards north
2) Ground water mound (divergent flow of ground water) observed in the southern part.

Pre monsoon ground water table map is presented in **Plate-12.**

The same flow pattern is observed during the post monsoon period. However, that there is change in the hydraulic gradient. Post monsoon ground water table map is presented in **Plate-13.**

During both pre- and post-monsoon periods, ground water mound (divergent flow of ground water) noticed in the of study area.

The ground water level fluctuation and the ground water table clearly indicate that there is surface (rainfall) and ground water interaction.

The main source of recharge in the study area is from rainfall.

3.3.3 Depth to water level

To understand the ground water situation of the study area covering 10 km radius, ground water level monitoring was carried out in 52 nos. of bore wells. Out of which 25 bore wells have been selected. At the time of field visit, the above 25 bore wells are noticed as non-pumping and **all** are located in different places of the core and buffer zones of the study area during Pre-monsoon season -March 2022. **During the field visit most of the bore wells are under pumping condition, hence the above 25 wells ground water levels were collected.**

Since, all most all the deep bore wells are under pumping, bore wells 25 are established as key observation wells in the core (2 km radius) and buffer zone (10 km radius) for monitoring purposes. 2 wells in the core zones and 23 in the buffer zone have been monitored.

Core zone: The minimum and maximum depth of bore wells in the core zone is **88 m to 92 m** respectively. Yield varies from **2.0 to 5.0 m³ /day**. Post-monsoon water level varies from **14.4 m to 16.2 m** below ground level. In Pre-monsoon period it varies from **18.3 m to 19.7 m** below ground level. Seasonal fluctuation in water level in these bore wells in the core zone varies from **2.1 m to 5.3 m**.

Buffer zone: The minimum and maximum depth of bore wells in the buffer zone is **60 m to 150 m** respectively**.** Yield varies from **2 to 5.0 m³ /day**. Post-monsoon water level varies from **3.2 m to 25.6 m** below ground level. In Pre-monsoon period it varies from **6.7 m to 31.4 m** below ground level. Seasonal fluctuation in water level in these bore wells in the core zone varies from **2.1 m to 5.8 m**.

Bore well are being used for drinking purpose and majority are used for irrigation purposes and facilitated with 3 to 5 HP electrical submersible pumps and running 5 to 8 hrs daily.

The recorded spring depth (tapped zone) varies from **8 m to 38 m** below ground level.

The Key well data for the core and buffer zones are presented in the following **Table 14 and 15**.

Table 16:Bore well- Pre, Post Monsoon ground water level and fluctuation

No	Location	Latitude	Longitude	Depth in m	Ground Water Level in m (Pre-Monsoon)	Ground Water Level in m post-Monsoon)	Ground Water Level Fluctuation in m
1	Khamaria Kalan (Parmania)	23° 12' 54.934" E	81° 12' 5.43" N	76.00	24.4	21.3	3.1
2	Khamaria Khurdh	23° 15' 13.71" E	81° 18' 19.85" N	92.00	19.7	14.4	5.3
3	Kalyanpur	23° 17' 21.46" E	81° 20' 23.83" N	90.00	14.5	10.2	4.3
4	Shahpur	23° 16' 1.5" E	81° 17' 49.6" N	88.00	18.3	16.2	2.1
5	Malchua	23° 15' 28.8" E	81° 15' 6.4" N	94.50	17.6	13.1	4.5
6	Bandhuwa Bara	23° 17' 35.6" E	81° 17' 12.9" N	8.60	6.7	3.2	3.5
7	Salaiya	23° 20' 40.104" E	81° 19' 22.783" N	90.00	19.1	16.3	2.8
8	Majhgawan	23° 19' 42.3" E	81° 16' 17.6" N	90.00	27.1	24.9	2.2
9	Chandpur	23° 19' 31.786" E	81° 13' 23.703" N	79.20	12.4	7.3	5.1
10	Lukamtola	23° 9' 54.982" E	81° 19' 13.539" N	106.00	31.4	25.6	5.8
11	Lamro	23° 12' 59.12" E	81° 16' 49.28" N	90.00	28.4	23.4	5.0
12	Pakaritola	23° 11' 11.823" E	81° 14' 53.909" N	10.58	9.2	7.0	2.2
13	Jugwari	23° 11' 19.809" E	81° 19' 23.092" N	90.00	24.6	20.6	4.0
14	Khohai	23° 12' 54.4" E	81° 18' 20.6" N	79.20	10.3	5.4	4.9
15	Kolhad	23° 15' 12.3" E	81° 20' 38.9" N	90.00	14.3	8.8	5.5
16	Fatehpur	23° 16' 24.529" E	81° 23' 20.714" N	90.00	14.7	10.6	4.1
17	Jodhpur	23° 12' 36.163" E	81° 23' 38.648" N	60.00	12.4	10.3	2.1
18	Antara	23° 12' 48.2" E	81° 21' 8.3" N	78.00	16.3	12.7	3.6
19	Simariha	23° 10' 46.1" E	81° 22' 10.7" N	80.00	18.9	14.3	4.6
20	Kannabahre	23° 19' 16.4" E	81° 18' 51.6" N	107.00	18.5	14.2	4.3
21	Sohagpur	23° 18' 41.3" E	81° 21' 8.5" N	120.00	14.3	10.4	3.9
22	Kotma	23° 19' 16.659" E	81° 22' 51.502" N	150.00	15.9	12.7	3.2
23	Kelmaniya	23° 10' 6.4" E	81° 20' 40.68" N	120.00	20.3	16.4	3.9
24	Jaithari	23° 10' 14.66" E	81° 16' 42.49" N	128.00	26.6	22.3	4.3
25	Amgar	23° 16' 50.07" E	81° 12' 42.58" N	112.00	22.5	17.2	5.3

The summarized ground water level of the Bore well for the core and buffer zone are given in the **Table 15. 25 Bore wells are considered to arrive minimum, maximum water level and fluctuation.**

Table 17: Summarized ground water levels in Bore well in core and buffer zone.

Ground water level	10 Km radius ground water level (Based on 25 Key wells)		
	Pre-Monsoon	**Post-Monsoon**	**Season wise Fluctuation in m**
Minimum in m	**6.70**	**3.20**	**2.1**
Maximum in m	**31.40**	**25.60**	**5.8**

The pre monsoon ground water level of the core zone is considered for seepage calculation.

In order to seepage estimation and ground water modelling ground water level for the pre and post monsoon periods, the open well ground water level considered. The field photographs captured during data collection is presented in **Figure - 11**

Figure 7: Photograph of the wells in the study area.

The above geo-tagged photographs of the bore wells are captured during the field visit, which was performed from May 2022.

In order to study the spatial distribution of ground water levels for the pre and post-monsoon periods, the monitored Bore wells ground water level is considered and accordingly, water level zone maps are prepared (**Plate-14 and 15**).

Pre-Monsoon

The pre monsoon depth to ground water level depict that relatively deepest of ground water level zone of **30-40 m** falls in the south and western part of the study. The shallowest ground water level zone of **5-7 m** occupies in the northern part of the study area.

The Core zone and mines fall in **15-20 m** zone. Pre-monsoon ground water level zone map is presented in **Plate-14.**

Post Monsoon

The post monsoon depth to ground water level depict that relatively deepest of ground water level zone of **20-30 m** falls in the south and northern part of the study area.

The shallowest ground water level zone of **5-7 m** occupies in the northern part of the study area. The Core zone and mines fall in **15-20 m** zone.
During the post monsoon period there is considerable rise in the ground water level. It is observed that there is increase of ground water level in the throughout the study area where the ground water level is deep during the pre-monsoon period.

It clearly indicates that rainfall recharge is taking place considerably. Post-monsoon ground water level zone map is presented in **Plate-15.**

Ground water level Fluctuation

Based on the pre and post monsoon ground water level data of the study area, the ground water fluctuation is generated in presented in **Plate – 16.**

The ground water level fluctuation of the study area indicates that the ground water level fluctuation ranges from **3.0 – 7.0 m** which indicates that the aquifer of the study area has moderate recharge potential. The Core zone falls in **3.0-5.0** m fluctuation zone.

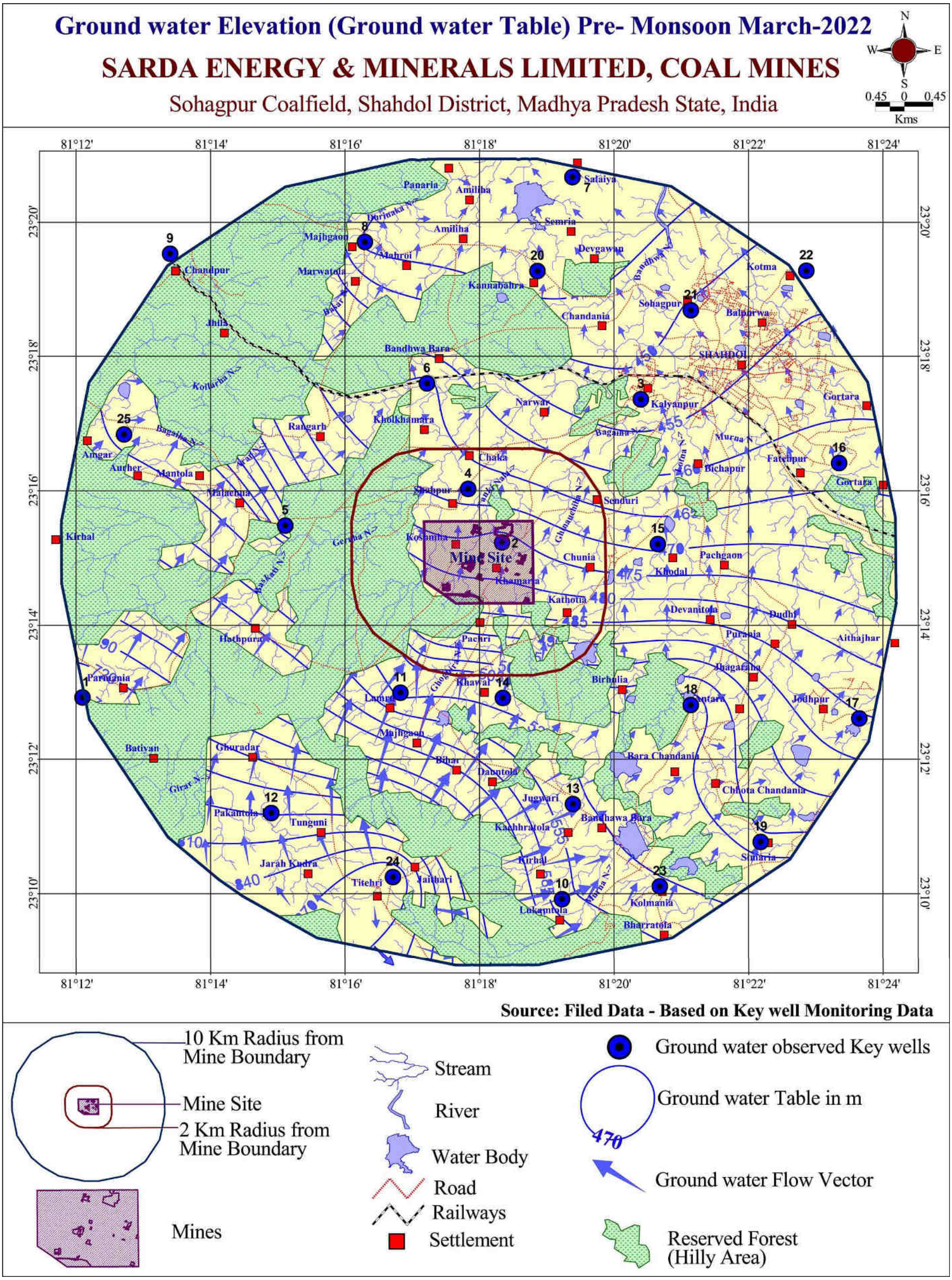


Plate 12: Ground water Table (Pre-Monsoon)

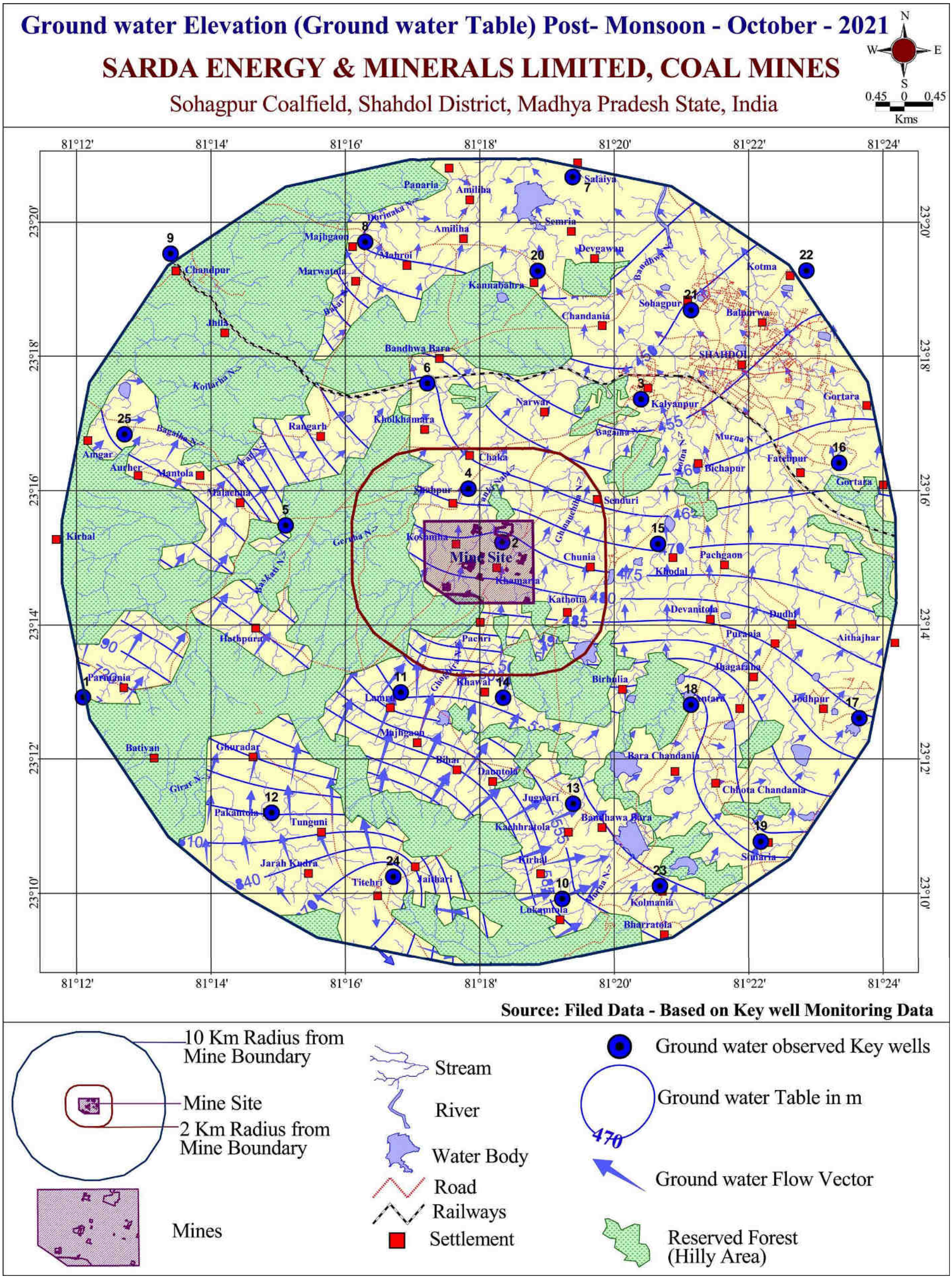


Plate 13: Ground water Table (Post-Monsoon)

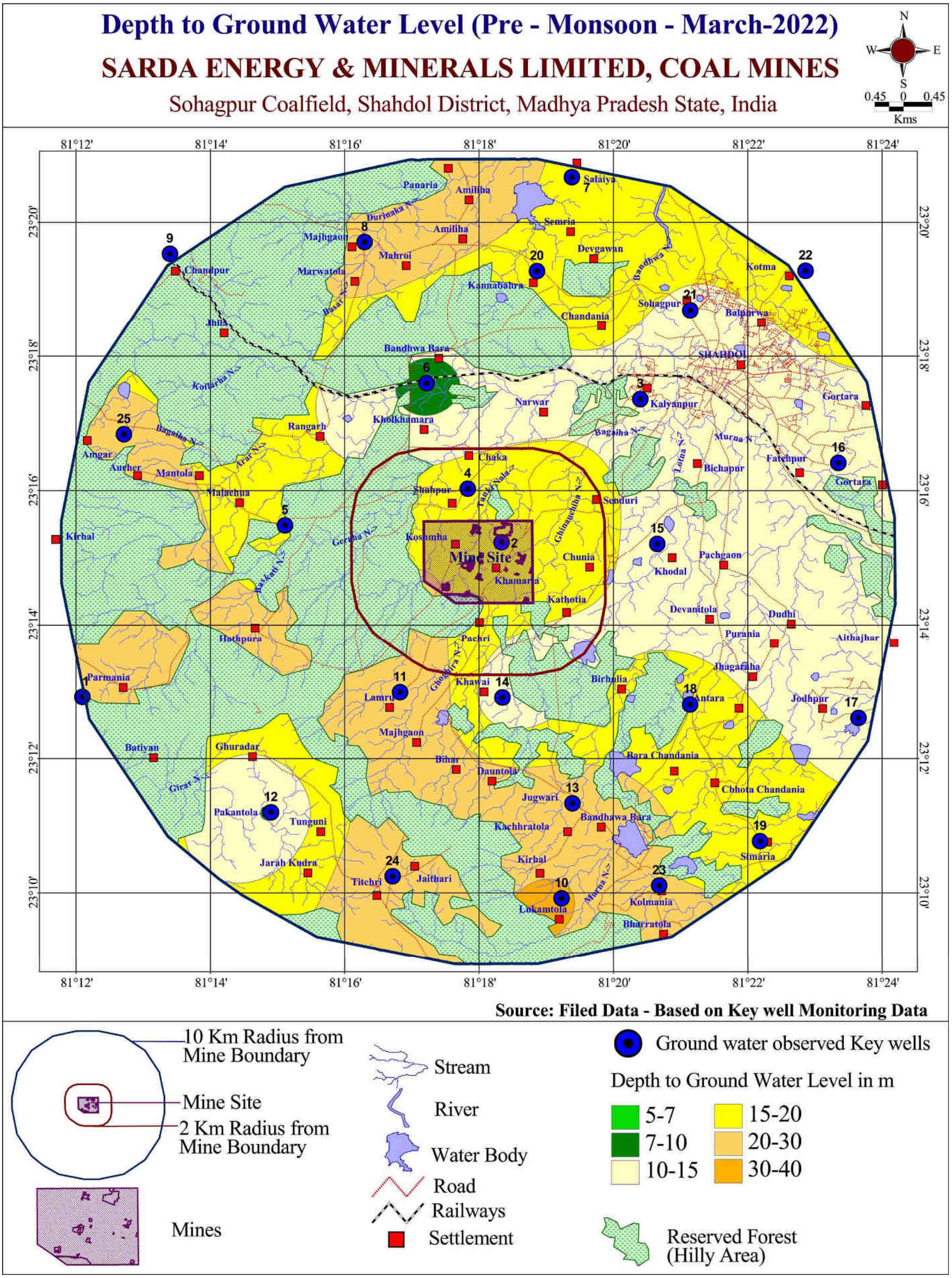


Plate 14: Ground water level zone (Pre-Monsoon)

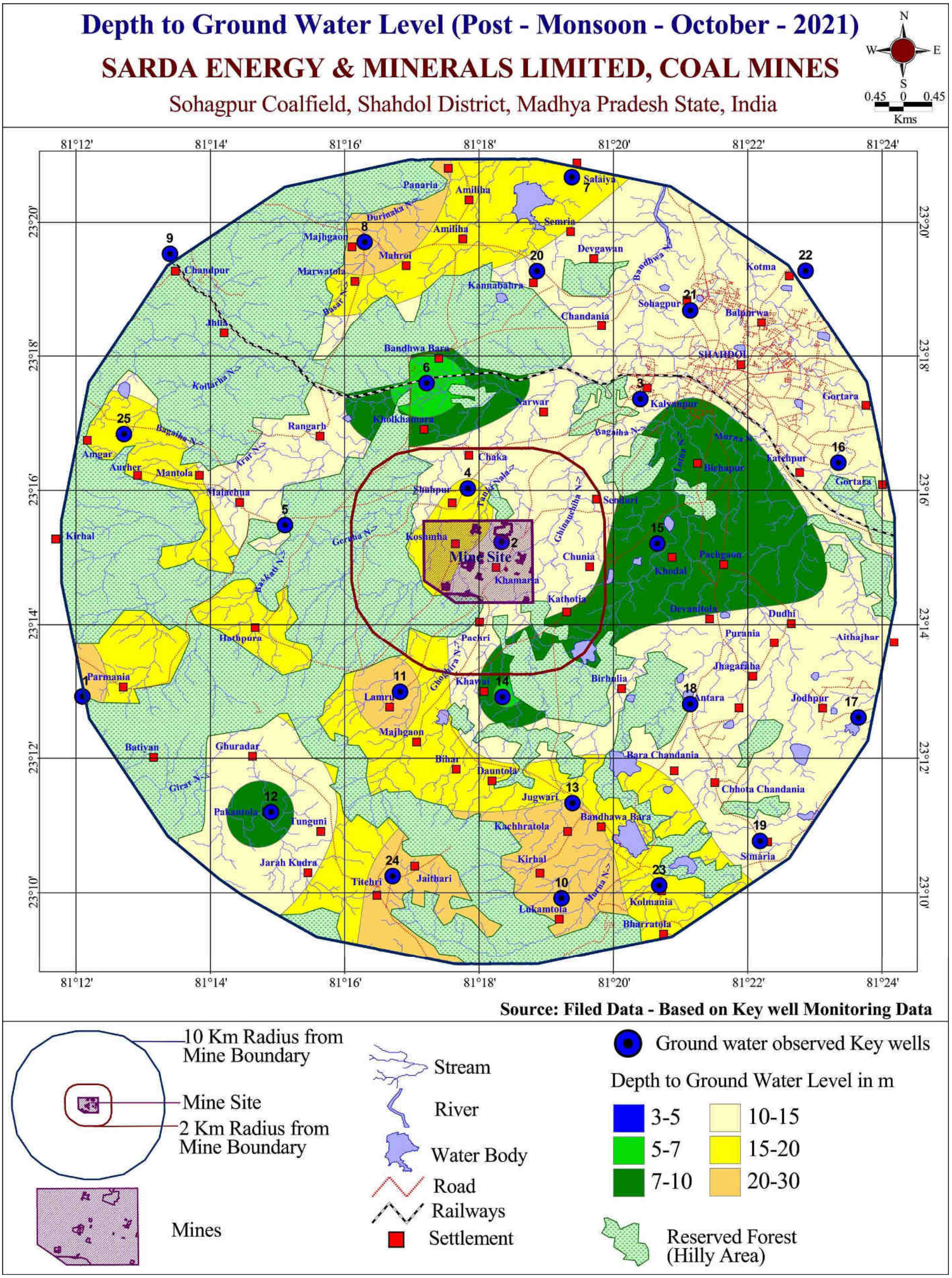


Plate 15: Ground water level zone (Post-Monsoon)

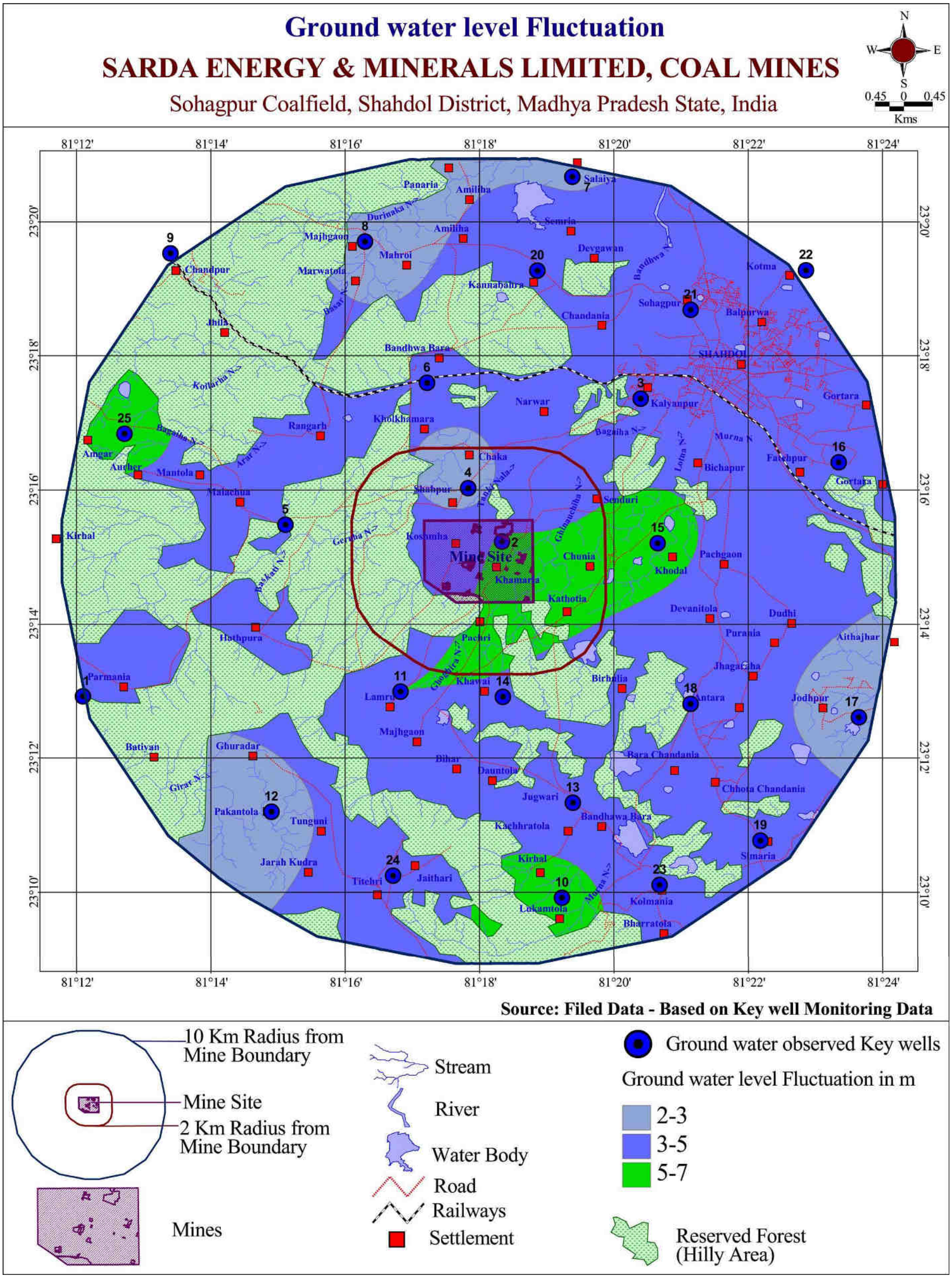


Plate 16: Ground water level fluctuation

3.3.4 Long term water level data analysis

In order to understand the long term (10 years) ground water level changes, the CGWB observation wells located in and around the study area has been downloaded from INDIAWRIS web site and plotted on the SOI topo map. The nearest continuous monitoring well (with less data gap) has been chosen for the long-term trend analysis. The locations of the CGWB observation in and around the study area is presented **Figure-12**:

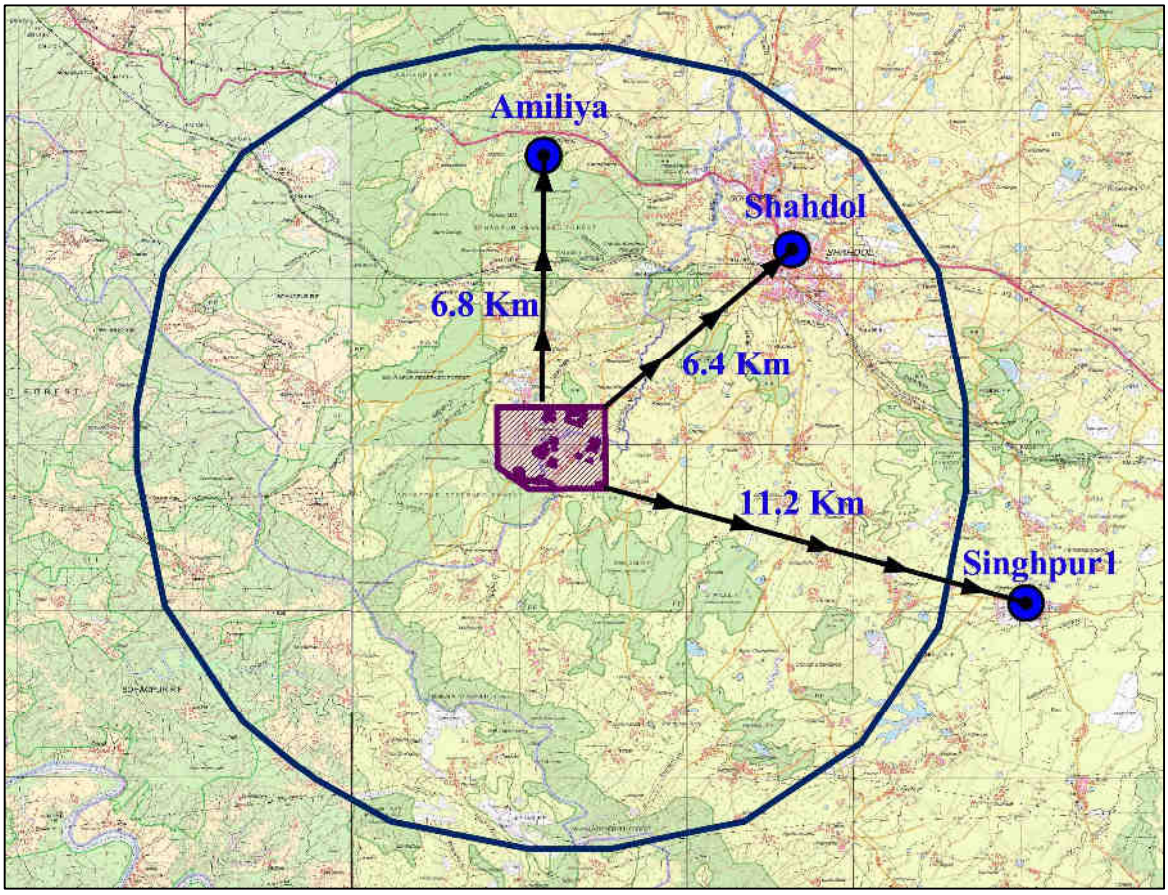


Figure 8: Location of CGWB Observation well

The continuous monitoring data available for location of **Amiliya, Shahdol and Singhpur 1** which are located within **12 Km radius** in North, south and east direction with same hydrogeological environs. The above observation wells have been considered for the long-term analysis.

Ground water observation well data for a period of 10 Years has been collected from CGWB for the above 3 locations. The geographic coordinate of the monitoring well is given in **Table-16.**

Table 18: CGWB monitoring well location

Sl. No	Location	Monitoring Agency	Latitude	Longitude	Direction	Distance
1	**Amiliya**	CGWB	23° 19' 19" N	81° 17' 52" E	North	6.8 Km
2	**Shahdol**	CGWB	23° 19' 19" N	81° 17' 52" E	North East	6.4 Km
3	**Singhpur 1**	CGWB	23° 19' 19" N	81° 17' 52" E	South East	11.2 Km

Ground water observation was done by CGWB to monitor the shallow ground water level in the study area. The ground water level data from 2011 to 2020 has been collected from INDIAWRIS Website.

Hydrograph of water level for 10 years

Decadal Trend of water levels for pre monsoon and post monsoon periods for the last ten years (2011-2020) have been computed for CGWB Ground Water Monitoring Wells. The Season wise hydrograph was constructed for the 4 Monitoring well is presented in **Figure – 13 - 15.**

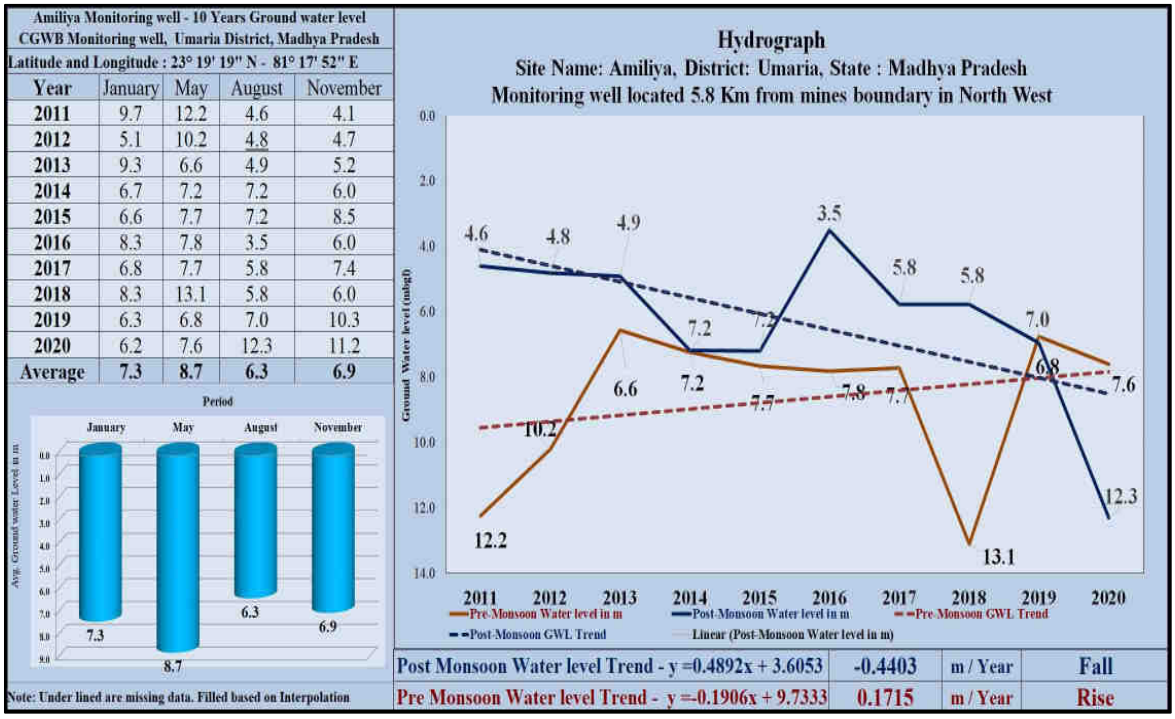
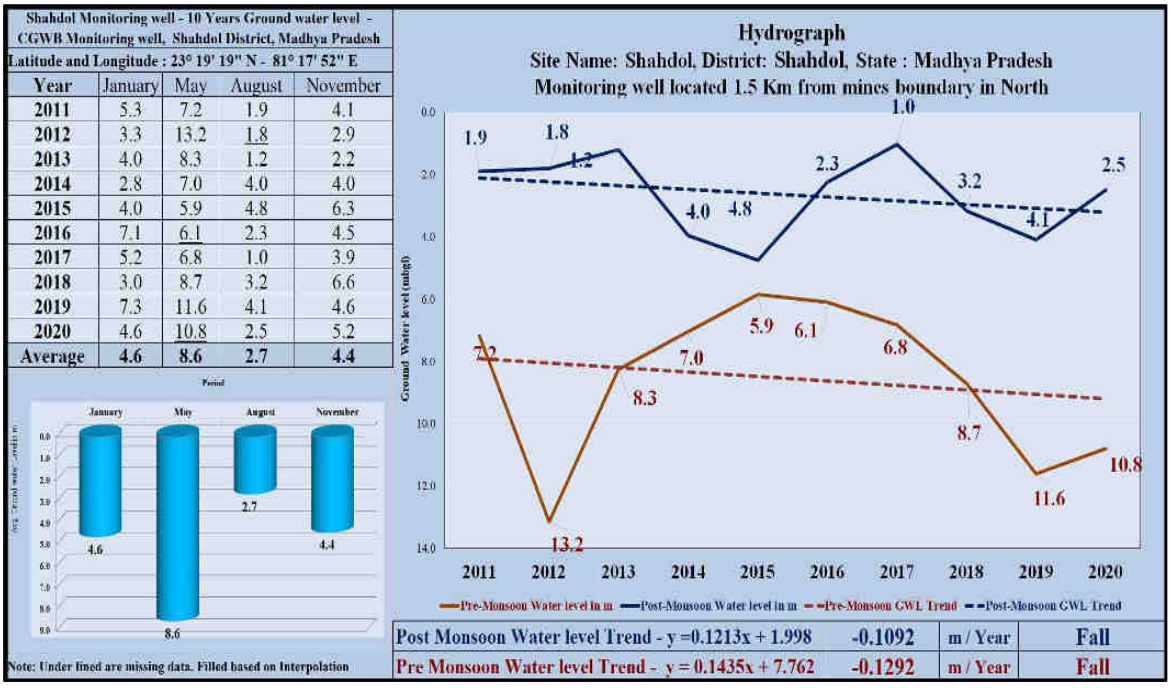


Figure 9: Hydrograph of Amiliya CGWB Monitoring well



Shahdol Monitoring well - 10 Years Ground water level - CGWB Monitoring well, Shahdol District, Madhya Pradesh

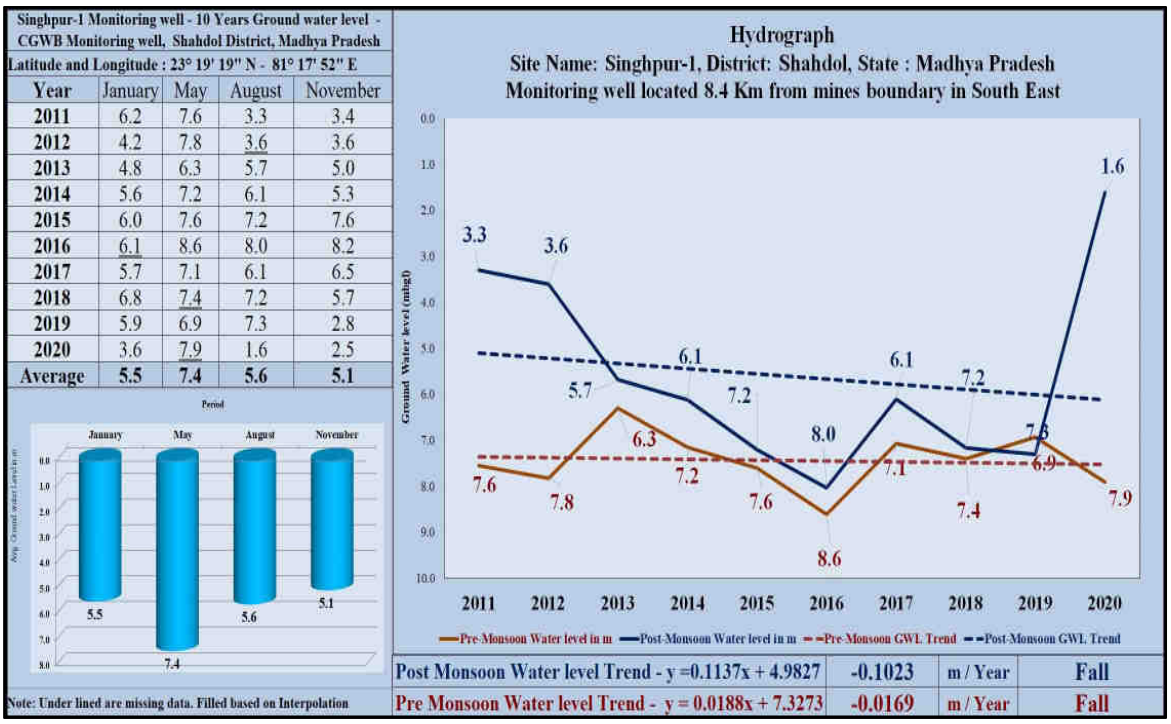
Latitude and Longitude : 23° 19' 19" N - 81° 17' 52" E

Year	January	May	August	November
2011	5.3	7.2	1.9	4.1
2012	3.3	13.2	1.8	2.9
2013	4.0	8.3	1.2	2.2
2014	2.8	7.0	4.0	4.0
2015	4.0	5.9	4.8	6.3
2016	7.1	6.1	2.3	4.5
2017	5.2	6.8	1.0	3.9
2018	3.0	8.7	3.2	6.6
2019	7.3	11.6	4.1	4.6
2020	4.6	10.8	2.5	5.2
Average	4.6	8.6	2.7	4.4

Note: Under lined are missing data. Filled based on Interpolation

Post Monsoon Water level Trend - y =0.1213x + 1.998	-0.1092	m / Year	Fall
Pre Monsoon Water level Trend - y = 0.1435x + 7.762	-0.1292	m / Year	Fall

Figure 10: Hydrograph of Shahdol CGWB Monitoring well



Singhpur-1 Monitoring well - 10 Years Ground water level - CGWB Monitoring well, Shahdol District, Madhya Pradesh

Latitude and Longitude : 23° 19' 19" N - 81° 17' 52" E

Year	January	May	August	November
2011	6.2	7.6	3.3	3.4
2012	4.2	7.8	3.6	3.6
2013	4.8	6.3	5.7	5.0
2014	5.6	7.2	6.1	5.3
2015	6.0	7.6	7.2	7.6
2016	6.1	8.6	8.0	8.2
2017	5.7	7.1	6.1	6.5
2018	6.8	7.4	7.2	5.7
2019	5.9	6.9	7.3	2.8
2020	3.6	7.9	1.6	2.5
Average	5.5	7.4	5.6	5.1

Note: Under lined are missing data. Filled based on Interpolation

Post Monsoon Water level Trend - y =0.1137x + 4.9827	-0.1023	m / Year	Fall
Pre Monsoon Water level Trend - y = 0.0188x + 7.3273	-0.0169	m / Year	Fall

Figure 11: Hydrograph of Singhpur -1 CGWB Monitoring well

The abstract of the long-term ground water level trend is given in **Table-17.**

Table 19: Long term Ground water level trend

Trends for the Hydrograph (Mentoring Well)	Trend – Rise		Trend - Fall		Trend - No Change	
	Pre-Monsoon Rate of Rise(m/yr)	Post-Monsoon Rate of Rise(m/yr)	Pre-Monsoon Rate of Fall(m/yr)	Post-Monsoon Rate of Fall(m/yr)	Pre-Monsoon (m/yr)	Post-Monsoon (m/yr)
Amiliya	0.172			-0.440		
Shahdol			-0.129	-0.109		
Singhpur 1			-0.017	-0.102		
Average	**0.172**		**-0.073**	**-0.217**		

The long-term ground water level trend for the 3 CGWB wells indicates there is raising trend in 1 season (Pre-monsoon period). The falling trend observed in 5 seasons (2 Pre-Monsoon periods and 3 in post monsoon periods).

The average Rise Post monsoon period is 0.172 m/year.

The average Fall in the Pre -monsoon period is –0.073 m/year and post-monsoon is -0.217 m/year.

The long-term trend in around the study area clearly indicates that there is no stress in the ground water.

3.3.5 Ground water quality

It is highly essential to assess the quality of ground water of the area and accordingly its suitability for various purposes viz drinking, irrigation and industrial purposes etc. During the inception of the project ground water quality at various location of the mining area were measured. During the course of the project, water quality has been determined by testing the water samples at various locations inside and outside of the lease area of Shahpur West Coal Block, near Shahpur, village, near Khamaria Kalan village, near Kalyanpur village, near village Lamro, near village Malchua, near village Majhgawan. Groundwater samples were analyzed in NABL Accredited laboratory by adopting standard method of analytical process. A groundwater quality reports are given in **Annexure-4.**

The test results are presented in **Table-18.** The analysis reveals that the quality of water is within the permissible limits of CPHEEO.

Table 20: Ground water sampling Results

S. no	Parameters	Unit	Unit Limits as per IS: 10500-2012		Majhgawan	Kalan	Malchua	Lamro	Kalyanpur	Shahpur
			Acceptable	Permissible						
1	Colour	Hazen	5	15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Turbity	NTU	1	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4	pH	-	6.5 – 8.5	No relaxation	7.16	7.14	7.22	7.09	7.32	7..19
5	Electrical Conductivity	µs/cm	-	-	470	320	416	523	338	530
6	Total Hardness (as CaCO3)	Mg/l	200	600	184	140	170	240	152	248
7	Calcium (as Ca)	Mg/l	75	200	44.1	33.7	40.9	57.7	36.5	59.7
8	Iron (as Fe)	Mg/l	1	No relaxation	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
9	Cholride(as Cl)	Mg/l	250	1000	45.6	37.2	32.8	49.6	39.8	52.8
10	Flouride (as F)	Mg/l	1	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
11	Total Dissolved Solids	Mg/l	500	2000	310	210	270	340	220	360
12	Magnesium (as Mg)	Mg/l	30	100	17.98	13.61	16.52	23.33	14.82	24.06
13	Sulphate (as SO4)	Mg/l	200	400	72.9	41.2	48.2	81.4	45.6	78.2
14	Nitrate (as NO3)	Mg/l	45	No relaxation	1.19	2.46	2.18	3.18	1.12	2.95
15	Total Alkalinity (as CaCO3)	Mg/l	200	600	180	140	164	210	142	220
16	Total Coliform	MPN/100 ml	Should be absent	No relaxation	Absent (<2)	Absent (<2)	Absent (<2)	Absent (<2)	Absent (<2)	Absent (<2)

The samples tested for the selected key wells during the field study reveals the following. The maximum and minimum EC concentration in ground water is **530 and 320** µs/cm which is potable as per the CPHEEO Standards. Based on the above results of EC, the spatial distribution of EC concentration has been generated and presented in **Plate – 17** The higher concentration of EC is observed in the easter part of the study area. Majority of the area falls under **400-480 µs/cm** EC zone. The Mine is located in 480-550 µs/cm zone. The spatial distribution of EC concentration reveals that the area is not falls under ground water quality affected zone.

pH: pH value of ground water indicates that water is in general a bit alkaline in nature. The range of pH is 7.1 to 7.3. The pH values of all analyzed samples remain within the standard norm.

Total Dissolved Solids: To ascertain the suitability of groundwater for any purposes, it is essential to classify the groundwater depending upon their hydro-chemical properties based on their TDS values. The ground water of the area is fresh water. Most of the groundwater samples are within the maximum permissible limit for drinking as per CPHEEO standard. TDS concentration varies from **210 to 380 mg/L**.

Chloride: The range of Chloride is 33 to 53. The Chloride values of all analyzed samples remain within the standard norm. The higher concentration of 40-48 mg/L is noticed near the Northern and southern part of the study area. The spatial distribution of Chloride concentration is presented in **Plate – 18.**

Nitrate: The concentration of nitrogen in groundwater is derived from the biosphere. Nitrogen is originally fixed from the atmosphere and then by soil bacteria into ammonium. Under aerobic conditions nitrogen is finally converted into nitrate by nitrifying bacteria.

All samples show nitrate concentration within the permissible limit. Nitrate concentration varies from **1.12-4.5 mg/L**. As the nitrate is a point pollution, Nitrate concentration map showing as point and its value has been generated and presented in **Plate – 19**

Fluoride: Fluoride concentration in ground water is of geo-genic nature. The fluoride concentration of the study area is within permissible limits of the drinking water standards. Fluoride concentration varies from **0.6-0.8 mg/L**. The fluoride concentrate ion as point map is presented in **Plate - 20**

The above results of physical and chemical analysis of ground water samples collected in and around the project area and analytical result reveals that ground water the quality of water is potable with respect to drinking, industrial and agricultural purposes.

Photograph showing the ground water sample collection

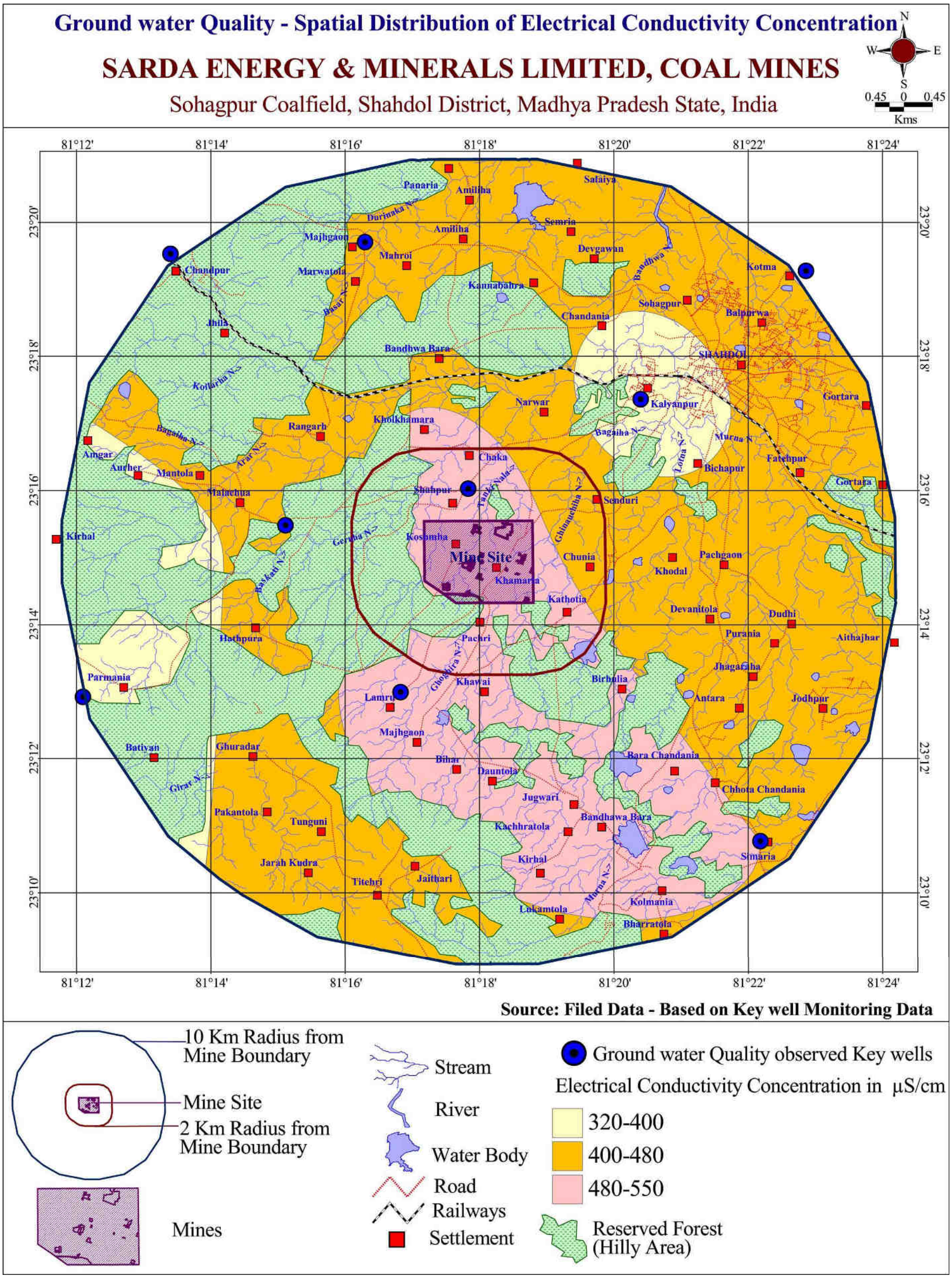


Plate 17: Spatial Distribution of TDS concentration in Ground water

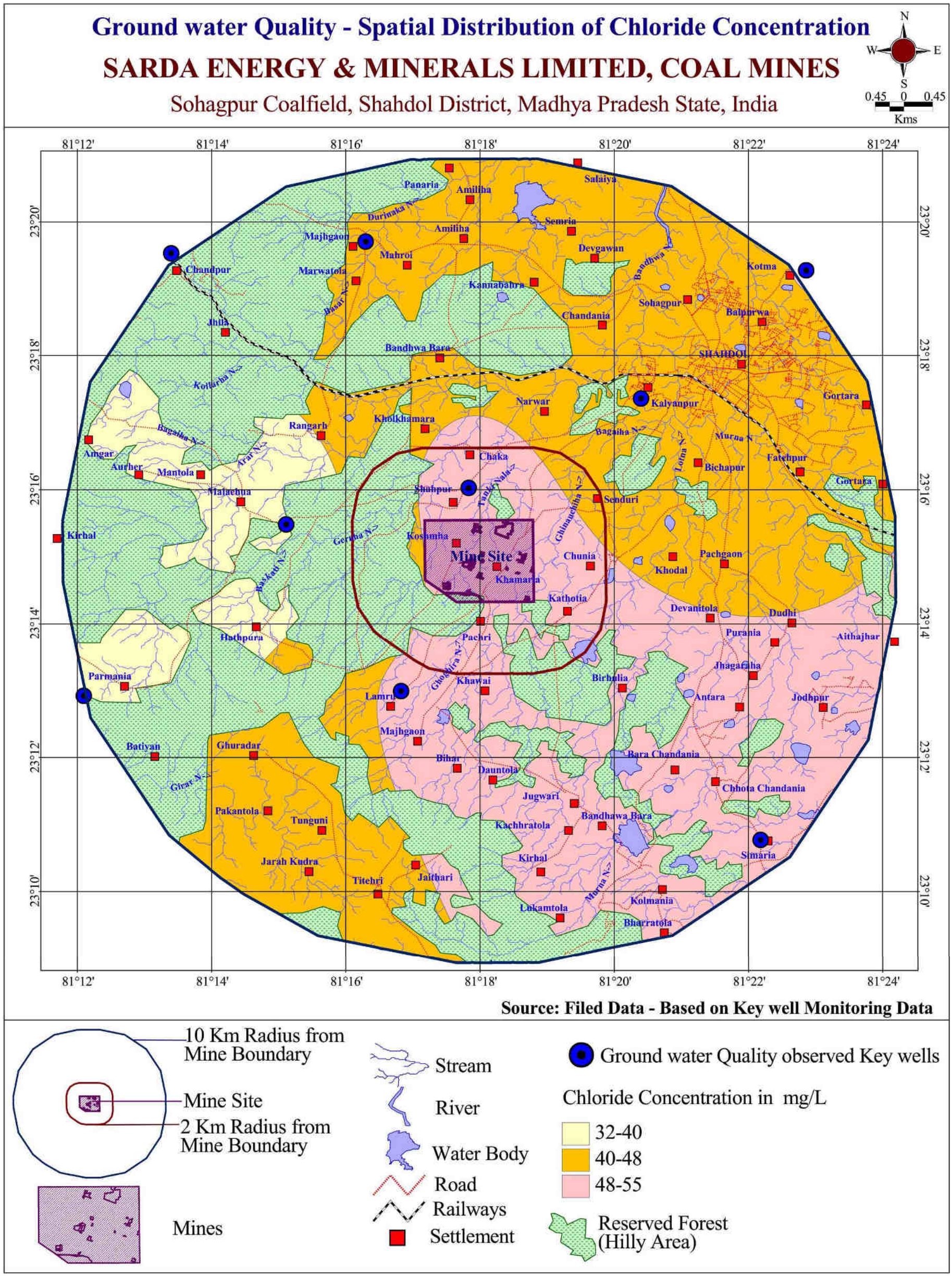


Plate 18: Spatial Distribution of Chloride concentration in Ground water

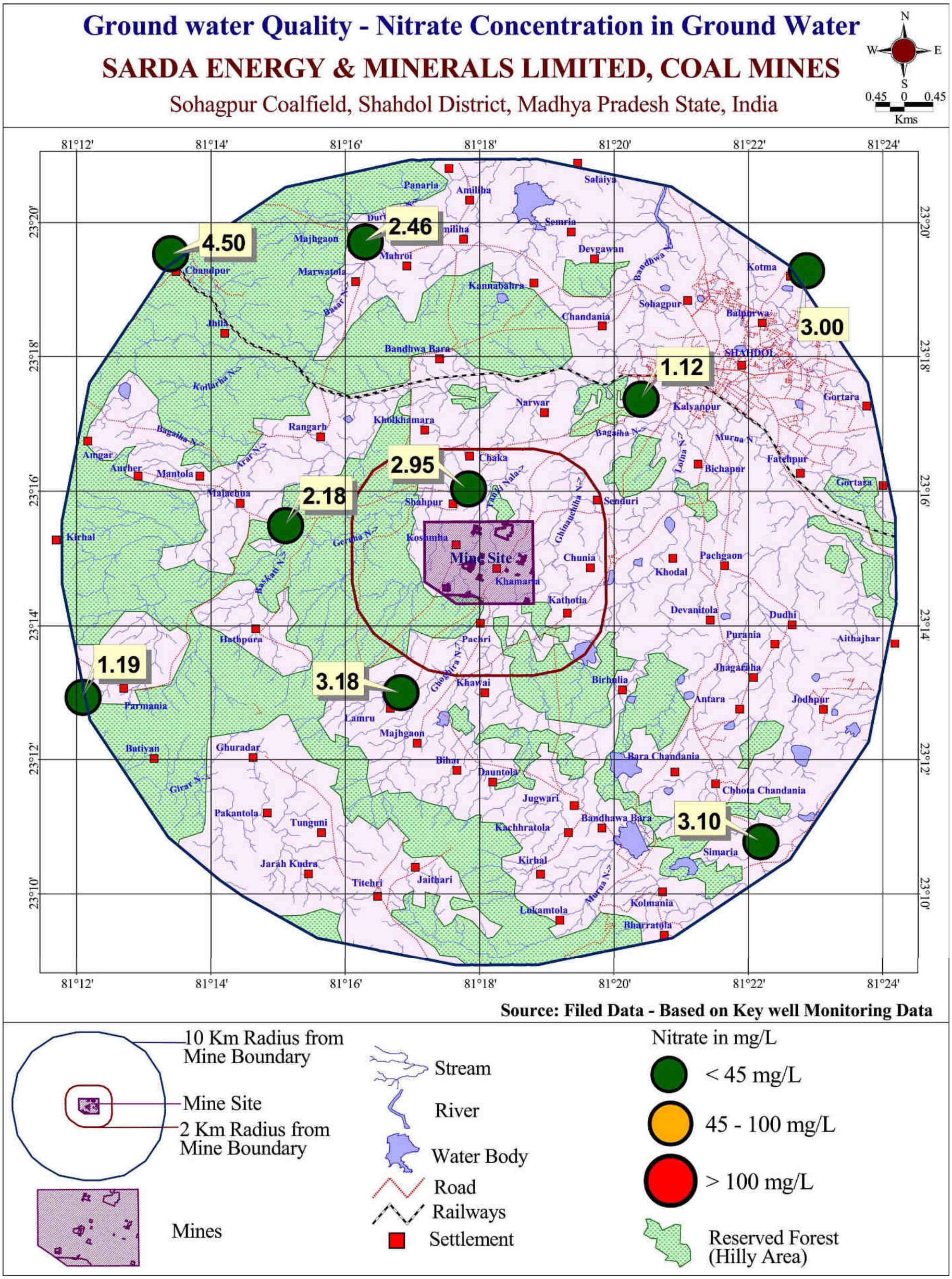


Plate 19: Nitrate concentration in Ground water

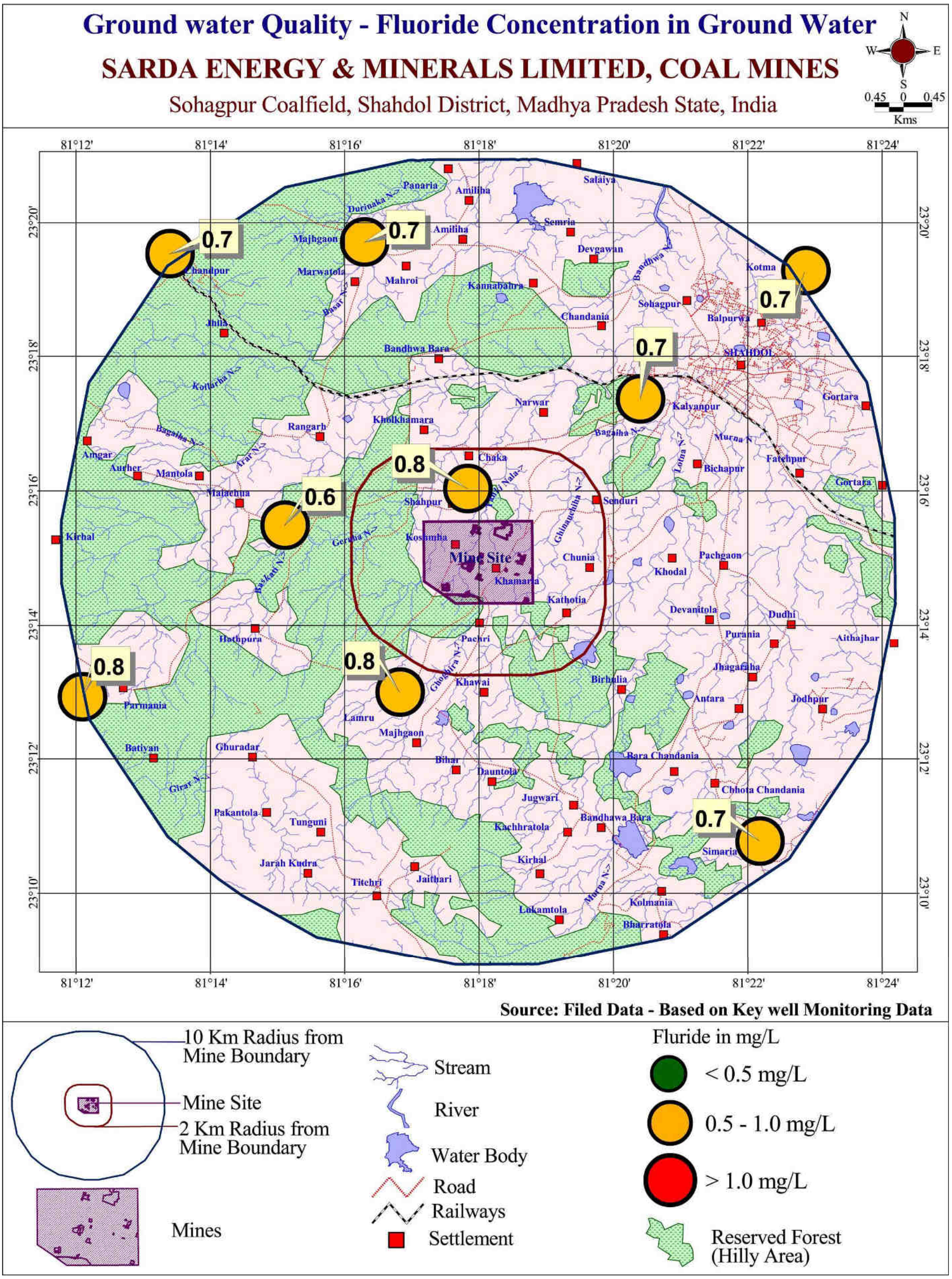


Plate 20: Fluoride concentration in Ground water

3.3.6 Water quality of nearby water bodies

The surface sample from river and water bodies have been collected in the study area and tested in the NABL Lab. The tested results reveals that the quality is with the permissible limit as per CPHEEO Standards. Since it is an under-ground mining project, surface water quality will not get polluted by mining activities. Water samples of Ghoghara Nalla and Khamaria pond were collected to determine various chemical parameters of the water. surface water quality analyzed and presented in **Annexure- 5**

Table 21: Surface water sampling Results.

S. No	Parameters	Unit	Limits as per IS: 2296-1982	Results of Surface water at Ghughara Nalla	Results of Pond / Surface water at Khamaria Khurdh
1	pH	-	6.5 – 8.5	7.11	7.16
2	Chloride (as Cl)	Mg/l	600	49.2	28.8
3	Electrical Conductivity	µs/cm	-	446	169
4	Fluoride (as F)	Mg/l	1.5	<1.0	<1.0
5	Total Dissolved Solids	Mg/l	1500	290	110
6	Sulphate (as SO_4)	Mg/l	400	59.8	31.5
7	Lead (as Pb)	Mg/l	0.1	<0.005	<0.005
8	Zinc (as Zn)	Mg/l	15	0.31	0.28
9	Cadmium (as Cd)	Mg/l	0	<0.001	<0.001
10	COD (as O_2)	Mg/l	-	20.5	24.9
11	BOD	Mg/l	3	2.6	2.8
12	Dissolved Oxygen	Mg/l	4.0 (Min.)	5.2	5

4. APPROVED MINE PLAN

The mine plan is provided below

Table 22: Parameters of Approved Mining Plan as follows

S.N	Block Area	Approved Mining
1	Geological Block Area HA	619.00 HA
2	Lease Area	619.00 HA
3	Project Area	619.00 HA
4	Life of the project in years	19
5	Minimum and Maximum depth of	72 to 142 m
6	Production target MTP	0.6000
7	Seams available as per GR	Seam-IV, Seam-L2, Seam-III A, Seam-III B, Seam-III L,Seam-II,Seam-
8		
9	Gross Geological Reserve Mte	38.376
10	Net Geological Reserve Mte	35.733
11	Blocked Reserve Mte	18.350
12	Minable Reserve Mte	17.380
13	Extractable Reserve Mte	10.380
14	% of Extraction/ recovery	29.04%
15	Balance Extractable Reserve Mte	10.380
16	OB IN MCU.M	0.000
17	SR CU.M/te	0.000
18	Mining Technology	Mechanized bord and pillar underground mining by Continuous Miner with shuttle cars as well as LHDs and SDLs with solid blasting method.
19	Handling of Rejects	Rejects not
	Land use pattern: In Ha	
20	Excavation Area	0.000
21	Top soil dump	0.030
22	External dump	0.000
23	Safety zone	0.000
24	Other use	1.376
25	Infrastructure Area i/c road, settling tank, embankment, ventilation, UG entry & magazine area etc	14.875
26	Green Belt	8.018
27	Undisturbed Area	594.70
Total		619.00

Although the Shahpur West Coal block has geological occurrence of eight seams, namely Seam-IV, Seam-L2, Seam-III A, Seam-III B, Seam-III L, Seam-II, Seam-I, Seam-L1. But following seams are not considered for Mining with reason as follows:

(1) Seam-IV not considered for UG as this seam is developed in patches and have not attained workable thickness.

(2) Seam-III B develops to workable thickness in western and south eastern part of the block but parting with III A (0.30 –2.93 m) does not allow any workings.

(3) Seam III L & Seam-L1 is not considered for UG as these seams are developed in patches and have not attained workable thickness.

(4) Seam-I is impersistent within the block and does not attain workable thickness.

Only Three seams viz. Seam L2, IIIA & II are the prominent seams in the block.

Mining Method:

The proposed method of working is same as that of the Approved Mining Plan i.e., by Underground Bord and Pillar method. Vertical stripping ratio of this block is assessed, and it is from 10 to 30 cum/tonne and so opencast mining will not be economical. Long wall method is not considered as the depth of cover varies from 72m to 141m. Seams with more than 1.5m thickness are proposed for extraction. Production capacity of 0.6Mtpa could be achieved by deployment of mass production technology. Skill and equipment to operate 1.2m seams with mass production technology are scarce in India. Seams are not uniformly 1.2m and in patches and such formation require semi mechanized board and pillar workings and by semi mechanized equipment the number of faces for achieving targeted production will be more. Also, the seams which are not considered are patchy and require lengthy drivage in stone for reaching the part to be extracted which will restrict the production capacity of the mine even by 50% of the proposed capacity. Entire seam II, part of seam L2 and IIIA are considered for reserves. Seams IV, IIIB, IIIL, L1 & I are not considered for mining as these seams are not fully developed in this block. The extractable reserves by underground Bord and Pillar method are estimated as 10.38Mt from three workable seams, out of which Seam-II contributes to around 84%. Mode of entry to the seams is by a pair of inclines from the surface namely Incline 1 & Incline 2.

Table 23: Details of proposed incline and its dimensions

Entry	Start RL	End RL	Gradient	Dimension	Length	Depth
Incline-I	488	354	1 in 5	5.2m X 3.2m	670	134
Incline-I	488	355	1 in 5	5.2m X 3.2m	666	133
Shaft	488	353	Vertical	6.0 m dia	-	135

Development of incline and establishing ventilation connections are key for safe working and therefore two years are considered for scientific planning, obtaining relevant approvals, drivage of inclines, shafts, deployment of equipment and commencement of extraction.

Bord and Pillar workings are planned with uniform pillar size of 35m (center to center) while the pillar size suggested in 111 of CMR 2017 is 25.5 for 4.8 m wide galleries. Scientific study is proposed for the following:

1. Degree of gassiness of the seams and study of explosives to be used in seams L2, III A and II.
2. Design of extraction of pillars in the seams without disturbing the surface
3. Deployment of Continuous Miner in Seam II
4. Support system for the seams
5. Subsidence study including stability of parting for the seams and their capability

Incline will be driven up to seam L2 first and seams will be developed by SDLs. During such development, initially before establishing connections with the shaft, Intake and Return will be through Incline 1 and Incline 2 respectively. In the meantime, incline drivage will be continued till seam II while shaft sinking would also progress till Seam II. After completion of shaft sinking till seam II, ventilation connection in Seam L2 will be established and the extraction will commence. The production from Seam L2 will be restricted during this period as there will be restrictions in ventilation because of single intake and return. SDL is proposed to be deployed during development, depillaring will be done based on the recommendations of scientific study and approval by DGMS. Parallelly, seam development and establishment of ventilation connection in seam IIIA and seam II will commence.

Development and extraction in Seam II are planned with continuous miner. Continuous miner with range of 1.5m to 4.6m for accommodating the thickness range of Seam II is proposed to be deployed. Thickness of 4.16m is observed in one bore hole SSH-30.

The width of the galleries will be 4.8m for Seam L2 and IIIA while it will be 5.8 m for seam II as continuous miner is proposed to be deployed in Seam II.

In all the seams the main heading is oriented in the diagonal direction northeast southwest to have uniform length of panel on both sides. Extraction will be done from top seam to bottom seam. However, development and extraction are proposed in seam II in the area where the other seams are not developed.

Barriers considered against nalla, major surface roads, villages etc.

The barriers considered are as per Regulations 121, 122 and 149 of CMR 2017 which are explained as below:

No working shall be made in any mine vertically below:

A. any part of any river, canal, lake, tank or other surface reservoir; or any spot lying within a horizontal distance of 15 meters from either bank of a river or canal or from the boundary of a lake, tank or other surface reservoir, in this case 30m barrier is maintained from Nalla as the Nalla course is meandering.

B. In the boundary, no working shall be made within a distance equal to half the distance as specified in column (5) of table under sub-regulation (4) of regulation 111 of CMR 2017, corresponding to the depth of the seam being worked.

C. Provided that, where work is done in more than one seam, the barrier kept at the boundary shall, as far as practicable, be vertically coincident and of the same dimensions

D. Details of barriers are provided while developing the workings is as follows;

Boundary safety barrier is left for a distance equal to half the distance as specified in column (5) of table under sub-regulation (4) of regulation 111, corresponding to the depth of the seam being worked.

I. Boundary safety barrier is left for a distance equal to half the distance as specified in column (5) of table under sub-regulation (4) of regulation 111, corresponding to the depth of the seam being worked.

II. Fault barrier of 10 m is left on either side of fault F3 and F4. Both faults have 5m throw.

III. Barrier of 30 m is left on both the sides of Nallah.

IV. Barrier of 15 m is left for ponds.

V. Barrier left around villages and roads are 50 m and 45 m respectively. No development and depillaring will be carried out beneath villages and road in Seam L2 and IIIA.

5. ESTIMATION OF MINE SEEPAGE AND ADVANCED DEWATERING PLAN

Type of mine (Open Cast/Underground)

Coal is mined by two main methods namely surface or ‘opencast’ mining and ‘underground’. The choice of method is largely determined by the depth, geology of the coal deposit and other factors. In general, the mining activity for exploitation of an orebody/ coal is being carried out below the ground water table and as a consequent groundwater inflow to mine excavation is observed. Therefore, prognostication of the amount and

pressure of groundwater that could flow into mine and the effect of pore water pressure on the stability of mine is imperative to address the water-related problems.

The proposed method of working is same as that of the Approved Mining Plan i.e. by Underground Bord and Pillar method. Vertical stripping ratio of this block is assessed, and it is from 10 to as high as 30 cum/tons and so opencast mining will not be economical. Long wall method is not considered as the depth of cover varies from 50 m to 150m and less reserves in Seam II, while other seams are patchy. Seams with more than 1.2m thickness are proposed for extraction. Seams IIIB, IIIL, L1 & I are not considered for mining as these seams are not fully developed in this block. The extractable reserves by underground Bord and Pillar method are estimated as 13.62Mt from four workable seams, out of which Seam-II contributes to around 64%.

To understand groundwater-related problems of the Sahapur West Coal UG mine, Hinterland Geological Setup and Basin Architecture of the area are studied first. Then the Hydrogeological setup encompassing the establishment of lay and disposition of the aquifer units and the evaluation of aquifer characteristics, drainage control of the area and probable influx and out flux.

Elevation of water table at mining area

To establish the water table configuration, field monitoring (pre-monsoon and post-monsoon monitoring) were conducted. Accordingly, the water table gradient has been estimated from the ground water table contours for pre and post monsoon periods and presented in **Table 24** and **Figure 12**.

The details of the Hydraulic gradient extracted for two different seasons are as follows:

Table 24: Calculation of hydraulic gradient.

Details	Hydraulic Gradient	
	Pre-Monsoon	Post Monsoon
h1 in m	495.0	495.0
h2 in m	470.0	470.0
I (Distance Between h1 and h2) in km	4.1	4.2
Hydraulic Gradient (i) = h1-h2/I	6.0980	5.9520
Or	0.006098	0.005952

The saturated aquifer thickness has been taken after deducting pre-monsoon as well as post-monsoon water levels from the actual thickness of the aquifer.

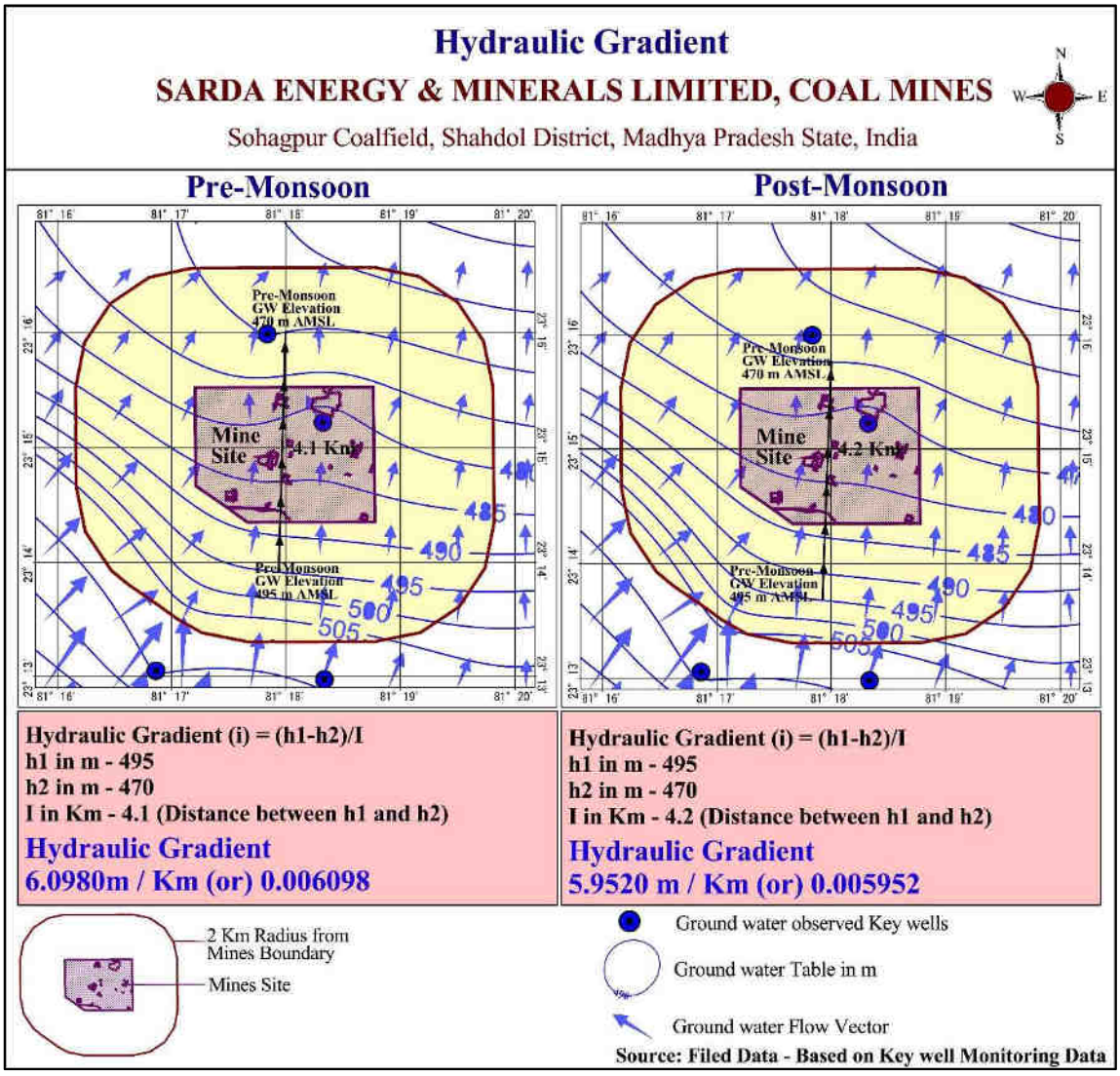


Figure 12: Pre and post-monsoon Hydraulic gradient

Details of Mine and tunnel (number of pits and tunnels with dimensions (Length, width, depth)

As per the approved mine plan of the Sahapur West Coal UG Mine is in the initial state of development.

The stage-wise mine plans divulge that the proposed ultimate stage of coal mining in **Coal Seam is 144 in the next 25 years**. **In 5 years, the proposed working depth is 136 m**. The mine dimensions up to the life of mine and present scenario are given in **Table 4.**

Table 25: Mine dimensions for the present and next – five-year period.

S.NO	Year	Working Panel		Year wise Depth of mining (m)	Perimeter (m) as per the mine dimensions
		Surface RL (m amsl)	Gallery floor RL (in amsl)		
1	Year 1	488.0	449.2	38.80	297
2	Year 2	499.2	358.0	91.20	2285
3	Year 3	358.0	352.0	6.00	2277
4	Year 4	352.0	352.0	-	3149
5	Year 5	352.0	352.0	-	3286
Total Depth				136.00	

For obtaining NOC the filing of an application is being done for the seepage of 2nd year. Hence, at the end of 2nd year mine seepage is considered for NOC as a mine dewatering.

5.1. ESTIMATION OF MINE SEEPAGE

In Consolidated sedimentary rocks, due to the stratification of formations, the horizontal permeability (KH) is usually many folds higher than the vertical permeability (KV). Thereby, the groundwater velocity along the bedding plane is higher than that across it. With the presence of local seams or coal streaks, some places the aquifer system behaves as multi-layer aquifers.

Thereby, the groundwater velocity / flow along the bedding plane is higher than across the plane. During mine development, the sandstone beds existing in the roof of the working seams become the major source for inflow into the mine. The development of younger coal seams in the roof behaves as aquicludes and restricts the connection between the phreatic aquifer and the lower confining aquifers. The aquifer lying only in the immediate vicinity of mine workings get largely drained.

However, with the presence of alluvium, sandy and clayey soil, loosely cemented and poorly consolidated and weathered sandstone in the unconfined aquifer system is the major potential bed in this aquifer system.

In the initial stage the mine inflow is in proportion to the rate of mine expansion. With the presence of low permeable formations, the inflow is significantly small in lower aquifer

units. In due course, due to partial de-saturation of the aquifer, the inflow reduces and gets stabilized in time.

The probable mine inflow from sedimentary bedded deposits can be made direct from **Darcy's law** (Eq. 1). Wherein, the groundwater inflow from different mine faces and the individual aquifer units is assessed, owing to the assumptions that flow is laminar and one phase flow into the mining excavation. However, it can be applied for multiphase flow conditions, if there exists a multi-layered aquifer system and interconnected due to structural controls in a regional scale. Using Darcy's law, one-dimensional inflow may be expressed as:

$$Q = T*I*L$$

...Eq. 1

where,

Q= Flow rate (cu.m)

b= Aquifer thickness (m)

T= Transmissivity =K*b (cu.m/day)

A= Area of the pit (cu.m) (i.e., Face length*aquifer thickness)

L= Perimeter/ average width of the cross-sectional area, L (m)

Accordingly, mine seepage has been predicted based on Darcy's equation (eq.1) for the exposure of formations/aquifers of Sahapur West Coal Mine. Different components used in this computation is as follows:

Groundwater in the study area occurs under phreatic or unconfined condition. The post-monsoon and the pre-monsoon ground water level data collected from the key wells and analyzed. The average ground water levels of pre and post-monsoon ground water level data monitored in the 10 km boundary is considered for seepage calculation (19.7 – 14.4).

Pumping tests have been conducted in the bore well located in the mine lease area (inside of mine the office) to ascertain aquifer parameters. Permeability (K) of **6.126 m/day** has been estimated for sandstone aquifer. The same is used for the estimation of ground water seepage into the mine.

Based on the above inputs the ground water seepage in to the mine for the end of 1st year and at the end of the 5th year stage of mining has been estimated for the Sahapur West Coal UG Mine and furnished in **Table -26**.

Table 26: Year-wise and panel wise mine seepage calculation from the roof the working seam.

Sarda Energy and Mineral Limited, Sahapur West UG Coal Mine - Seepage from Working Panel

Year	Period	Working Pakl Surface Reduce Level in respect to MSL (m)		Year wise Mine Depth in m	Depth to water RL (m)	Perimeter of the Mine (m)	Saturated Thickness (m)	Hydraulic Gradient	Hydraulic Conductivity (m/day)	Per Day Mine Seepage (Cu.m/Day)	Annual Seepage in cu.m / Year (Pre-Monsoon -151 Days Post Monsoon - 214 Days	Total Annual Seepage in cu.m / Year	Average Per Day Mine Seepage in cum/day (Pre and Post)
		Working Panel Surface RL	Gallery Floor RL										
Year-1	Pre-Monsoon	488	449.2	38.80	468.3	297	8.26	0.00610	6.126	92	13,892	45,350	124
	Post-Monsoon				473.6		13.56	0.00595		147	31,458		
Year -2	Pre-Monsoon	449.2	358.0	91.20	429.5	2285	16.50	0.00610	6.126	1,409	2,12,759	6,01,383	1,648
	Post-Monsoon				434.8		21.80	0.00595		1,816	3,88,624		
Total (Year - 1 and Year - 2)							**Pre monsoon**			**1,501**	**2,26,651**	**6,46,733**	**1,772**
							Post monsoon			**1,963**	**4,20,082**		
Year -3	Pre-Monsoon	358	352	6.00	338.3	2277	20.60	0.00610	6.126	1,753	2,64,703	7,24,803	1,986
	Post-Monsoon				343.6		25.90	0.00595		2,150	4,60,100		
Year -4	Pre-Monsoon	352	352	0.00	332.3	3149	20.60	0.00610	6.126	2,424	3,66,024	10,02,246	2,746
	Post-Monsoon				337.6		25.90	0.00595		2,973	6,36,222		
Year -5	Pre-Monsoon	352	352	0.00	332.3	3286	20.60	0.00610	6.126	2,529	3,81,879	10,45,707	2,865
	Post-Monsoon				337.6		25.90	0.00595		3,102	6,63,828		

NOC is being granted for 2 Years.
Hence, 2 Year Mine Seepage of 1772 cu.m / day is considered for NOC

214 Days for Post-Monsoon - June-December and 151 Days for Pre-Monsoon- January to May Considered for Annual Seepage Calculation

5.1.2 Seepage from Bottom of the mine pit

As per the subsurface borehole data and geophysical survey carried out in the study area, the bottom of the mine is composed of Aquiclude (Impervious layer) hence the bottom seepage may not encounter in to the mine **(Table-27).**

Table 27: Seepage from Bottom of the Pit.

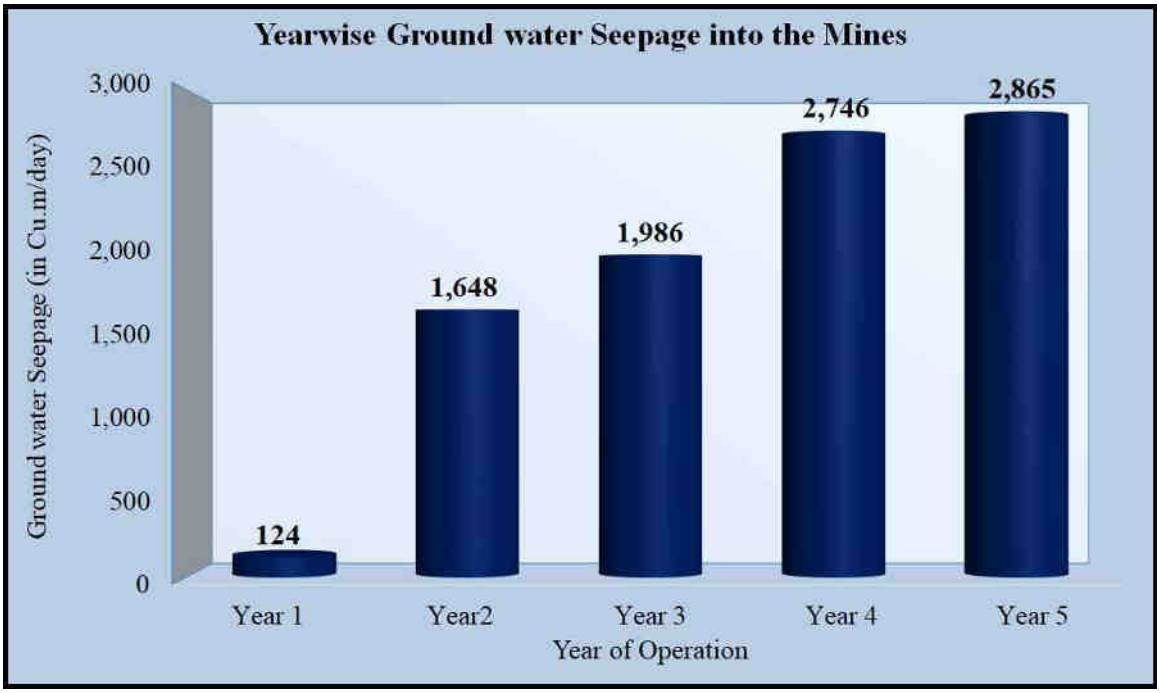
Year	Period	Hydraulic Conductivity (m/day)	Per day mine Seepage (cu.m/day)	Annual mine Seepage (cu.m/Year)
Years 1 - 5	Pre monsoon	NA	NA	NA
	Post monsoon	NA	NA	NA

5.1.3 Total Mine Seepage

The total mine inflow predictions for different stages of the mine for the Sahapur West Coal Mine UG is provided in **Table 28.**

Table 28: Total mine seepage.

Total Mine seepage				
Year	Period	Annual Mine Seepage (cu.m/year)	Total Annual Mine Seepage (cum/year)	Average Per Day Mine Seepage (cum/day)
Year 1	Pre monsoon	13892	45350	124
	Post monsoon	31458		
Year2	Pre monsoon	212759	601383	1648
	Post monsoon	388624		
Total (Year - 1 and Year - 2)	**Pre monsoon**	**2,26,651**	**646733**	**1772**
	Post monsoon	**4,20,082**		
Year 3	Pre monsoon	264703	724803	1986
	Post monsoon	460100		
Year 4	Pre monsoon	366024	1002246	2746
	Post monsoon	636222		
Year 5	Pre monsoon	381879	1045707	2865
	Post monsoon	663828		



In the above Table 28, the inflow of water into the mine at future stages of development 2nd year scenario have been appraised. The estimated total seepage from the mine is **1772 cu.m/day (6,46,733** cu.m / year). Wherein, 214 days for the post-monsoon season (June-

December) and 151 days for the pre-monsoon season (January to May) were considered for the annual seepage calculation.

Therefore, the groundwater seepage estimated for the 2nd year predicted mine seepage for stage plan is considered for fresh NOC towards dewatering quantity of **1772 cu.m/day (6,46,733** cu.m / year).

As per the CGWA guideline, Flow meter with telemetry will be installed in the mine dewatering sumps of the underground workings.

Inference of mine ground water seepage calculation

- The Seepage estimation has been done for five years period.
- The NOC for dewatering quantity applied for the predicted mine seepage of **2nd year stage plan**.
- The total mine seepage of **1772 cu.m/day or 6,46,733 cum/year** is considered for fresh NOC. This dewatering quantity is considered for filing the CGWA NOC application.
- However, it is to be noted that with the spatial variation in aquifer parameters and recharge, the observed inflow may slightly deviate from that estimated**.**

Estimation of Rain water collection in the Mine

Since, the mine is an underground mine no rainwater collection is taking place in the mine workings.

5.2. ADVANCE DEWATERING PLAN IN CASE OF COAL / LIGNITE MINES

Coal is mined by two main methods namely surface or 'opencast' mining and 'underground'. The choice of method is largely determined by the depth, geology of the coal deposit and other factors. In general, the mining activity for exploitation of an orebody/ coal is being carried out below the ground water table and as a consequent groundwater inflow to mine excavation is observed. Therefore, prognostication of the amount and pressure of groundwater that could flow into mine and the effect of pore water pressure on the stability of mine is imperative to address the water-related problems. Underground mine working changes hydraulic gradient which affects the underground surface water flow pattern. It induces slow inflow of water from, porous soil and rock mass towards the mining

excavation. Mine dewatering is the removal of percolated or logged water from mines to ensure the safety of operating personnel and to safeguard the machineries involved in excavation. Usually, pumps are employed for the purpose of removal of water because of their high economical value and reliability moreover pipeline network is also significant for the fast removal of logged water inside mine. Therefore, an optimize pipeline network is essential. Interception methods, which involve the siting of major underground dewatering centers at the extremities of the mining areas. The centers should be so sited as to intercept the inflow of aquifer water, down the cone of dewatering towards the mine, to prevent the recharge of the aquifers in the mining area. Simple drainage methods, which is widely used in mines where the pumping capacity is sufficient to handle uncontrollable flows of groundwater. It is probably the simplest and most widely used drainage method throughout the world. It involves the mining of development drives into aquifer zones, where hydrostatic pressures have been previously reduced by dewatering drilling. The theoretically uncontrollable flows of water, induced by the raining, are catered for by substantial pumping capacity and arrangements of watertight doors to protect shaft and other major underground parts of mine. The proposed method of working is same as that of the Approved Mining Plan i.e., by Underground Bord and Pillar method. Flow meter with telemetry will be installed in the mine dewatering sumps of the underground workings.

5.3. GROUND WATER MODELLING

As per the SOP, Ground water modelling has been attempted considering the draft, recharge of the study area covering a10 km radius from the mine boundary. The objective of the groundwater flow modelling of Sahapur West Coal Mine UG mine is an effort to estimate the impact of mining on water resources in and around mining project.

5.3.1 Brief about the Model Area

The total ground water withdrawal for mine dewatering is **1772 cu.m/day** and the same is being used for industrial and domestic purposes at the mine site and residential colony of the project. The model area covers **379.25 km^2**. The area is considered for modeling is **242.54 km^2** excluding the hill areas which acts as runoff zone.

In order to estimate the impact of ground water drawl for industrial and domestic purposes, detailed Ground Modeling Studies include ground water mass balance (input and output

from various sources), the ground water head changes, and impact of the withdrawal of ground water for the irrigation purpose has been attempted. **The DEM and the terrain profile of the model area is given in Figure: 2**

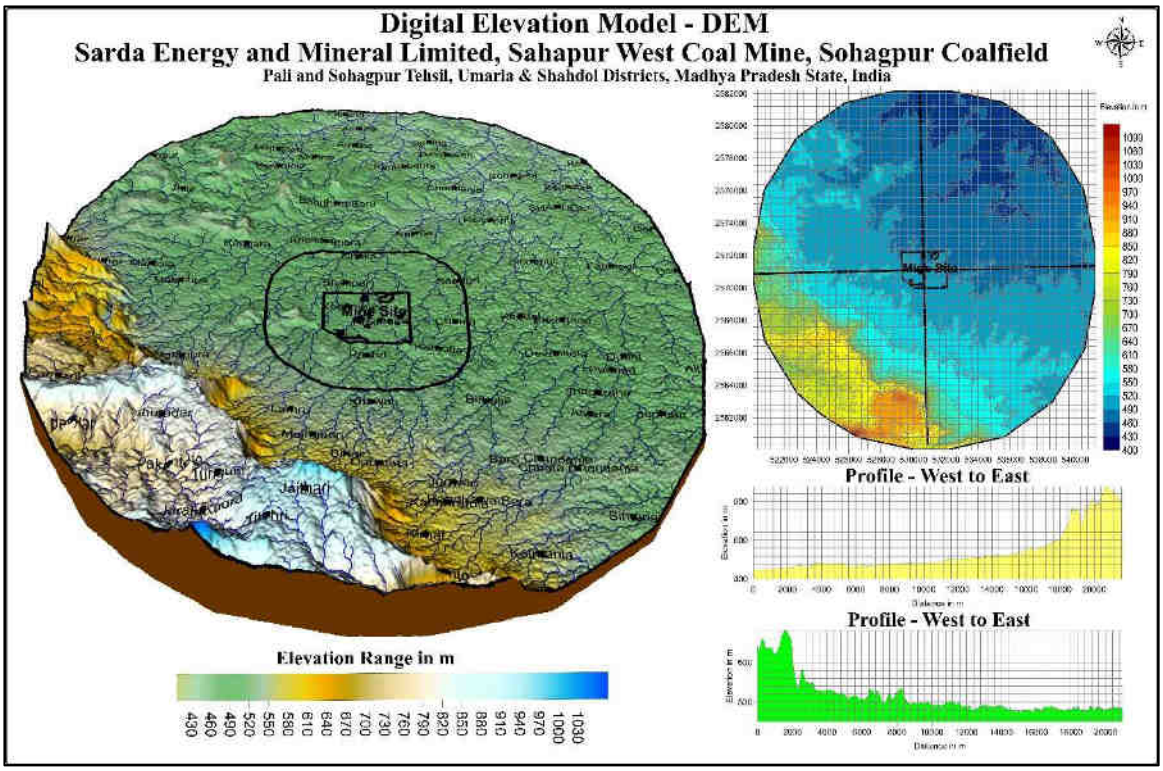


Figure 13: Digital Elevation Model (DEM) of the Model area.

5.3.2 CONCEPTUAL MODEL

The Occurrence and movement of ground water in hard formation is mainly controlled by secondary porosity through joints and fractures. Ground water, in general, occurs under unconfined; Semi confined conditions.

The fundamental geologic and hydrogeologic database is used to create the 3D hydrogeologic framework model which defines the distribution of Hydrogeologic units in the groundwater flow model. This 3D Hydrogeologic framework model is a representation of the extent and geometry of the Hydrogeologic units.

For the purpose of ground water modeling, a six-layer model has been developed by considering all the three coal seams and the inter burden material. The coal seams are acting as aquicludes and the parting material between coal seams is acting as aquifers.

Accordingly, layer properties are assigned (**Table 8**). The aquifer model is given in **Figure-3.**

Table 29: Details of the model inputs.

Parameter	**Value**	
Grid	Grid Size in m	200 X 200 m
	No. of Column	106
	No. of Row	111
	No. of Active Grid	18246
	No. of Inactive Grid	6325
Top of aquifer (m) range of elevation	Ground surface Elevation – 433.28–1020.13 m Layer 1 - 370.28 – 997.13 m	
Bottom of aquifer (m) range of elevation	Bottom Layer 247.28 to 834.13 m	
Initial Piezometric Heads (m amsl)	Layer 1	440.54 – 896.11 m
Aquifer Type	Layer 1	Weathered Formation
	Layer 2	Sandstone
	Layer 3	Coal Seam
	Layer 4	Sst. Parting
	Layer 5	Coal Seam
	Layer 6	Sst. Parting
	Layer 7	Coal Seam
	Layer 8	Sst. Parting
Boundary Conditions Used	Constant Head Boundary Recharge Boundary Condition Well Boundary Condition River Boundary Condition	
K (m/ Day)	Layer 1	6.123
	Layer 2	0.002
	Layer 3	6.006
	Layer 4	0.002
	Layer 5	5.36
	Layer 6	0.002
	Layer 7	5.36
	Layer 8	5.36
Specific yield (%)	0.2	
Storage Parameters	$2.56X10^{-5}$	
Recharge applied	0.60 mm/day *(Based on the CGWA Estimation Committee Report)*	
Draft applied	As per CGWB Estimation Committee, the irrigation draft has been considered (**140 ha.m)**	
Proposed Draft applied for the firm (NOC)	**1772 cu.m / day mine dewatering quantity**	

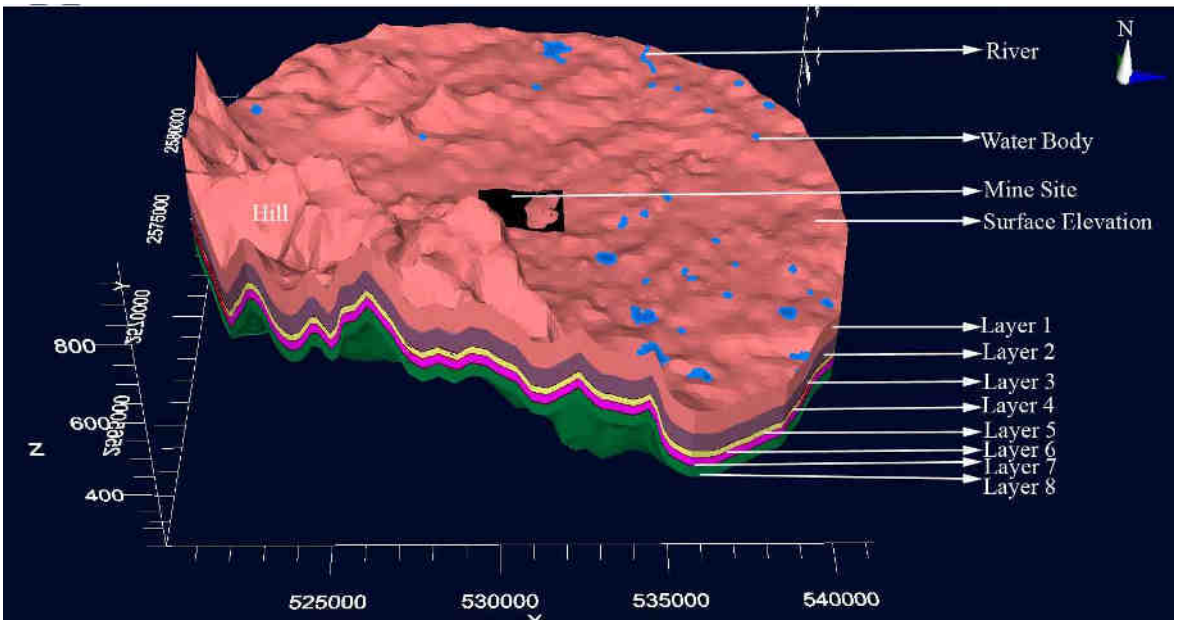


Figure 14: Aquifer geometry of mine model area

Ground water Model area

The model area is created covering a 10 km radius from the mine boundary (as per CGWA Guide lines). The below figure shows the model area covering the mine boundary, water body and hills. One river flow in the model area. The model area and the components of the model is given **Figure:4.**

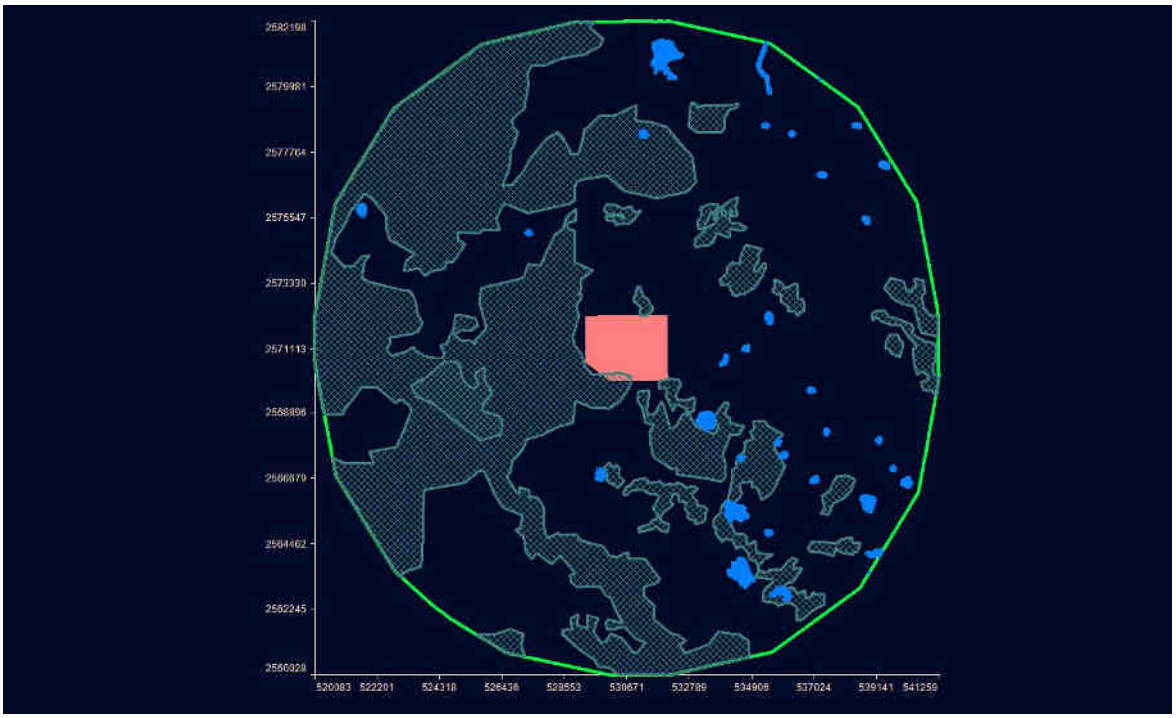


Figure 15: Model showing the Model Boundary, River and mine site.

Aquifer Geometry

The ground elevation has been generated using Carto-DEM data for the model area. From the surface elevation, the layer thickness is generated based on interpolation of the well inventory data and geophysical survey interpreted results.

A multi-layered aquifer system has been conceptualized to construct 3D Hydrogeologic framework model for inclusion of all identified coal seams up to a depth of 136 m.
The reduced level of the ground surface has been generated and the same is used as input for the model. The distribution of aquifer geometry for each layer is presented in **Figures 5-9.**

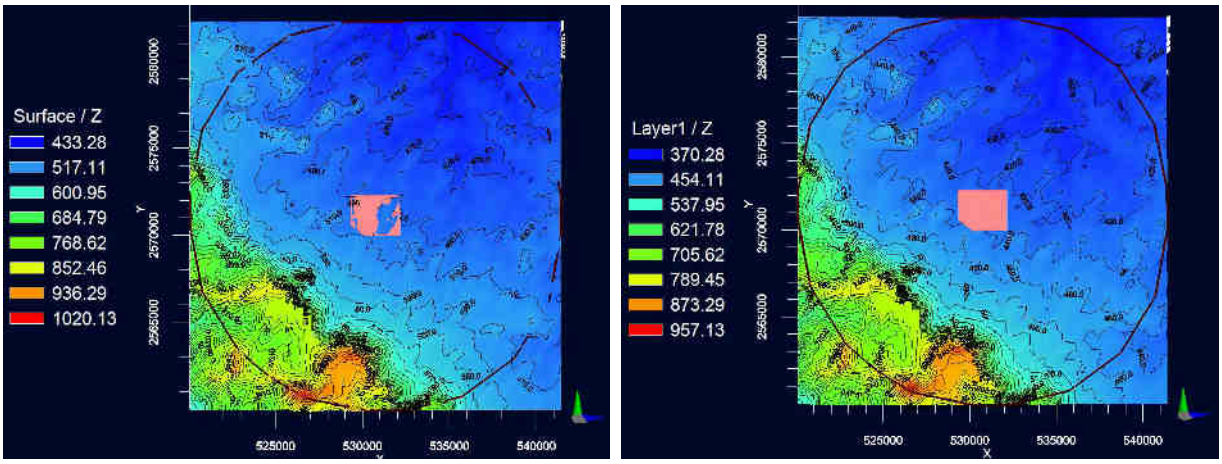


Figure 16: Top Ground Elevation and Layer 1 Top Elevation.

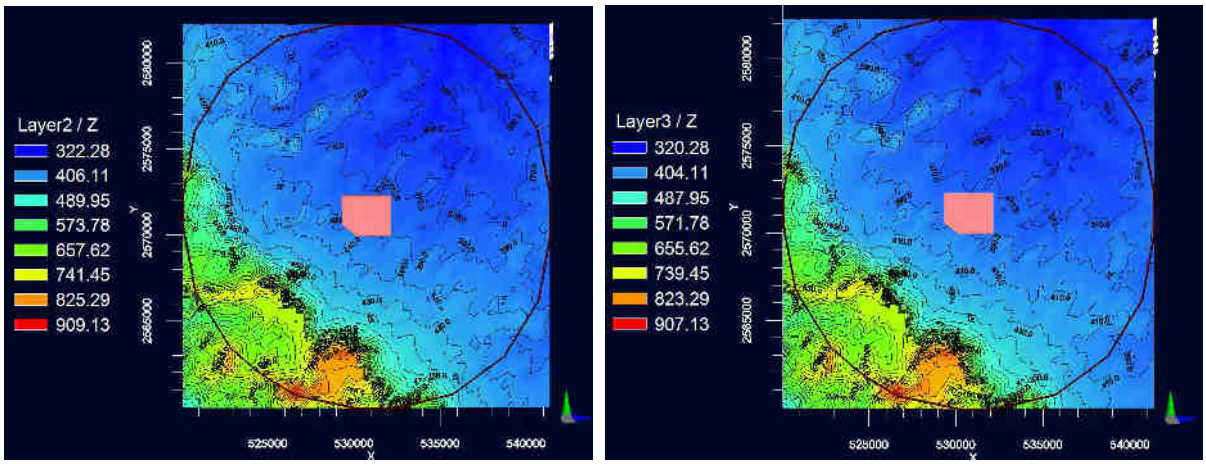


Figure 17: Layer 2 Top Elevation and Layer 3 Top Elevation.

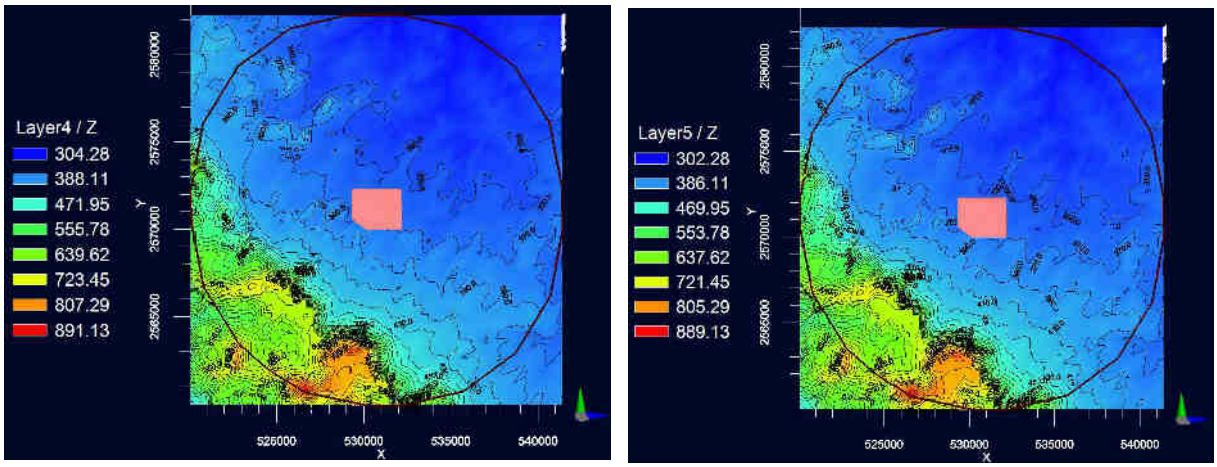


Figure 18: Layer 4 Top Elevation and Layer 5 Top Elevation.

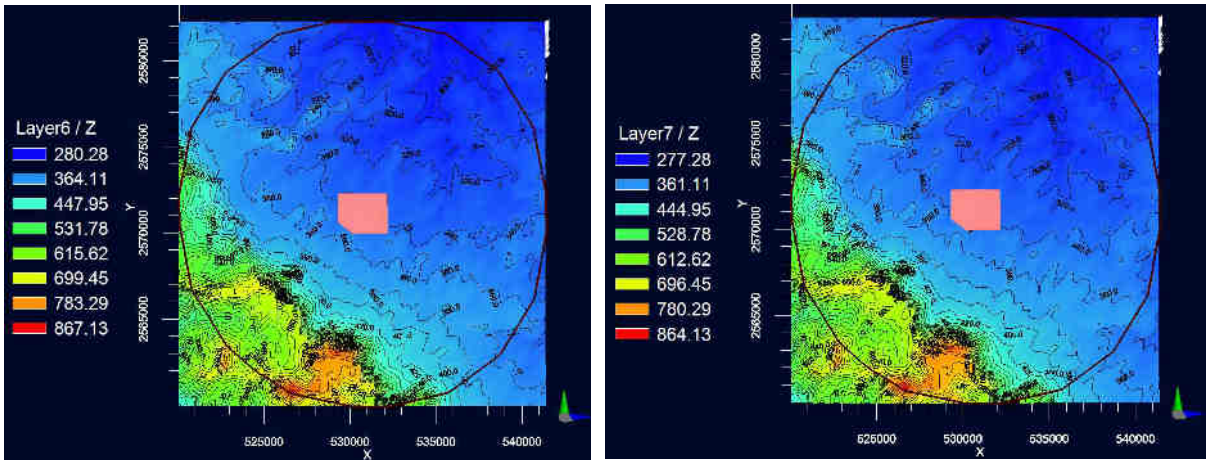


Figure 19: Layer 6 Top Elevation and Layer 7 Top Elevation.

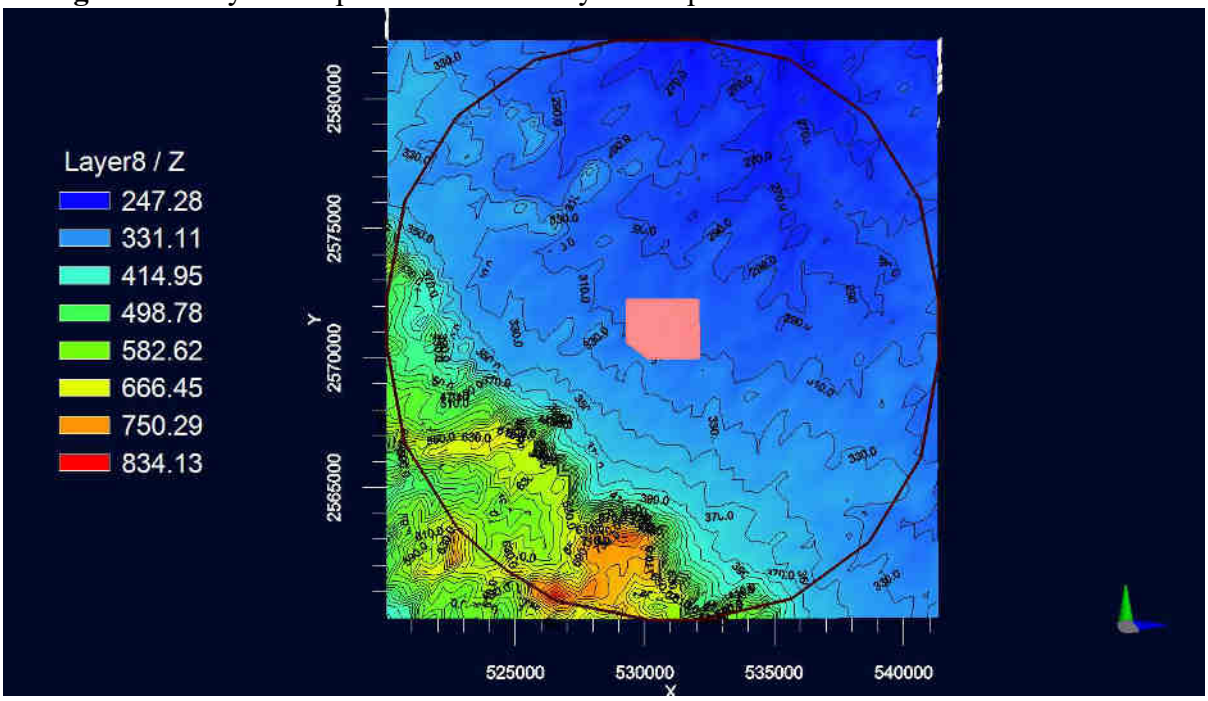


Figure 20: Layer 8 Top Elevation.

Grid Design

The area has been divided into 119 rows and 126 columns with a uniform grid size of 200 m X 200 m covering a **379.25 km^2 area.** However, the effective area considered for Modeling is about **242.54 kcu.m** after excluding the hill areas which act as runoff zone.

The grid has been grouped into six layers containing three main aquifers and three aquicludes. The bottom layer (layer 6) is considered as the base impervious layer. **Hence, no upward leaky condition is observed in the mines. Inflow from the bottom of the mine pit is considered as nil**.

The bottom of layer 8 has been considered as the base of modeling depth. Spatial and vertical variations in hydrologic characteristics in the aquifer framework were represented by discrete values in each of the model cells.

Model cells extend vertically into the aquifer and divide the aquifer into discrete volumes of aquifer material that are assumed to have uniform Hydrogeological characteristics. The model grids are shown in **Figure** 10. The green colour in the numerical grid indicates inactive cells. The layer thickness of the model is given in **Figures- 11-13.**

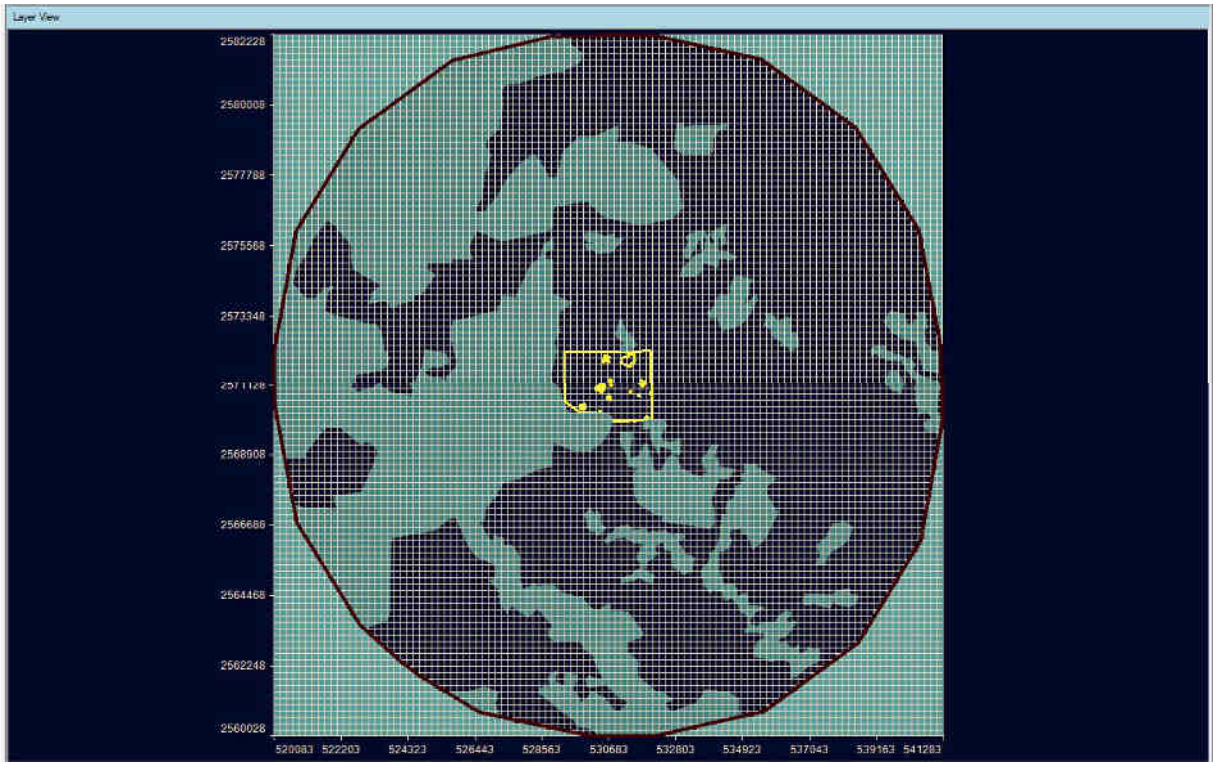


Figure 21: Numerical Grid.

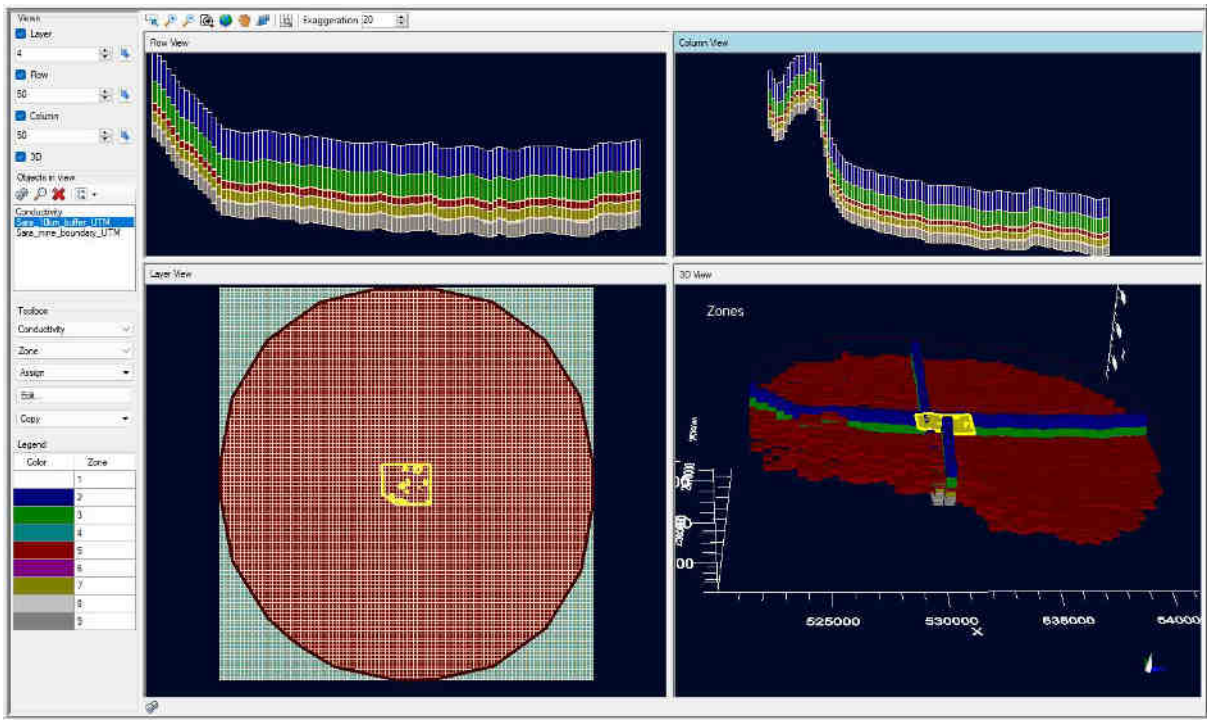


***Figure 22**: Plan & Section along X-X' direction (west-east) and North-South in y-y".*

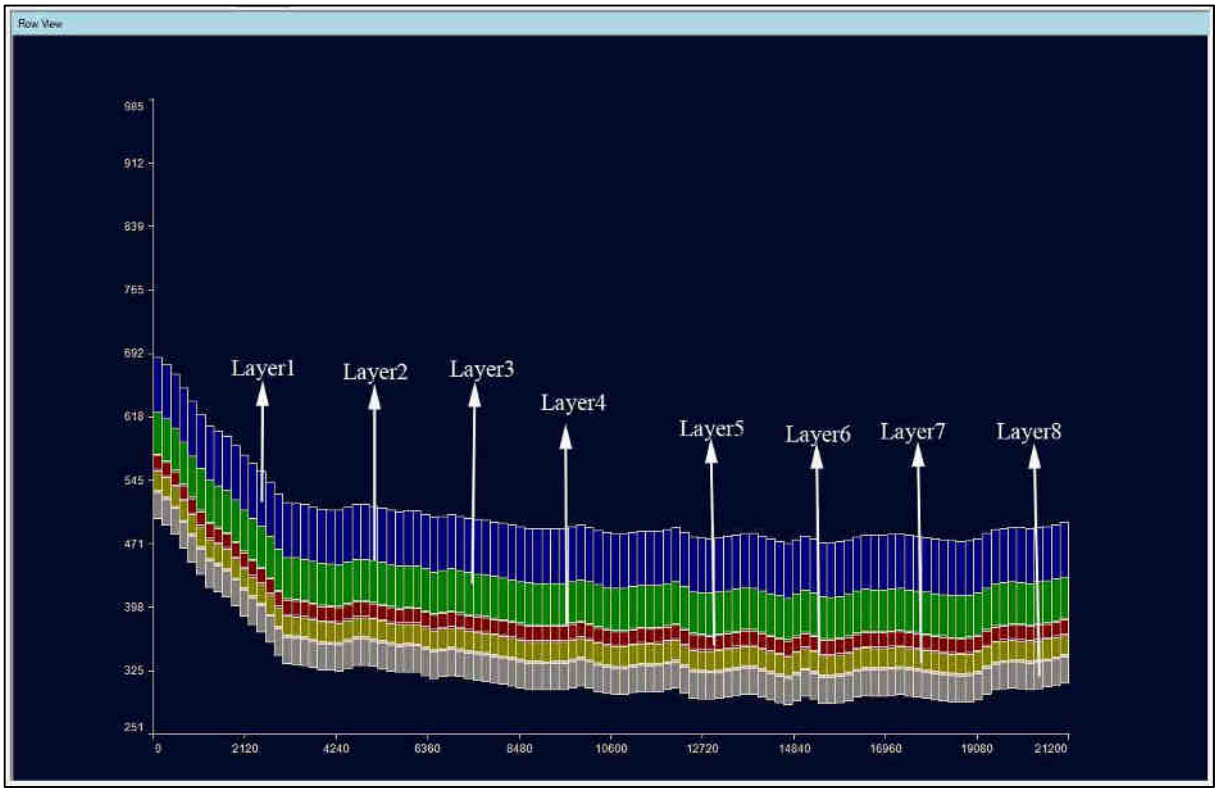


Figure 23: Lithological cross section along North-South row 50.

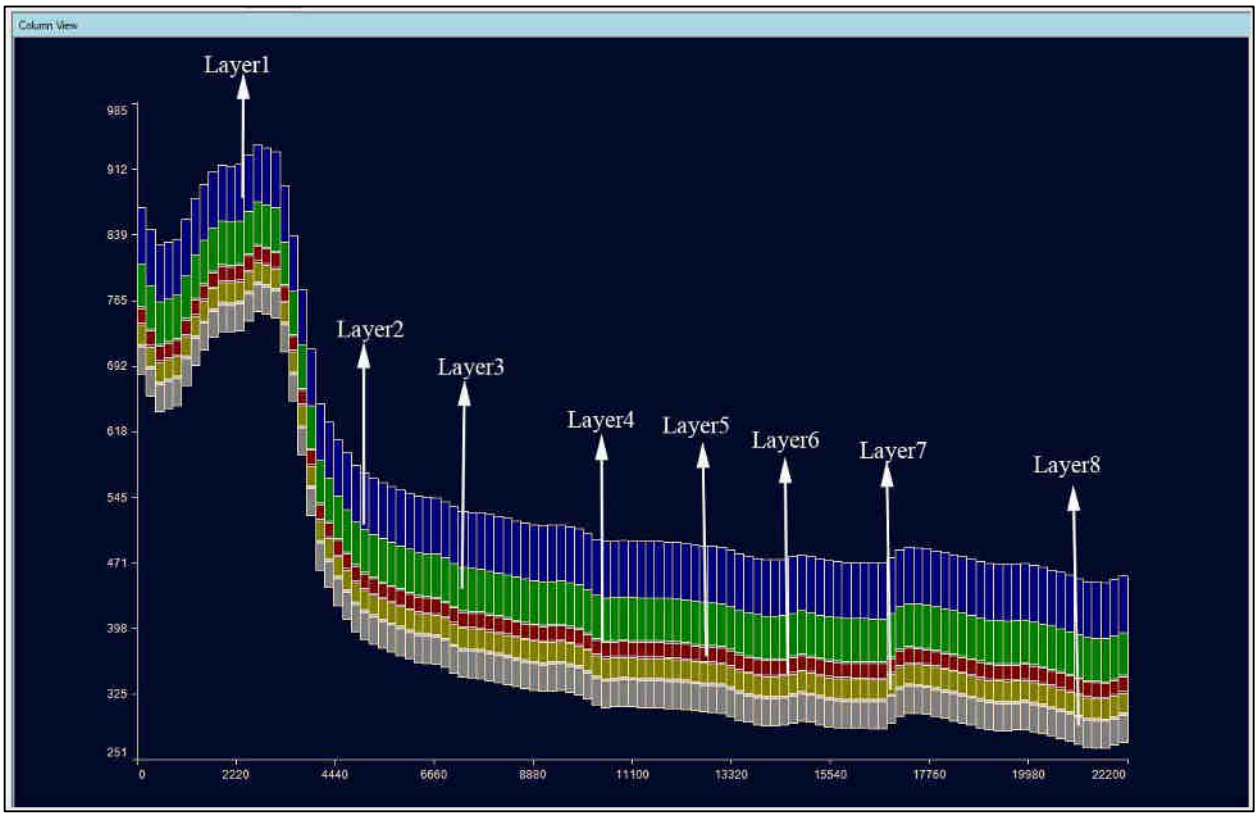


Figure 24: Lithological cross section along West - East column 50.

Boundary Conditions

Boundary conditions are defined along the edges of the simulation domain including the top and the bottom. Their main function is to separate the model region from the rest of the world and are required for the solution of the ground water flow equation. Model boundaries are either physical (real) and hydraulic (artificial).

The physical boundaries are well defined Geologic and Hydrologic features that permanently influence the pattern of groundwater flow. While, Hydraulic boundaries are artificial and are derived from groundwater flow nets (Kresic, 1997). Based on the geological formation and infiltration characteristics of the individual formation, the rainfall recharge boundary conditions are defined.

The rainfall recharge values of 10-12 % (i.e., 0. 60 mm/day *after referring to the GEC 2015 Report)* have been assigned in the recharge boundary condition. The above recharge quantity is considered in the model. The river boundary condition is applied.

In the underground mines, the seepage water is being pumped out from the conventional sumps of the underground mines through centrifugal pump sets. Hence, pumping well

boundary condition is applied for the present modelling. The mine dewatering is being undertaken by three pump sets from the sump and the surplus of which after meeting the Mine requirement of the project is discharged onto the local drainage system for irrigation use by the local populace after treating it through the series of settling tanks.

Apart from the above bore wells used for irrigation / drinking are applied in the model. All the wells have been assigned pumping well boundary condition. The boundary condition in the model is presented in **Figures 14 and 15.**

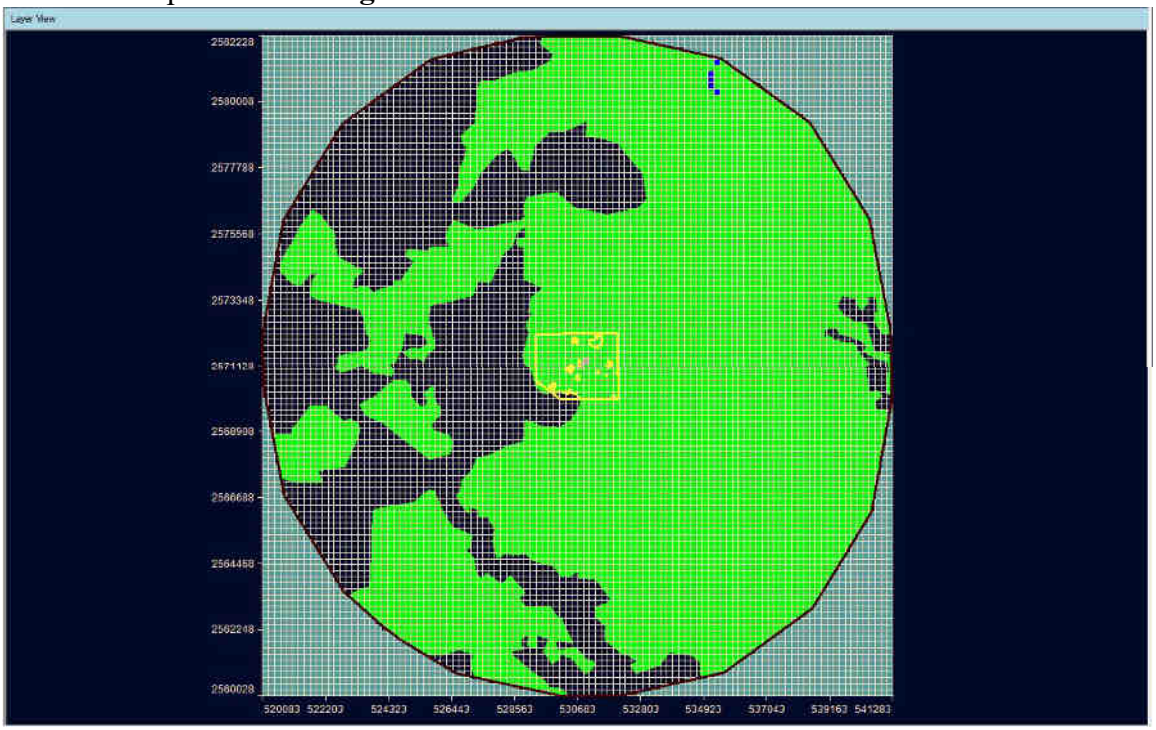


Figure 25: Boundary Conditions – River, Recharge.

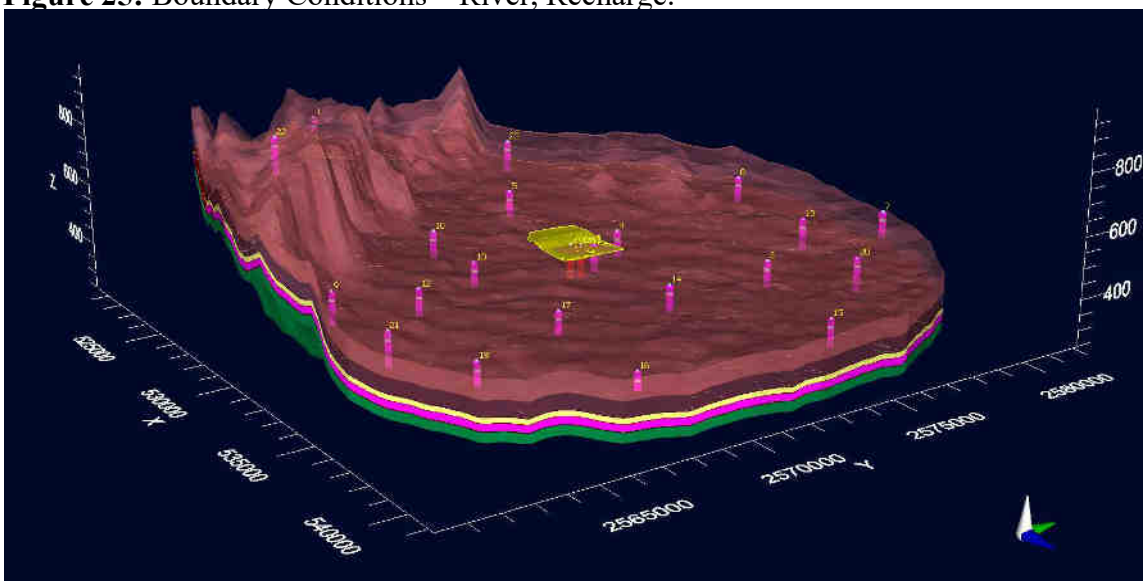


Figure 26: Pumping wells used in the model domain.

Initial Head

Initial heads for all the aquifers are generated based on the ground water level data collected during the field study. Also, the long-term ground water level data from CGWB has been compared and initial heads are generated.

The ground water level of the shallow bore well is considered as the initial head of Layer 1 and the deep bore well (fractured) water level is considered as the initial head of Layer 2. The initial head is presented in **Figure 16.**

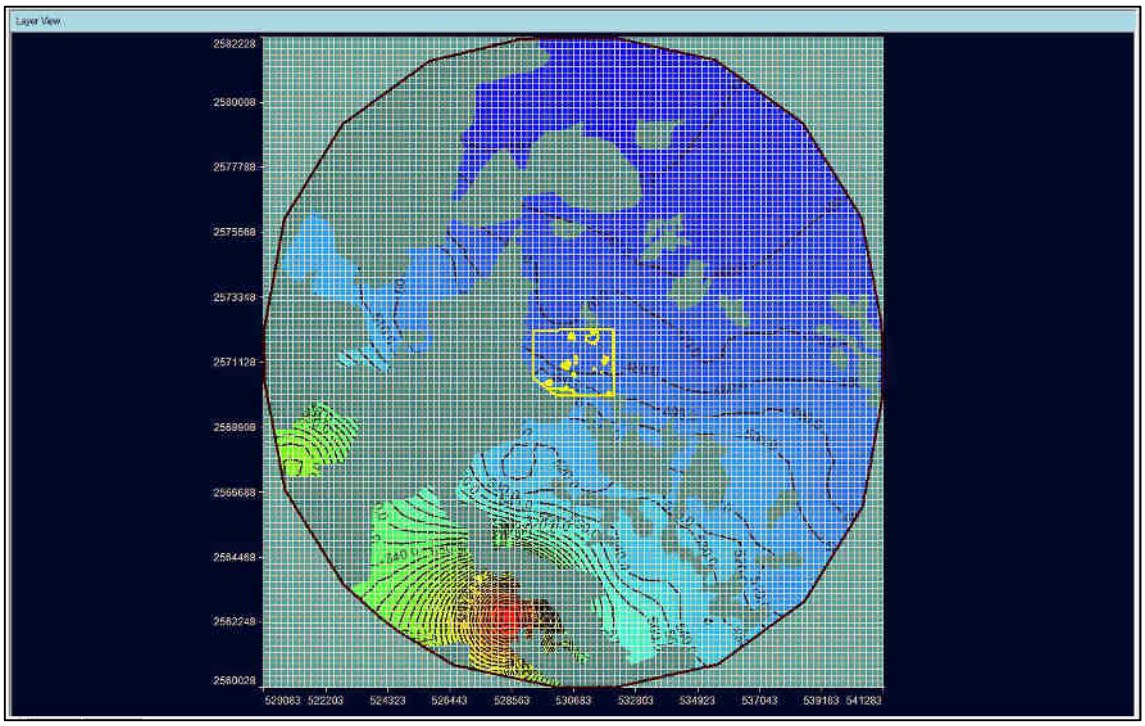


Figure 27: Initial Head.

5.4. Calibration and Validation

The boundary conditions and aquifer properties are defined for the model and also pumping well and observation well objects are added to the model. Then data from the conceptual model is translated to the Numerical model and then the VISUAL MODFLOW FLEX module with flow budget is estimated. The main benefit of using the VISUAL MODFLOW FLEX code is that it provides mass balance calculations in such a way that the source of water provided to a groundwater system can be traced easily. The model convergence is

obtained after a number of trials run by changing errors in the initial heads and aquifer parameters entry.

To evaluate the validity of the updated flow model, the groundwater heads simulated by the updated flow model were compared with the observed water level heads. In this connection, the groundwater head observations for the period of 2022 have been used for validating the model.

The scatter plot showing the statistics for aquifers responses. It divulges that the **root mean squared (RMS) of the residuals 2.068 m, and NRMS is 0.79 %** which, indicating a reasonably good fit of the observed and simulated levels with the majority of the data lying close to the 1:1 line. **(The accepted RMS error as per CGWA Guidelines (Webinar Presentation) is less than 3.5 m).**

The calculated and observed head is presented in **Figure 17 and Table 9.**

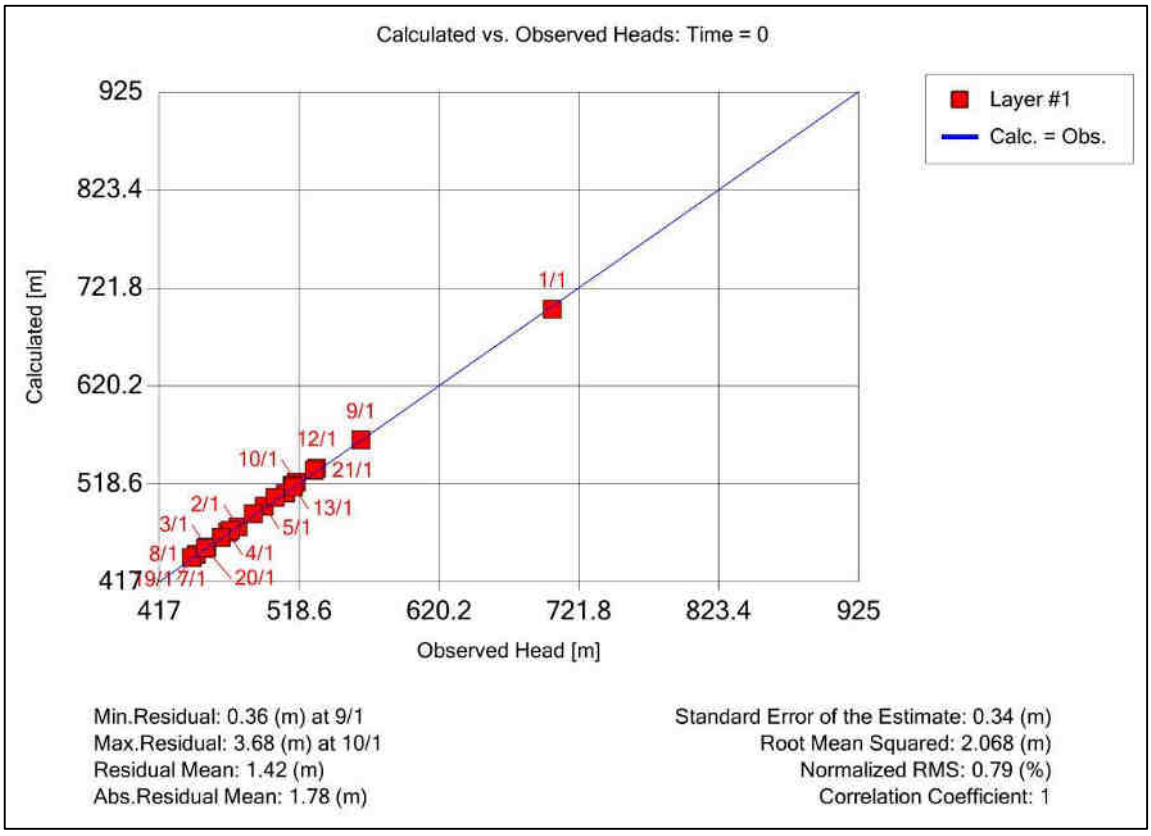


Figure 28: Calculated Vs observed head of the model.

Table 30: The calculated and observed heads of the model.

X	Y	Z	Calculated Head	Observed Head	Calc.-Obs Deviation in m
521060	2567500	702	699.65	702.60	-2.95
531250	2571700	469	473.72	474.30	-0.58
534760	2575600	441	452.88	451.50	1.38
530390	2573100	460	468.44	466.70	1.74
525750	2572100	486	495.31	493.40	1.91
533020	2581700	435	441.99	440.90	1.09
527760	2579900	446	445.27	443.90	1.37
532800	2561900	570	563.96	563.60	0.36
528690	2567500	520	520.28	516.60	3.68
533060	2564500	531	534.90	531.40	3.50
531280	2567400	499	517.04	513.70	3.34
535200	2571600	458	470.29	468.70	1.59
539790	2573800	452	463.14	462.30	0.84
540320	2566800	473	487.24	485.60	1.64
536050	2567200	500	509.21	508.70	0.51
537830	2563400	495	504.43	501.10	3.33
532140	2579100	434	442.08	440.50	1.58
536030	2578000	440	451.50	450.70	0.80
535280	2562200	525	532.32	529.70	2.62
521660	2574600	512	515.26	514.50	0.76

The model could not be simulated in a Steady-state condition as the study area is consisting of a multi-layered aquifer system alongside mining activity involved. Generally, in such conditions, there will be a difference in the inflows and outflows of the Hydrogeological system. Hence, her model was run in a Transient state condition.

The prerequisite data for running the model in the Transient state are initial heads and stress periods. The year is divided into twelve stress periods i.e., every month. Each stress period is divided into one-time step to have monthly heads and flow. The prediction model was run for 10 years.

Considering the above-mentioned facts, the calibrated model has been used to assess the impact of groundwater withdrawal for industrial purposes on the groundwater system for a period of five and ten years.

Change in the ground water head at the end of 5th year and end of 10th year has been simulated. ***There is a change of head in and around the mine Dewatering area has been observed and which ranges from about 9 to 11 m. (Initial Head 475 m (at the Mine pumping location)) and the observed head 466 m at the end of the 5th year and 464 m at the end of the 10th year in the mine lease area).***

The change in heads can be attributed to industrial pumping and however, it is found to be meager. The simulated head at the end of the 5th and end of the 10th year is presented below in **Figures: 36-37**.

Though the predicted change in the head and the drawdown is moderately high, the recharge from the rainfall and other groundwater recharge practices adopted by the PP will ameliorate the ground water scenario.

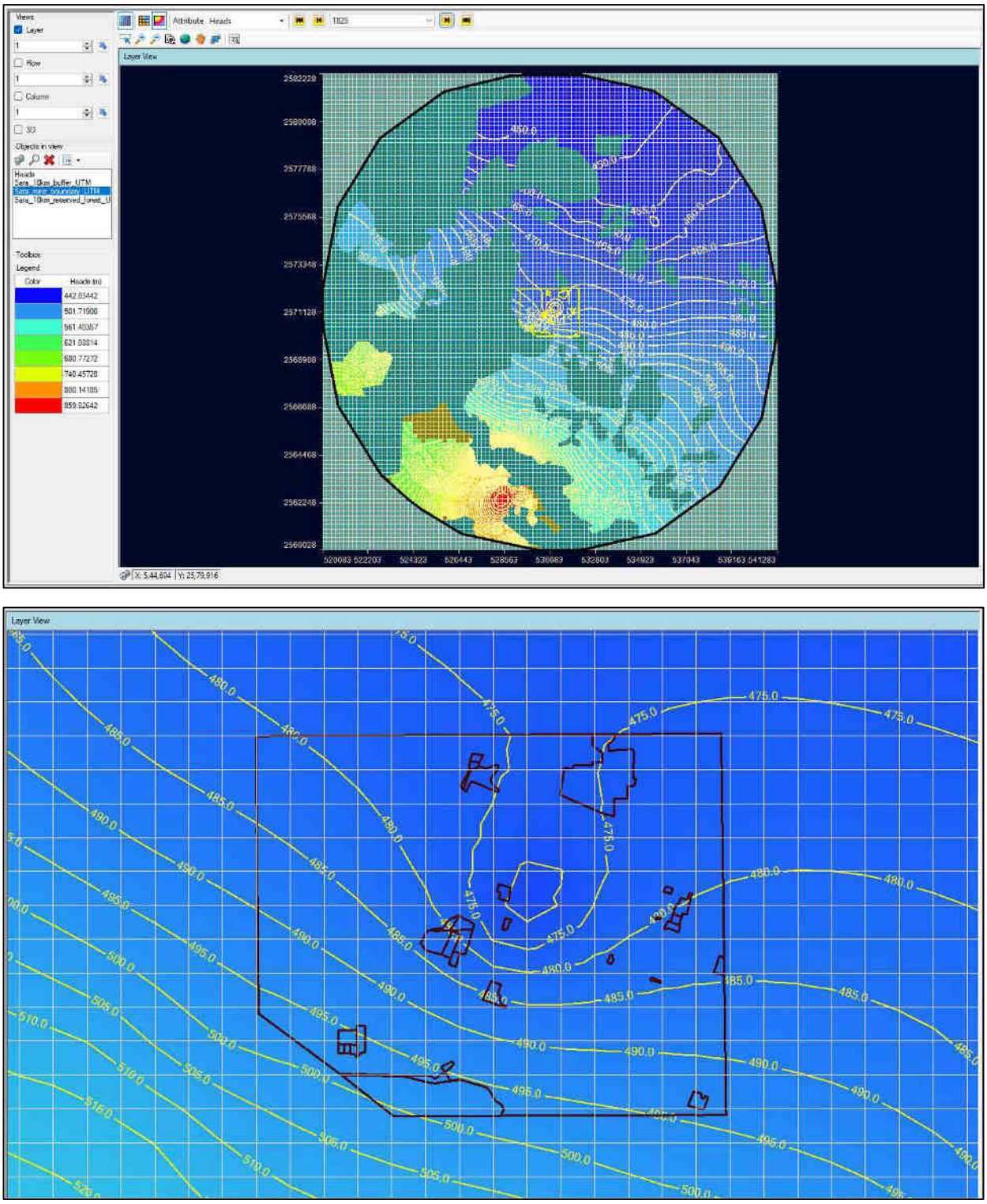
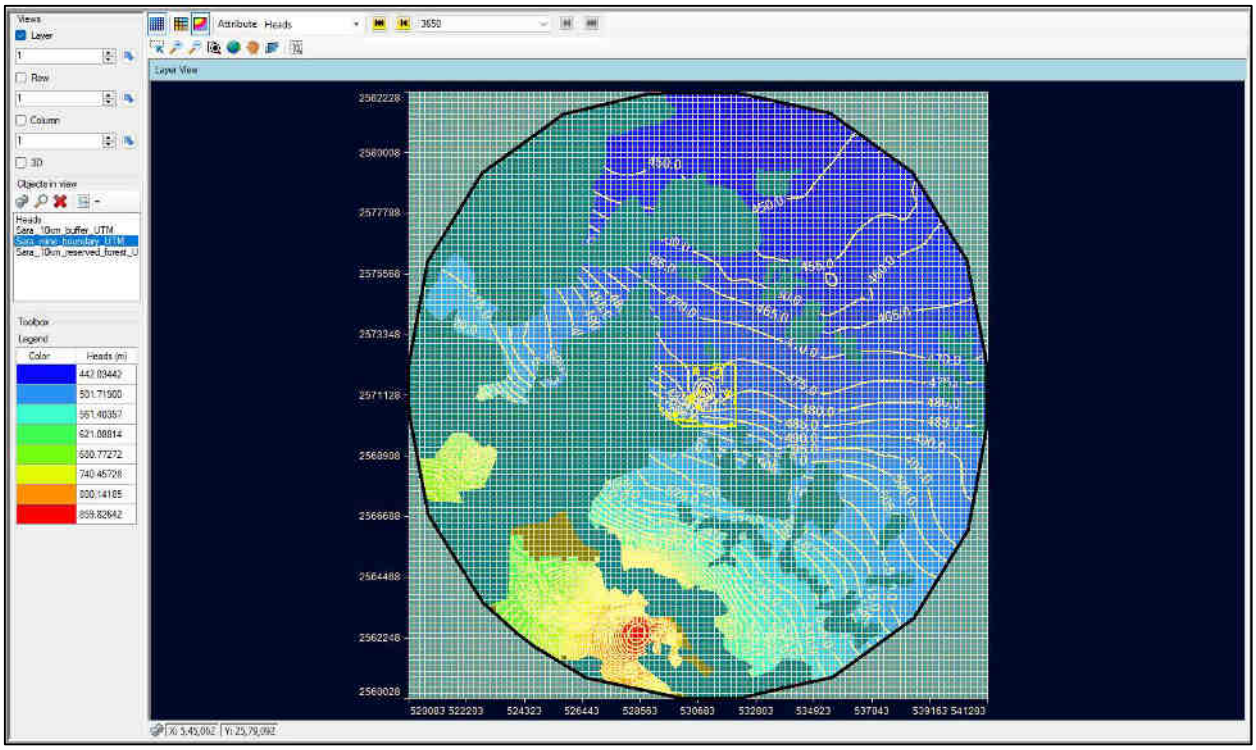


Figure 29: Predicted Head – End of the 5th year.



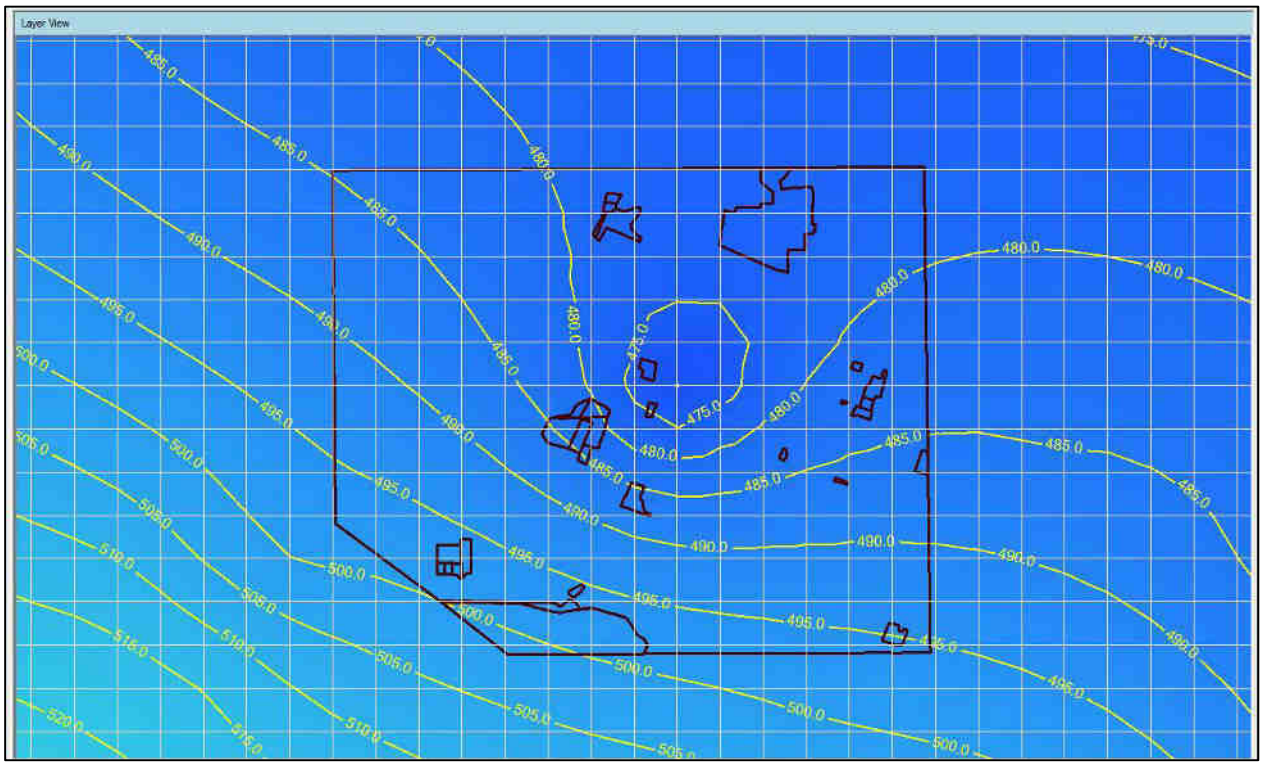


Figure 30: Predicted Head – End of the10th year.

Table 31: Statement showing the Mass Balance

Inflow and Outflow from various boundaries in Second Year (2024)		
Heads	**Inflow**	**Outflow (Sink)**
	Volume in cu.m	**Volume in cu.m**
Storage	31785196	64224112
Constant Head		
Wells		1293560
River leakage		24615
Recharge	33756080	
Total	**65541276**	**65542287**

Inflow and Outflow from various boundaries in Fifth Year (2027)		
Heads	**Inflow**	**Outflow (Sink)**
	Volume in cu.m	**Volume in cu.m**
Storage	68075704	149172288
Constant Head		
Wells		3233900
River leakage		61539
Recharge	84390200	
Total	**152465904**	**152467727**

Inflow and Outflow from various boundaries in Tenth Year (2032)		
Heads	**Inflow**	**Outflow (Sink)**
	Volume in cu.m	**Volume in cu.m**
Storage	115472512	277663040
Constant Head		
Wells		6467800
River leakage		123098
Recharge	168780384	
Total	**284252896**	**284253938**

From the mass balance graph for the 2nd year, 5th year and the mass balance for the 10th year, the changes in the contribution from various sources have been computed. From the above Table 30, it can be seen how the contribution from various sources changes in the projected scenario for the year 2024 from that of the year 2032.

The estimated seepage using TIL formula as per SOP is –1772. Whereas, the computed seepage by ground water modeling is 1771 cu.m / day. As per SOP the higher value has to be considered for NOC. Hence the dewatering quantity of 1772 cu.m /day is requested for NOC.

The most important changes are in the Recharge boundary which contributes a major part of the mine dewatering and pumping of the surrounding wells in 2024 and 2032.

The mass balance clearly indicates that the ground water drawl of the study area is only from the recharge quantity.

The Mass balance graphs at the end of the 2nd year (2024), end of the 5th year (2027), end of the 10th year (2032) is presented in **Figures**: **20-22.**

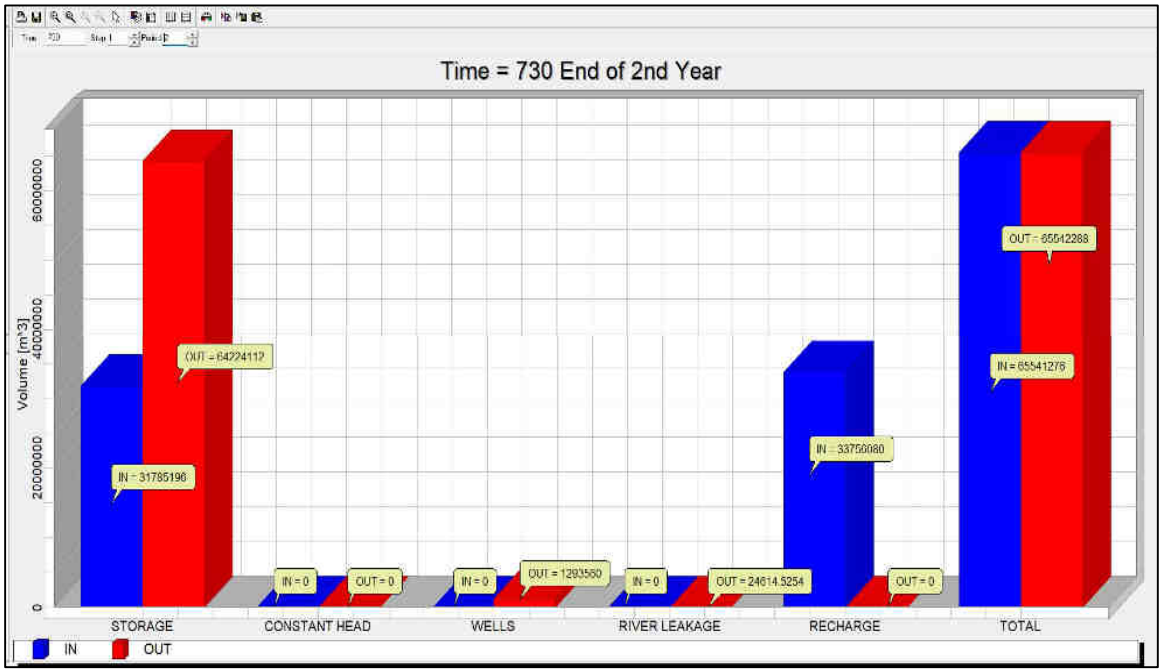


Figure 31: 2nd Year Mass balance.

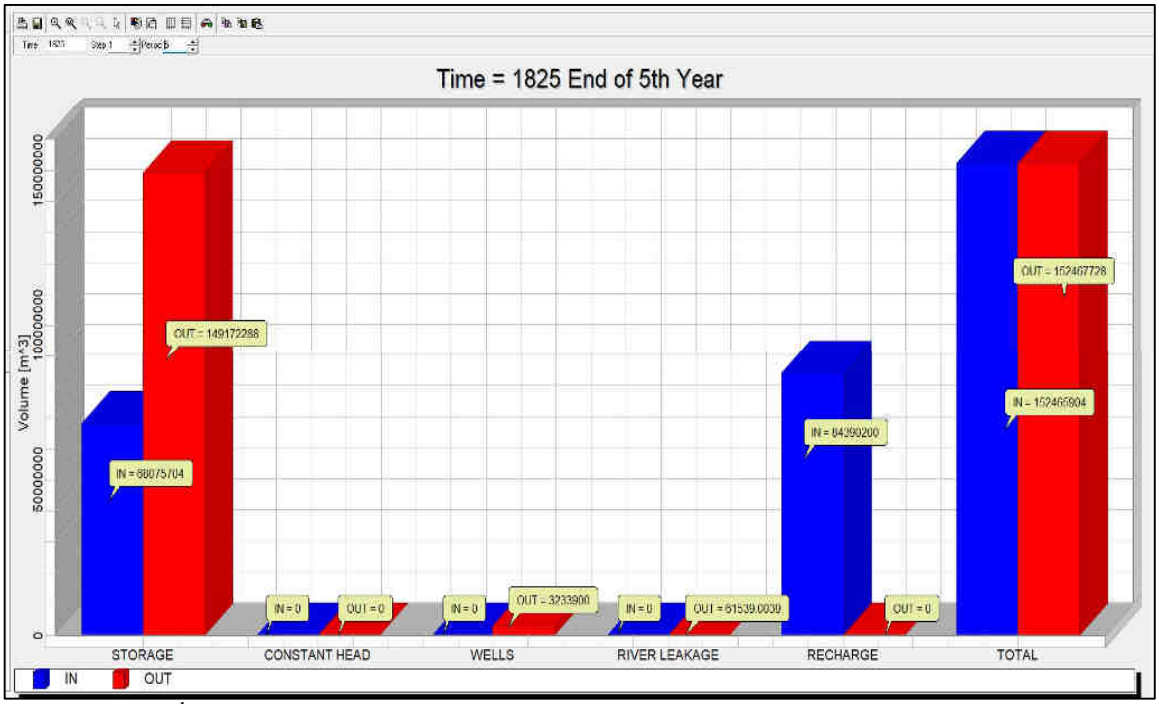


Figure 32: 5th Year Mass balance.

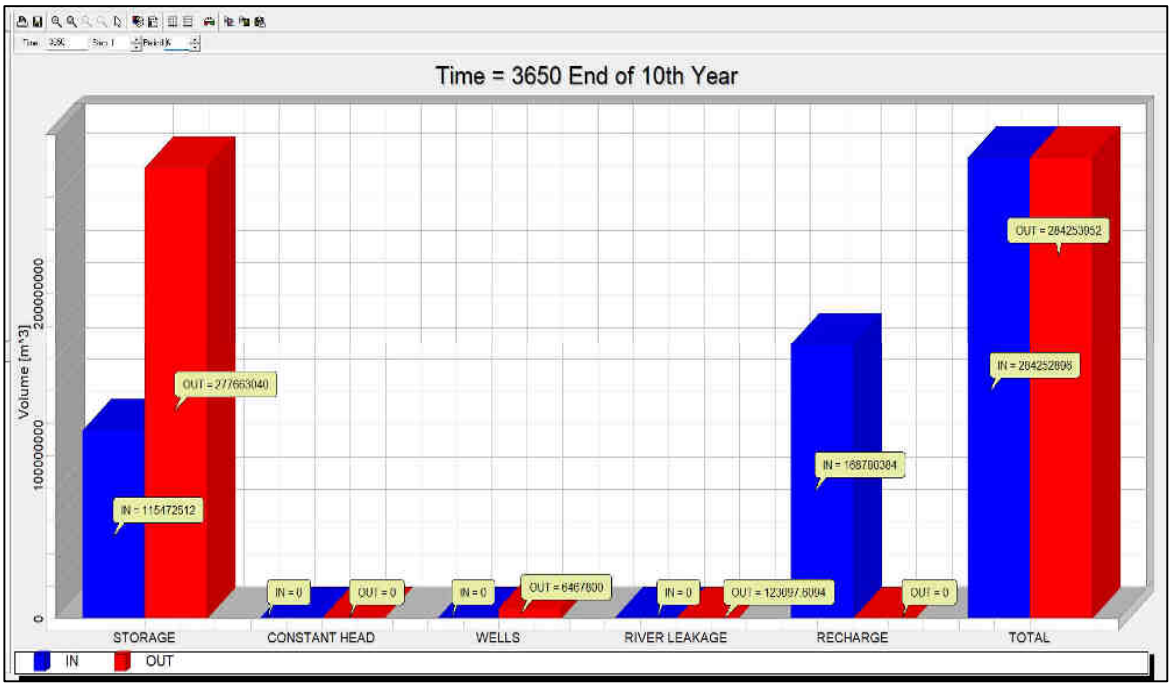


Figure 33: 10th Year Mass balance.

5.5 MODEL LIMITATION

The major simplifying assumptions in the present modeling study include

1. All pumpages in a model cell has been simulated as coming from the cell center;
2. The pumpages throughout a stress period is applied equally
3. Recharge is in variant over large periods of time
4. Small scale variations of hydraulic conductivity within cells are negligible

5.6. CONCLUSTION AND RECOMMENDATION

- A numerical groundwater flow model was developed and calibrated by using extensive geological, hydrogeologic and existing mine data representing present mining scenario with the objective of predicting potential impacts of the proposed projects on the ground water regime, including lowering of groundwater-level.

- ***Dewatering of the Sahapur West Coal UG Mine project will result in lowering of groundwater levels (observed heads) to a depth of 466 m at the end of the 5th year and 464 m at the end of the 10th year in the mine lease area against the Initial Head of 475 m.***

- This will create a drawdown in the regional groundwater system propagating outward. The drawdown will be most dynamic in the vicinity of the project, the effects of which will decrease with increased distance from the project

- The estimated seepage using TIL formula as per SOP is 1772 cu.m/day which is inclusive of the present predicted seepage. While the model predicted seepage is 1771 cu.m/day. Hence the dewatering quantity of 1772 cu.m/day is considered for NOC application.

6. MINE WATER MANAGEMENT

Sandstones are suitable formations for medium deep tube wells in the area. For ground water abstraction, two number of bore-wells shall be construct in lease area. The depth of each bore-well is 90 m and the diameters of the wells are 177mm. The yield from bore well is 8 cum/hr.

The two bore wells will be operated for about 2 hours to meet the daily domestic requirement of 32 cum/day. Further, the seepage water from the mine will be dewatered through a mining pit of 100m depth and 200 mm diameter will be proposed to use 125 HP pump. The pump will be operated for 4 hours a day for 365 operational days to dewater 1772 cum/day from the mine.

Table 32: Details of the tube wells/ borewells proposed to be constructed

S. No	Tube well No	Year of Construction	Depth In m	Diameter in mm	Depth to water level	Tentative discharge (In cu.m/hr)	HP of pump	Pump lowered in m
1	T-1	2022	90	177	22.9	8	5	75
2	T-1	2025	90	177	22.9	8	5	75

At present no quantum of water is being pumped out of the mine. As the ground water seepage shall be occurred due to mining operation, dewatering of the mining pit shall be required. Based on available data it has been estimated that groundwater inflow into mining

pit during period of approved mining plan, it will be 124 cu.m /day or annually 45350 cum during 2025-26.

In year 2026-27 it will be 1648 cu.m /day (annually 601383 cu.m). In 2027-28 it will be occurred 1986 cu.m /day (annually 724803 cum), In 2028-29 it will be occurred 2746 cu.m /day (annually 1002246 cum) and at the end of current SOM period i.e., year 2029-30 it will be around 2865 cu.m /day or 1045707 cum/year.

The groundwater seepage is pumped out from working mine pit will be use in greenbelt area, dust suppression, underground mining activity and remaining groundwater will be used for agricultural benefits of nearby farmers of the area.

In addition to that 32 cu.m /day of ground water source from borewell is proposed to utilized for drinking and domestic purposes for mine workmen in the lease area.

The pumped water from the mining pit is proposed to be utilized for irrigation purpose for nearby villages and for other mining activity.

It is proposed to be utilized 77 cu.m /day of water for green belt development, 62 cu.m /day of the water dust suppression, 10 cu.m /day for washing purposes, 10 cu.m /day for underground spraying, 10 cu.m /day for fire-fighting and about 180 cu.m /day of the water will be used for underground mining activity for Continuous Miner operations in mining activity.

NOC is being granted for two years; hence two-year mine seepage of 1772 cum/ day is considered for NOC as a mine dewatering. The water balance chart is presented in **Figure 23.**

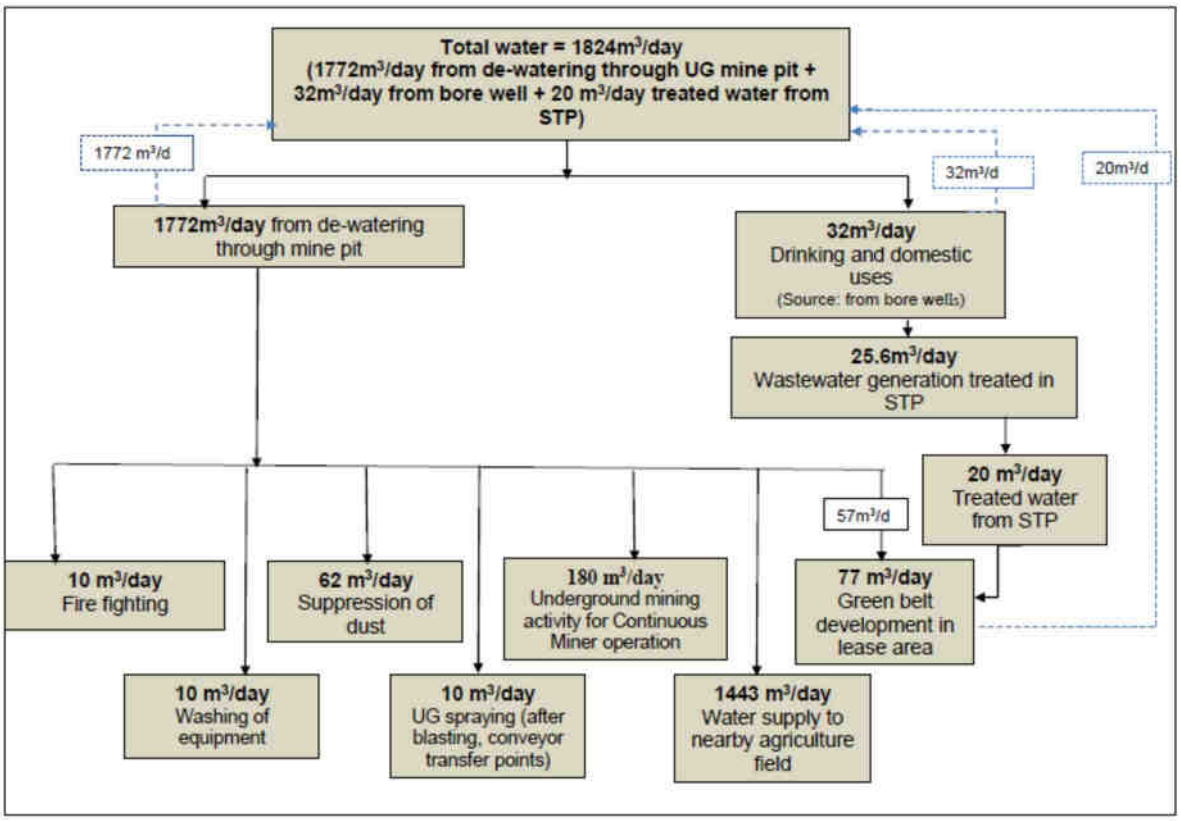


Figure 34: Water Balance Chart

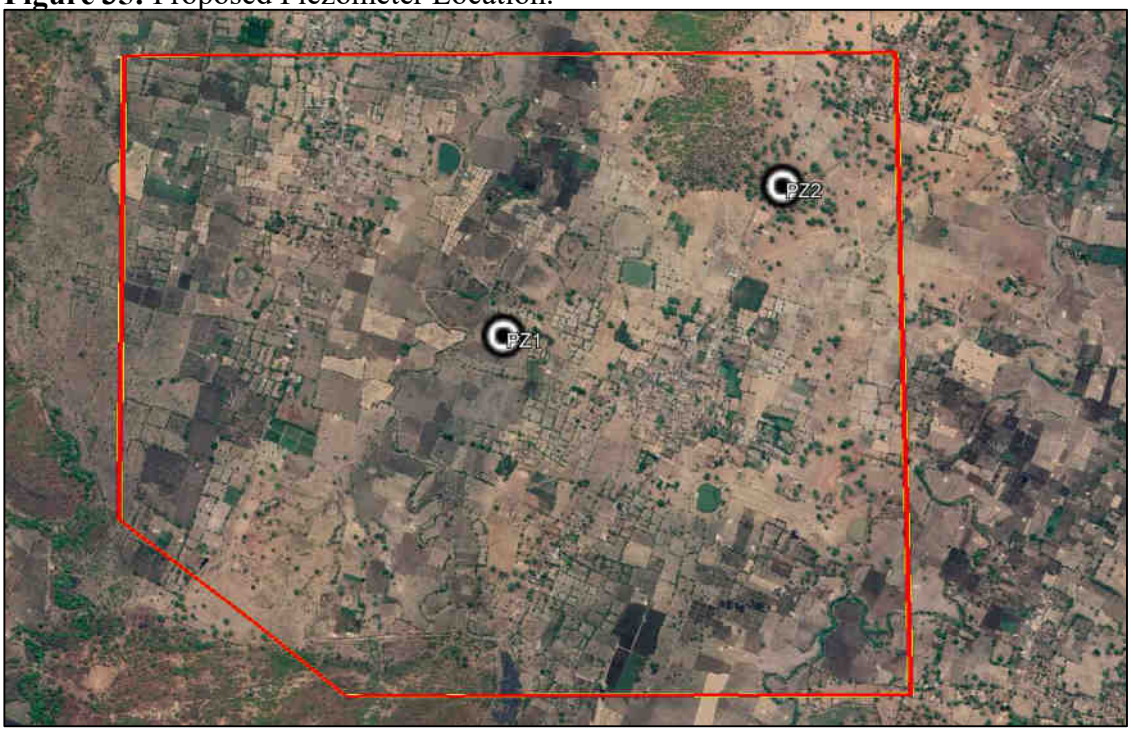
Location of Piezometers

As per the Guidelines CGWA, 2 piezometers (More than 500 cu.m/Day) have to be installed in the mine lease area. One dedicated bore well is installed with DWLR and another with telemetry.

One near the main gate of the project and another at northeast barrier zone of the lease area. The depths of the piezometers are 100 m and are located in the vicinity (minimum approximate distance-50 m) of withdrawal points to monitor the effect of withdrawal activities.

The Location of the proposed piezometer is presented in **Figure- 13.**

Figure 35: Proposed Piezometer Location.



7. IMPACT OF MINE DEWATERRING / ABSTRACTION AND MITIGATION MEASURES

7.1 IMPACT ON THE GROUND WATER REGIME

Based on the aquifer characteristics and the withdrawal of water for industrial purposes, the impact of pumping in the surrounding areas has been attempted using Visual MODFLOW Flex Software.

The following assumptions have been considered for the model:

- The mine dewatering quantity of **1772 cu.m /day**.
- The rainfall recharge is same all the years considered.
- Surrounding irrigation wells pumping considered.

The Initial head of the mine lease area has been derived based on the ground water level data collected for the per-and post monsoon periods.

The Initial head has been considered for the ground water modeling and the predicted head due to the mine dewatering has been projected using the Visual Modflow software for the periods of the 5th and 10th year **(As per recent CGWA webinar presentation 5th and 10th years prediction).** Initial head in and around the mine lease area is given in **Figure-23.**

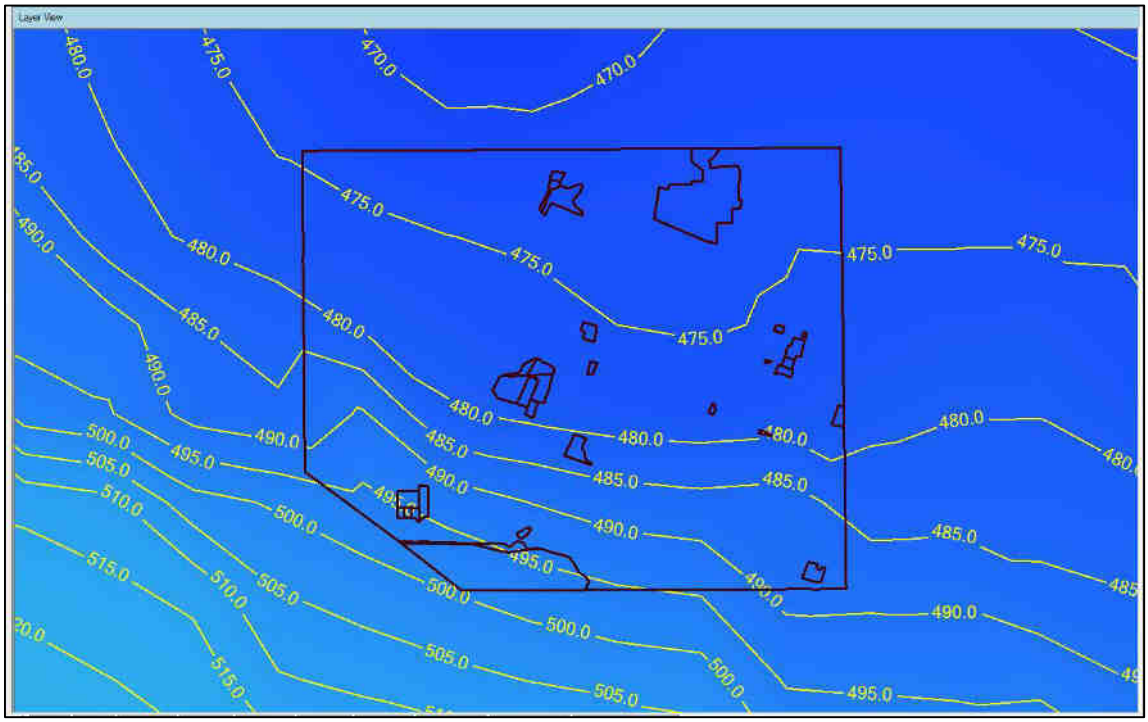


Figure 36: Initial Head in and around the mine lease area.

Prediction Scenario 2–Second year pumping Scenario:

	Second Year
Predicted Maximum Down in m	**6.0**

Figure 37: Drawdown in the mine at end of the 2nd Year.

Prediction Scenario 5–Fifth year pumping Scenario:

Fifth Year	
Predicted Maximum Down in m	**9.0**

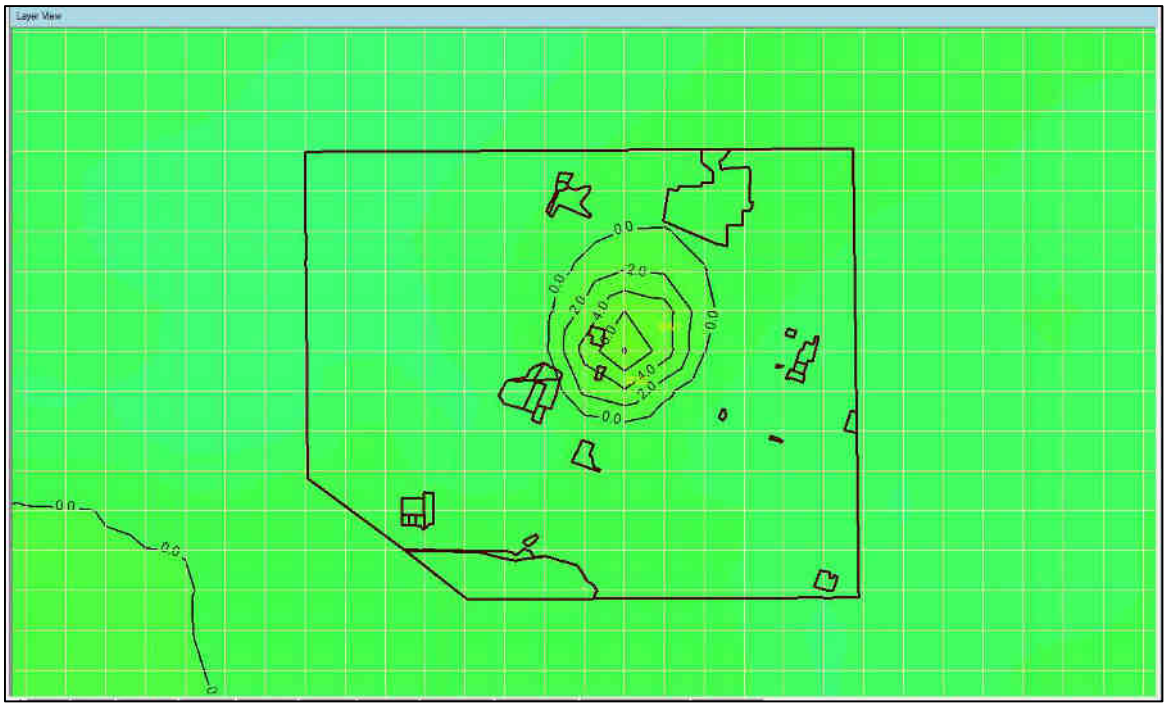


Figure 38: Drawdown in the mine at end of the 5th Year.

Prediction Scenario 6 – Tenth year pumping Scenario:

Tenth Year	
Predicted Maximum Down in m	**11.0**

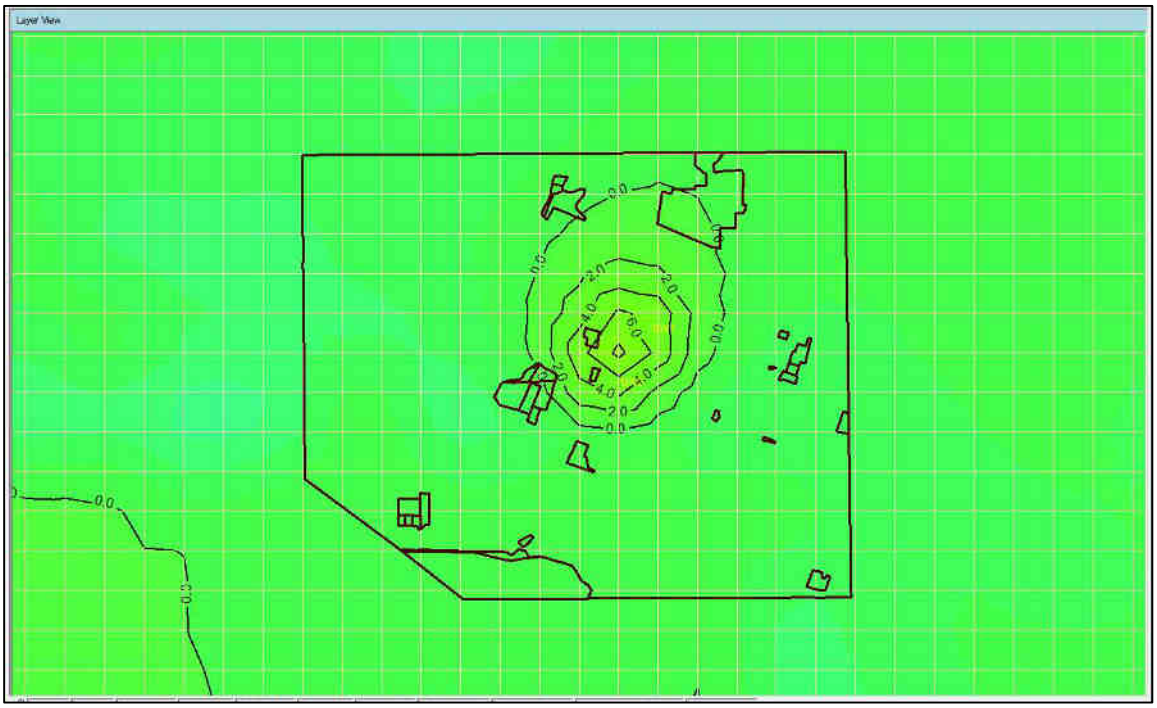


Figure 39: Drawdown in the mine at end of the10th Year.

The numerical model using Visual mudflow flex has been attempted and the radius of influence has been estimated. The radius of influence is **210 m from the pumping wells**. The model output of the radius of influence is given below:

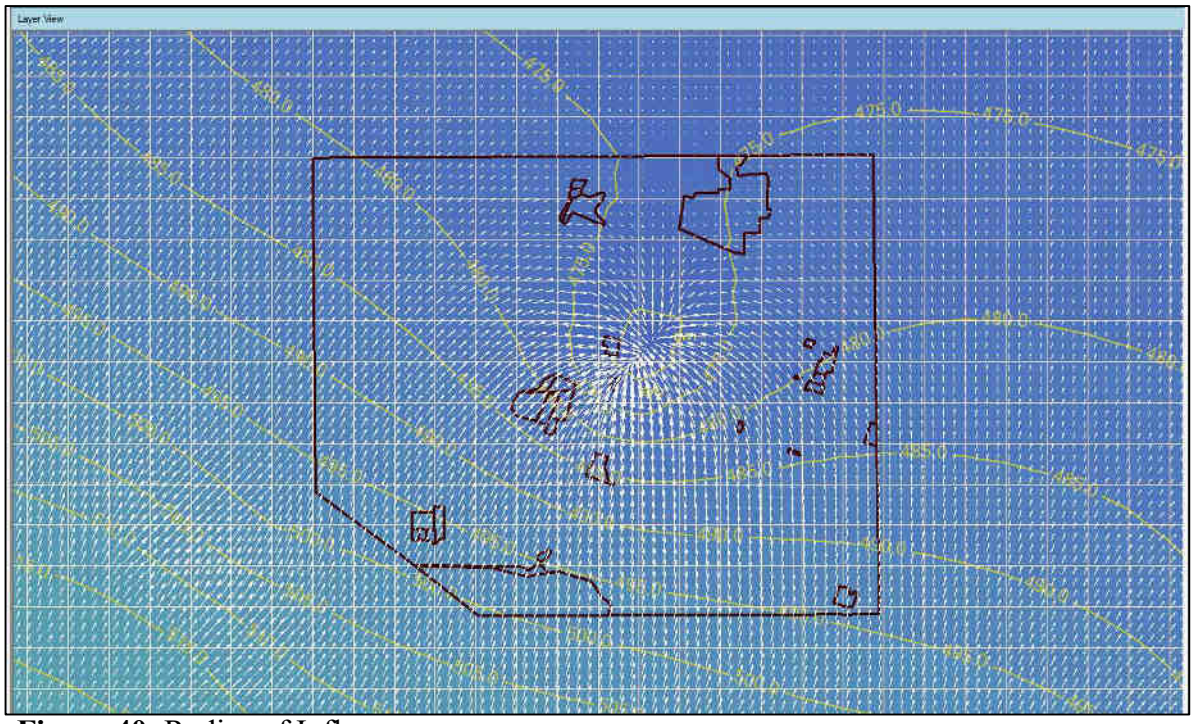


Figure 40: Radius of Influence.

Inference:

- The predicted drawdown in the mine site is **9 m in the fifth year.**
- The predicted drawdown in the mine lease area is **11 m in the Tenth year.**
- This is the predicted drawdown computed by the model after considering mine dewatering into account. Therefore, the water level declined during the non-mining period may raise to the original water level in the monsoon period.

The radius of influence predicted by the model is about **210 m.**

7.2 Inference of the Modeling Results

- The results of mathematical modeling have thrown light on the overall scenario of the ground water condition of the model area. Ground water modeling study reveals that the pumping in the second layer has very less effect on Unconfined Aquifer.
- The Mine dewatering is from the first and second layer. The dewatering quantity of **1772 cum/day** for the Mine would not make adverse impact in the ground water system of the model area.

- ***There is a change of head in and around the mine Dewatering area has been observed and which ranges from about 9 to 11 m. (Initial Head 475 m (at the Mine pumping location)) and the observed head 466 m at the end of the 5th year and 464 m at the end of the 10th year in the mine lease area).***
- Though the predicted change in the head and the drawdown is more, the recharge from the rainfall and the recharge imitative taken by the project proponent has ameliorated the ground water scenario.
- The predicted radius of influence is **210 m**. The convergent of flow in the mine pit indicates the ground water flow towards the mine pit and the radius of influence is limited the mine lease area.

The most important changes are in the Recharge boundary which contributes major part of the mine dewatering and pumping of surround wells in 2025 and 2030.

- The predicted drawdown in Mine pits **9.0 m in the fifth year.**
- The predicted drawdown in Mine pits **11.0 m in the Tenth year,**
- The predicted drawdown is at the time of dewatering. During the monsoon period and non-mining period the water level raise to the original water level in the monsoon period.

Hence the dewatering quantity of 1772 cum/day would not make any adverse impact in the ground water regime.

The model output reveals that the impact of pumping would not affect the surrounding pumping wells as the radius of influence confines to the mines lease area.

Aquifer performance reveals that the **86 %** recovery attained less than 1 hours after pumping stopped.

It is clear that the aquifer replenishes quickly. Considering all the above, there would not be any adverse impact on ground water system surrounding the Mine area.

The Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Tehsil, Umaria & Shahdol Districts, Madhya Pradesh. Umaria & Shahdol blocks are Safe block as per the assessment of CGWA 2020. The Ground Water Information

available in the *website: https://indiawris.gov.in/wris/#/,* for the year 2020 have been used to compute the Net Annual Ground Water Availability and Existing Gross Ground Water Draft on a pro-rata basis. The detailed computation for the buffer zone is shown in the table below.

Block	Sohagpur	Pali	**Total**
District	Shahdol	Umaria	
State	Madhya Pradesh	Madhya Pradesh	
Area of Block falling in buffer zone in Ha	28338	9587	**37925**
Net Annual Ground Water Availability (Ham)	2326.70	842.31	**3169.01**
for all uses (Ham)	520.84	59.60	**580.44**
Stage of GW Development (%)	22.38	7.07	**18.31**
Categorization	*Safe*	*Safe*	**Safe**

Computation of Stage of Ground Water development after the proposed ground water draft:

The net annual groundwater availability in the buffer zone is **3169.01** ham. The existing gross groundwater draft for all uses in the buffer zone is **580.44** ham. The ground water draft for the current project is proposed as **65.84** ham (@**1772** cu.m/day though dewatering + **32cu.m/day** from borewell for domestic uses in project).

Stage of Ground Water Development = (Existing Gross Ground Water Draft /
Net Annual Ground Water Availability) X100
= (580.44+65.84)/3169.01 X100 = 20.39 %

Thus**,** the stage of GW development after withdrawal of ground water of **1804 cu.m/day** for **SEML** will be about **20.39 %.** As per the criteria for categorization of the area made by Central Ground Water Authority for the development point of view, the present study area falls under 'Safe' category. There is an ample amount of scope for ground water development in the region. Hence, the withdrawal of groundwater amounting to **1804 cu.m/day** or **658413 cu.m/year** will not have any appreciable impact on groundwater resources.

There will be no impact on environmental due to the mine activities. This also infers from the CGWB's Long term water level trend of 3 locations taken from the India WRIS site**.**

In order to augment the ground water, the Mines proponent implemented ground water recharge structures with in the Mine, such as recharge bore well, cleaning of village ponds as corporate social responsibility. It is estimated, about **70 %** of the Mine ground water will be recharged (Including recharge Pond). The details of the rain water harvesting is presented in chapter 7.4. Considering the above there would not be negative impact on ground water regime in and around the Mines.

7.2 IMPACT ON SURFACE WATER SOURCES

Surface drainage will not be get affected because proposed project is Underground Mining. The water seeping into the mine and collected in the mine sump will be partly used in the mine and excess amount will be used to agricultural field of nearby area. The used up in the mine for spraying on haul roads, conveyor at loading and unloading points bunkers etc is lost by evaporation.

The possible sources of water and wastewater due to the mine activities are:

(a) Mine discharge water.

(b) Domestic waste water.

Maximum amount of mine discharge water will be used for various purposes in the project and balance water will be discharged into settling ponds and subsequently supply to nearby agriculture field.

The domestic waste water generated in project area will be treated in STP and treated water is reused in greenbelt area of project. Thus, there will be no possibility of any impact of the waste water on the existing water regime.

7.3 IMPACT ON WATER QUALITY

No adverse impact in the water quality

7.4 MITIGATION MEASURES

The water for harvesting in the project area is the available rainfall runoff generated from the lease area and is the most important factor to plan the rainwater harvesting. The rainwater runoff available for harvesting and recharge to ground water depends on the

rainfall in the area and the runoff coefficient of the surface on which the rain falls. The main surfaces in the mining lease area are Build-up area, road area, green belt (plantation area) and open area. The long term annual normal rainfall at Shahdol district is 1115mm (1.115m). The Runoff coefficient for the Road & Paved area as 65%, Roof top area as 85%, Green belt area as 15% and open land area as 20% as per CGWA norms and the runoff generated is quantified. The details of various types of surfaces and quantity of runoff generated due to rainfall are given below.

Recharge Computation:

1. Rainwater to be generated in surface right land:

Though the firm has been granted lease for 619 ha of land for underground mine for production of coal but surface right area has only for 24.299ha for development of infrastructures inside the lease area. So total available land used for recharge purpose 24.299 ha only.

Table 33: Available Land for Recharge.

Land Use Details	Existing (In sqm)	Proposed (In sqm)	Grand Total (Sq.meter)
Green Belt Area	-	80180	80180
Open Land	-	82335	82335
Road/ Paved Area	-	29750	29750
Rooftop area of building/ sheds	-	50725	50725
Total surface right area	-	242990	242990

Table 34 Volume of Rain Water Generated in Surface right Land.

Particulars	Area, (m^2)	Catchment Factor	Normal Rainfall (m)	Volume of water generated cu.m/year
Green Belt Area	80180	0.15	1.115	13410
Open Land	82335	0.2	1.115	18361
Road/ Paved Area	29750	0.65	1.115	21561
Rooftop area of building/ sheds	50725	0.85	1.115	48075
Total Volume of Water generated				**101407**

Volume of rainwater potential = 101407 cu.m/year or 0.101 MCM/year.

As per new guide line of CGWA, there is no mandatory of implementation of artificial recharge in the mining area. However, firm may implement the recharge practices to improve the ground water resources. The total groundwater recharge potential is to be created as 101407cu.m/annum.

Structures feasible for recharge: Keeping in view of the hydrogeological situation, topography and the lay out plan of proposed UG mine of Shahpur west block following structures are recommended for rain water harvesting to augment ground water.

1. Recharge through Peripheral Garland

2. Recharge through recharge pit with recharge well

Peripheral Garland: Peripheral Garland may be utilized for recharge to ground water. As the ground water levels in the area are more than 6m bgl during post monsoon period the recharge to shallow aquifers is feasible, length of garland may be approximately 1.339 km. It is expressed as below.

Total area covered under green belt, road and open space = 192265 sq.m.

1. Length of trenches = 1339 m

2. Width of trenches = 1m

3. Depth of trench = 1.25 m

4. Storage capacity: 1339 x 1 x1.25 = 1674 cu.m

5. No of filling during monsoon = 5

6. Recharge capacity = 50%

7. So total Recharge from trenches = 1674*5*0.50 = 4185 cu.m

Recharge from green belt, open space and roads etc. areas = 4185 cu.m /Year

Recharge from roof top area through bore well: By making proper arrangement for roof top rain water harvesting ground water can be recharged by means of suitable recharge structures. The main component of roof top rain water harvesting is as below.

(1) Roof top as catchment

(2) Conveyance

(3) Storage or settling tanks

(4) Filter chambers and

(5) Recharge structures

Description of each one with its design specification is as below;

Roof: The existing roof is made use of to collect rainwater. Since rainwater is pure as it falls from the sky, it is necessary that the roof be kept clean for water to remain pure when it is collected. When cleaning the roof with water the first rain separator must be kept open so as not to allow the dirt to enter the filter and the tank.

PVC Gutters: The gutters of PVC collect the rainwater from the roof and transfer it to the filter. On sloping roofs, PVC gutters can pick up leaves, dust, small twigs and other organic matter. The gutters need to be cleaned regularly at least once in a week. During the rainy season, the PVC gutters should be inspected and cleaned daily. The gutters are fixed to the roof or the walls with clamps. The clamps hold the gutter or pipes to the wall or the roof firmly and allow a small slope in the system to enable water to flow in one direction. At all times, the PVC gutters or pipes should slope in the direction of the storage tank and not away from it. The PVC gutters should always have an end cap at the end where rainwater begins to flow in the direction of the tank.

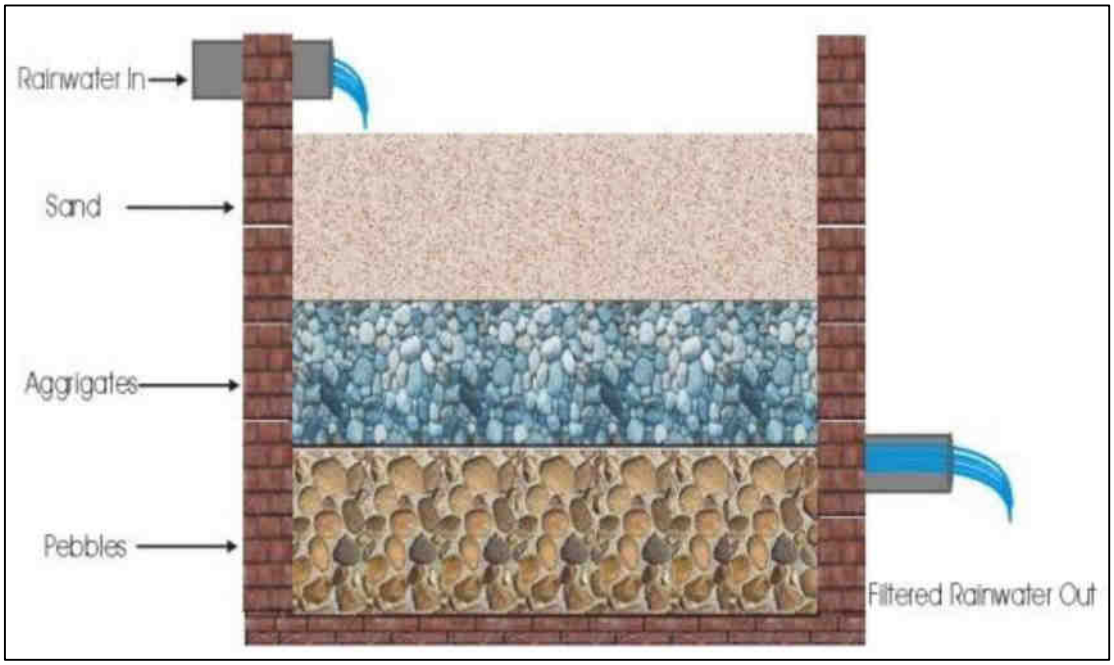
Downpipes: PVC down pipes brings the water from the rainwater gutters or pipes vertically down. They should invariably be clamped firmly to the wall and should never be loosely fixed. The down pipe should always be firmly fixed and if necessary, the clamp should be replaced or tightened whenever necessary.

First rain separator: The first rain separator, or a washout pipe as it is called, has a valve or an end cap to allow the first little amount of rainwater to be collected separately. This has most of the dust and dirt in it. The first rain separator is also used when the roof is being cleaned or when rainwater is not to be collected. It is important to ensure that the first rain separator is always kept in the closed position and never left open. After every rain, it should be opened carefully and the waste water allowed to flowing out. The pipe should then be cleaned and the valve or the end cap, closed. Sometimes the first rain separator can get jammed due to the dirt or dust in it. In such a situation the valve or the end cap should be carefully replaced by a good plumber.

Storage cum sedimentation tank or settling tank: A sedimentation tank allows suspended particles to settle out of water or wastewater as it flows slowly through the tank, thereby providing some degree of purification. A layer of accumulated solids, called sludge forms at the bottom of the

tank and is periodically removed. Sedimentation is usually preceded by treatment using bar screens and grit chambers to remove large objects and coarse solids.

Filter Media (Sand): A layer of coarse sand, ranging in thickness from 60 to 90 cm is placed above the gravel. The effective size of sand used varies from 0.35 to 0.60 mm and its uniformity coefficient is between 1.20 and 1.70, ensuring increased rate of filtration on account of the increase in the void space between particles when compared to slow sand filters



Recharge through recharge pit with recharge well: Water collected from roof top area is diverted to the filter pit constructed near the building to recharge the ground water resource. The rain water from the filter pit will then be used for recharge to ground water.

Recharge computation from recharge well:

1. Injection Recharge Rate = ‘a’ lps

2. No of days of recharge = ‘b’ days

3. Quantity of recharge in cubic meter = a X 86.4 X b

4. Here a= 2.66 lps (Recharge rate is taken as 60% of the discharge capacity of nearby wells of lease area. Average discharge is 4.44 lps so recharge rate would be 2.66 lps.

5. b= 60 days (rain water available days)

6. Recharge= 2.66X86.4X60= 13789 cubic meter

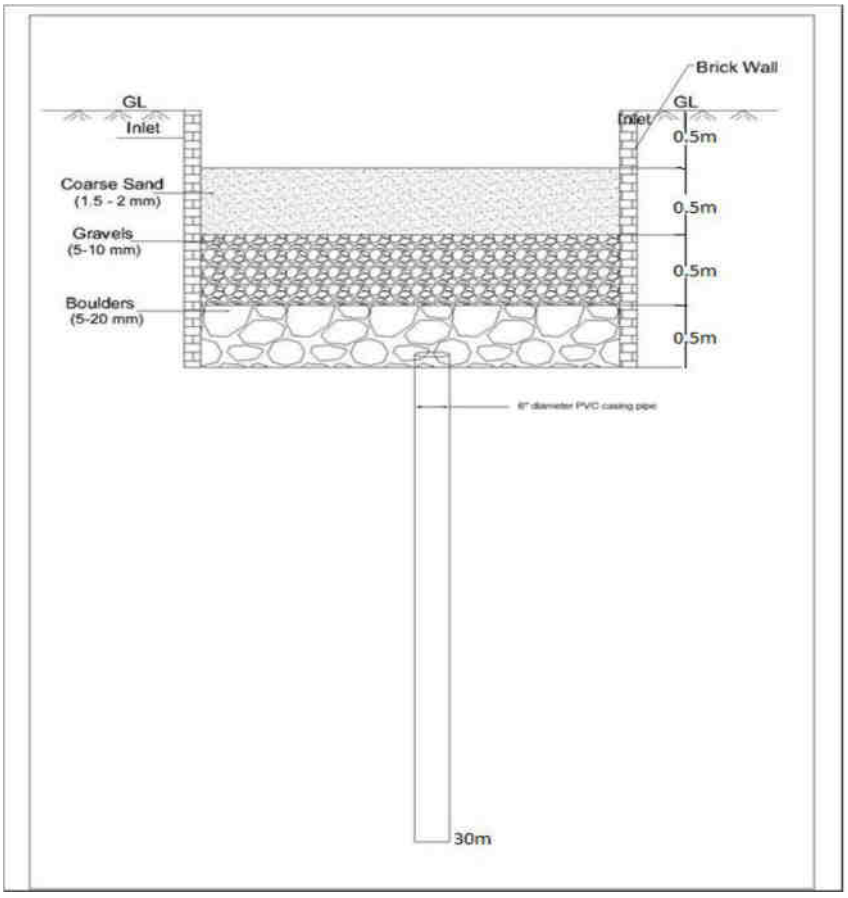
7. No of structures = 4

8. Rain water harvesting potential from Roof Top area = 48075 cubic meters.

9. So, recharge will take place from four recharge pit with well.

Recharge through Recharge pit with well = 48075 cu.m / year

A schematic design of a recharge pit with recharge well is shown below:



Recharge from rain water harvesting through trenches along green belt, open land and road area (Cu.m/year)	Recharge from Roof top rain water harvesting	Total Recharge (cu.m/year)
4	48075	52260

7.5 SALINE WATER DISPOSAL STRATEGIES (INCASE OF SALINE WATER ABSTRACTION)

The industry is not using saline water. Hence, the disposal of saline water does not arise

8. ANY OTHER DETAILS PERTAINING TO THE PROJECT

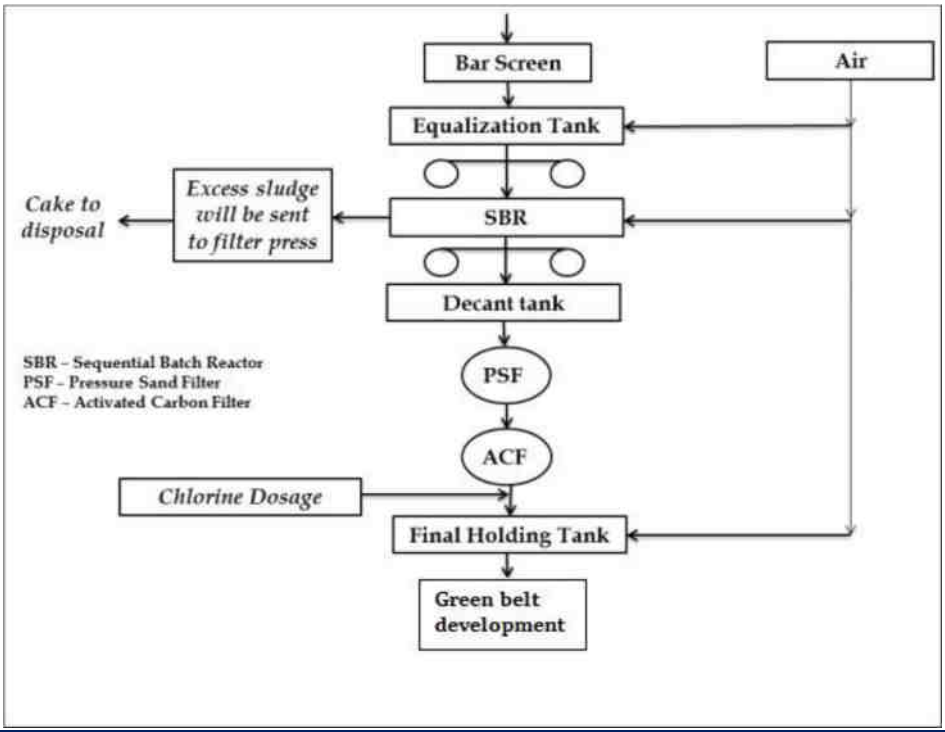
Sewage Treatment Plants

As per the CGWA Guidelines, STP to be installed if the domestic consumption is more than 20 cu.m / day. The total water requirement of the project for domestic use is 40 cu.m/day. The sewerage disposal at mine site will be through septic tanks while a sewerage treatment plant (STP) will be provided at the colony. The sewage is the water used by the community and drained into the sewer system. Usually, a small portion of spent water is lost in evaporation, seepage in ground, leakage, etc. About 70%-80% of the water supply reaches the sewers. This quantum will be treated in the STP.

Capacity of Sewage Treatment Plant = 80% of Total Water Supply

= 0.80 * 32 cu.m/day = 26 cu.m/day

= 26 cu.m/day



9 SUMMARY AND CONCLUSION

In order to augment coal production to meet the growing demand for the generation of power, the Government of India has allotted Shahpur West Coal Block covering an area of 619 Ha under Government dispensation route to M/s Sarda Energy and Mineral Limited, Shahpur West Coal Mine, Sohagpur Coalfield, Pali and Sohagpur Tehsil, Umaria & Shahdol districts, Madhya Pradesh.

A numerical groundwater flow model was developed and calibrated by using extensive geological, hydrogeologic and existing mine data representing present mining scenario with the objective of predicting potential impacts of the proposed projects on the ground water regime, including lowering of groundwater-level.

Dewatering of the Shahpur West Coal UG Mine project will result in lowering of groundwater levels (observed heads) to a depth of 466 m at the end of the 5th year and 464 m at the end of the 10th year in the mine lease area against the Initial Head of 475 m.
This will create a drawdown in the regional groundwater system propagating outward. The drawdown will be most dynamic in the vicinity of the project, the effects of which will decrease with increased distance from the project.

The predicted radius of influence is 210 m. The convergent of flow in the mine pit indicates the ground water flow towards the mine pit and the radius of influence is limited the mine lease area. Ground water modeling study reveals that the pumping in the second layer has very less effect on Unconfined Aquifer. The Mine dewatering is from the first and second layer. The dewatering quantity of 1772 cum/day for the Mine would not make adverse impact in the ground water system of the model area.

The predicted drawdown is at the time of dewatering. During the monsoon period and non-mining period the water level raise to the original water level in the monsoon period.
All treated domestic wastewater duly complying with MPPCB/CPCB norms will be utilized on land of project premises for greenbelt development. Treated wastewater will therefore not impact any existing surface water body or groundwater.

The estimated seepage using TIL formula as per SOP is 1772 m3/day which is inclusive of the present predicted seepage. While the model predicted seepage is 1771 m3/day. Hence the dewatering quantity of 1772 m3/day is considered. In addition to that 32 m3/day of ground water from borewell is proposed to utilized for drinking and domestic purposes for mine workmen in the lease area. Therefore, the total pumped out quantity 1804 m3/day is considered for NOC application.

It can be concluded that after the implementation of the mitigation measures, the project activities would have no adverse impacts on the groundwater regime. The activities of the proposed UG Coal Mine will be done in accordance with rules and regulations as stipulated in the relevant legislations for setting up the project.

NOC Requested for <u>1804 cu.m/ day</u> (1772 cu.m / day from mine seepage, + 32 cu.m / day from bore well sources)

The Central Ground Water Authority (CGWA) is requested to consider the proposal and accord NOC.

10 ACCREDITATION CERTIFICATE

Accreditation Board of CGWA

Certificate of Accreditation

Mr. V. Pugazhendy

Has been accredited as Ground Water Professional to prepare reports in the Functional Areas of

- *Impact Assessment Report with Modelling.*
- *Hydrogeological Report for mining projects.*

Valid from : 01.10.2021

Valid thru : 30.09.2026

Certificate No. : CGWA/RGI/042

Dated : 30.11.2021

क्षेत्रीय निदेशक
Regional Director
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

सदस्य
Member
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

Accreditation Board of CGWA

Certificate of Accreditation

Mr. V. Pugazhendi

Has been accredited as a Ground Water Professionals to prepare reports in the Functional Areas of

- *Impact Assessment of Existing / Proposed GW Extraction*

Valid from : 15.02.2021

Valid thru : 14.02.2026

Certificate No. : CGWA/RGI/012

Dated : 07.07.2021

क्षेत्रीय निदेशक
Regional Director
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

सदस्य
Member
आरजीएनजीडब्ल्यूटीआरआई
RGNGWT&RI

Annexure 1: Copy of Work Order

1st Floor, Vanijya Bhawan, Jail Road,
Devendra Nagar Square,
Raipur – 492001 (C.G.)
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Fax: +91 7712214213/14
PAN No.: AAACR6149L
CIN: L27100MH1973PLC016617
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info@seml.co.in

An ISO 9001, ISO 14001 & OHSAS 18001 Certified Company

SARDA
SARDA ENERGY & MINERALS LTD.

Ref: SEML/COAL/SW/HG/006
Date: 18.04.2022

Mr. V. Pugazhendi
Accrediadated Consultant from CGWA&NABET
A-6 Balaji Arcade, 140- Arcot Road,
Virugabakkam, Chennai- 600092
Mob. : 944319234

Sub: Servide Order for preparation of comprehensive hydrogeological report with groundwater modeling on groundwater conditions in core and buffer zones of Shahpur West Coal Mine for obtaining NOC from CGWB/CGWA for groundwater from Borewell and Drawl of Mine Seepage water from undergroung face.

Dear Sir,

With reference to the subject cited matter, we are please to award the Servide Order for preparation of comprehensive hydrogeological report with groundwater modeling on groundwater conditions in core and buffer zones of Shahpur West Coal Mine for obtaining NOC from CGWB/CGWA for groundwater from Borewell and Drawl of Mine Seepage water from undergroung face.

The Description, Scope of Works and the terms & conditions are as given below:

1. **Scope of Work:**
   The study is to be done as per new guidelines/ Gazette notification issued by CGWA from time to time and format of report as per CGWA guideline

   Considering these aspects, the main scope of the assignment can be defined as –
   a) To assess the present hydro geological setup of the core and buffer zone.
   b) To assess the availability of groundwater source and potentiality of the study area.
   c) To assess the quality and quantity of groundwater source in core and buffer zone including ground water hydraulics, to assess the impact due to mining activity.
   d) To identity potable potential zones in the core and buffer zone and to locate the existing and tapping points in identified zones, for meeting the requirements of fresh water.
   e) To identify and assess the quantum of Mine Seepage due to intersection of water table.
   f) To identify appropriate location for artificial recharge of groundwater to have sustainable yield in all the existing and proposed groundwater discharging structures and also to improve groundwater quality and quantity.
   g) Submission of Application (online and/or Offline) for grant of NOC from CGWB/CGWA
   h) To prepare technical reports and maps for implementation and also for assist in technical discussions for execution of NOC from CGWA, for ground water extraction.

2. **Deliverables:** Preparation and submission of report - Soft copy and two hard copy of final report along with maps will be submitted to M/s. Sarda Energy & Minerals Ltd.

SARDA ENERGY & MINERALS LTD. RAIPUR

3. **Time Period:** Comprehensive hydro geological report for Shahpur West Coal Mine shall be submitted within 120 days after completion of field work. Field work will be started within 7 days after award of this Service Order.

4. **PROFESSIONAL CHARGES:**
The total lump sum fees for the above mentioned scope of work shall be [redacted]

5. **STATUTORY FEE**: All the statutory fee as applicable shall be paid by SEML

6. **GST:** Additional at actual as per prevailing government rates (SEML GST no is 27AAMCS9942A1Z3)

7. **T.D.S:** will be deducted as per prevailing government rates.

8. The Professional Charges also include expenses for lodging, boarding and transportation for your personnel and equipments.

9. **WORK SUPERVISION/VERIFICATION:**
The above mentioned work will be monitored and verified stage wise by SEML and all the related payments on each stage shall be certified along the submission of Invoices to Mr Mrinal Sachdev –Manager or any other person nominated by him.

10. **SITE COORDINATOR:** Shri Shyam Shukla, Mob: 81204 56223

11. **PAYMENT TERMS**
All payments for the above work shall be made as per submission of Invoices certified by Mr Mrinal Sachdev –Manager or any other person nominated by him.
   a. 30% advance along with work order.
   b. 20% payment after completion of field work.
   c. 30% payment after submission of comprehensive hydrogeological report and application.
   d. 20 % payment after grant of NOC.

We hope you shall find our offer in order. Please feel free to seek clarifications, if any.

As a token of Acceptance of the above terms & conditions, kindly return a signed copy of this service order.

Thanking you,

Yours Faithfully
For Sarda Energy & Minerals Limited

Authorized Signatory

Annexure 2: Copy of Amendment letter from MoEF

F.No. J-11015/280/2010-IA-II(M)
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)
*****

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi – 3
Email: lk.bokolia@nic.in Tel: 01120819417

Dated: 12th May, 2022

To,

Head Corporate Affairs
M/s Sarda Energy and Minerals Limited
Vanijya Bhawan, Jail Road
District Shahdol-492001, Madhya Pradesh
Email: pduttagupta@seml.co.in

Sub: Sahapur West UG Coal Mine of 0.6 MTPA (Peak production) in an area of 594.401 Ha of M/s Sarda Energy and Minerals Limited at village Khamariya Khurd, Kushmaha Khurd, Shahpur, Tehsil Pali of District Umariya and village Khamhariya Kala, Kathotiya, Tehsil Suhagpur, District Shahdol (Madhya Pradesh) - For Amendment in Terms of Reference- reg

Sir,

This has reference to your Online Proposal No. IA/MP/CMIN/266928/2022 dated 12th April, 2022, on the above-mentioned subject.

2. The Ministry of Environment, Forest and Climate Change vide letter dated 22.11.2021 had granted Terms of Reference to Sahapur West UG Coal Mine of 0.6 MTPA (Peak production) in an area of 594.401 Ha of M/s Sarda Energy and Minerals Limited at village Khamariya Khurd, Kushmaha Khurd, Shahpur, Tehsil Pali of District Umariya and village Khamhariya Kala, Kathotiya, Tehsil Suhagpur, District Shahdol (Madhya Pradesh).

3. Project Proponent has requested for amendment to increase the area from 594.401 to 619.0 Ha. The revision in details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under: -

(i) Total mining lease area as per block allotment is 619 ha. Mining Plan and Mine Closure Plan for 587.5 Ha. Block Area was approved by Ministry of Coal vide 13016/28/2010-CA-I dated 07.02.2012. (Internal Committee constituted under MMDR Act 1957 for approval of Mining Plan / Mine Closure Plan has recommended the approval of Revised Mining Plan is beinghas been submitted for re-demarked Block area of 619 Ha. with a mining lease area 619 Ha. in its meeting held on 28/02/2022)

(ii) The change in land use pattern as per the issued ToR of the project is as mentioned below:

Pre-mining land use details

Land Type		Earlier (In TOR) Area in Ha.	Amendment Requested Area in Ha.
Tenancy	Agricultures (includes few residential houses)	497.777	511.220
	Township		
	Grazing	-	-
	Barren	-	-
	Water Bodies	-	-
	Road	-	-
	Community/ Other	-	-
Govt. Non Forest	Agriculture	1.337	2.191
	Township	-	-
	Road	6.282	3.583
	River/Nallah	9.643	9.418
	Water Bodies	13.868	9.100
	Grazing	3.258	
	Community/ Other	17.956	2.898
	Barren	-	-
Forest	Revenue Forest	15.949	34.102
	Reserve	16.083	34.240
	Protected	12.248	12.248
Free Hold		-	-
Total		**594.401**	**619.000**

Land use During Mining

Type	Earlier (In TOR) Area in Ha.	Amendment Requested Area in Ha.
Top Soil Dump	0.030	0.030
Settling pond	0.200	0.200
Ventilation shaft	0.170	0.170
Coal stack yard	0.630	0.630
Magazine	0.185	0.185
Transportation and approach road	13.888	4.005
Other support infra including internal road, office, workshop, store, CHP, Canteen, Diesel Bunk and area between the building		9.884
Embankment	0.877	0.880
UG Entry	0.300	0.300
Green Belt	8.018	8.020

Undisturbed/ Mining right for UG	570.103	594.696
Total	**594.401**	**619.000**

Post Mining

Proposed Land Use Details (After Amendment)

Type	Land use (Proposed)	Land Use (End of Life)	Land use (Post Closure)						
			Agricultural land	Plantation	Water Body	Public/ Company use	Forest Land (Returned)	Undisturbed	Total
Excavation Area	-	-	-	-	-	-	-	-	-
Backfilled Area	-	-	-	-	-	-	-	-	-
Excavated Void	-	-	-	-	-	-	-	-	-
Without plantation	-	-	-	-	-	-	-	-	-
Top Soil Dump	0.03	-	-	-	-	-	-	-	**0.03**
External Dump	-	-	-	-	-	-	-	-	-
Safety Zone	-	-	-	-	-	-	-	-	-
Haul Road between quarries	-	-	-	-	-	-	-	-	-
Road diversion	-	-	-	-	-	-	-	-	-
Diversion / below River/Nallah/canal	-	-	-	-	-	-	-	-	-
Settling pond	0.20	0.20	-	0.20	-	-	-	-	**0.20**
Road & Infrastructure area	14.87	14.87	-	10.20	-	4.68	-	-	**14.87**

Rationalization area	-	-	-	-	-	-	-	-	-
Garland drains	-	-	-	-	-	-	-	-	-
Embankment	0.88	0.88	-	0.88	-	-	-	-	**0.88**
Green Belt	8.02	8.02	-	8.02	-	-	-	-	**8.02**
Water Reservoir near pit	-	-	-	-	-	-	-	-	-
UG Entry	0.30	0.30	-	0.30	-	-	-	-	**0.30**
Undisturbed/ Mining right for UG	594.702	594.702	-	-	-	-	-	594.702	**594.702**
Resettlement	-	-	-	-	-	-	-	-	-
Pit head power plant	-	-	-	-	-	-	-	-	-
Water harvesting	-	-	-	-	-	-	-	-	-
Agricultural land	-	-	-	-	-	-	-	-	-
Total	**619.000**	**618.970**	-	**19.593**	-	**4.675**	-	**594.702**	**619.000**

Core area: Mining Lease Area is 619 Ha

(iii) Total geological reserve reported in the mine lease area is 39.709MT with 17.380 MT mineable reserves. Out of total mineable reserve of 10.38MT, 10.38 MT are available for extraction. Percent of extraction is 29.049%

(iv) 3 seams with thickness ranging from 0.15 m –4.16 m are workable. Grade of coal is G7, while gradient is 1 in 23 to 1 in 57

(v) Method of mining operations envisages by Mechanised board and pillar underground mining by Continuous Miner with shuttle cars as well as LHDs and SDLs with solid blasting method.

(vi) Life of mine is 19 years.

(vii) The proposed is an underground mine. The coal from the underground working face will be evacuated through conveyor. On surface the coal will be dumped in a ground hopper from where it will be stored in silo.

(viii) 80.590 ha of forest land has been reported to be involved in the project. Approval under the Forest (Conservation) Act, 1980 for diversion of 80.590ha of forest land for non-forestry purposes application will be submitted shortly

3. The application for grant of amendment in ToR for increase in Mining Lease Area 594.401 Ha to 619 Ha is submitted by the PP as per the details hereunder; -

Details	Area as per granted ToR	Proposed Change	Final Area Amendment	Remarks
Mine Lease Area	594.401 Ha	24.599 Ha	619 Ha	Increasing due to addition of new area.
Private Land	497.542 Ha	13.678 Ha	511.220 Ha	Increasing due to addition of New area and change in Land schedule as per DGPS survey
Forest Area	44.28 Ha	36.310 Ha	80.590 Ha	Increasing due to addition of New area and change in Land schedule as per DGPS survey
Govt. Land	52.579 Ha	-25.389 Ha	27.190 Ha	Decreasing as a result of change in Land schedule as per DGPS survey

4. The Expert Appraisal Committee in its 29th EAC meeting held on 25th & 26th April, 2022, through Video Conferencing has recommended the proposal for grant of amendment in Terms of References (ToR) w.r.t the increase in area is mainly due to the increase in forest area of 36.310 Ha i.e total 80.590 Ha and private land by 13.678 Ha.

Details	Area as per granted ToR	Proposed Change	Final Area Amendment
Mine Lease Area	594.401 Ha	24.599 Ha	619 Ha
Private Land	497.542 Ha	13.678 Ha	511.220 Ha
Forest Area	44.28 Ha	36.310 Ha	80.590 Ha
Govt. Land	52.579 Ha	-25.389 Ha	27.190 Ha

5. Based on the recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby grants approval as in para above to the amendment in Terms of References for Sahapur West UG Coal Mine of 0.6 MTPA (Peak production) in an area of 619 Ha (previously 594.401 Ha) of M/s Sarda Energy and Minerals Limited at village Khamariya Khurd, Kushmaha Khurd, Shahpur, Tehsil Pali of District Umariya and village Khamhariya Kala, Kathotiya, Tehsil Suhagpur, District Shahdol (Madhya Pradesh), under the provisions of EIA Notification, 2006 and its amendments therein with following additional specific conditions to be followed:

(i) The Stage –I FC to be obtained by PP for 80.590 ha
(ii) The revised mine plan to be submitted by PP at the time of EC

6. All other conditions stipulated in ToR No. F No. J-11015/280/2010-IA- II(M) Dated 21st November, 2021 shall remain unchanged and this letter shall be read with ToR letter dated 21.11.2021.

This issues with the approval of the competent Authority.

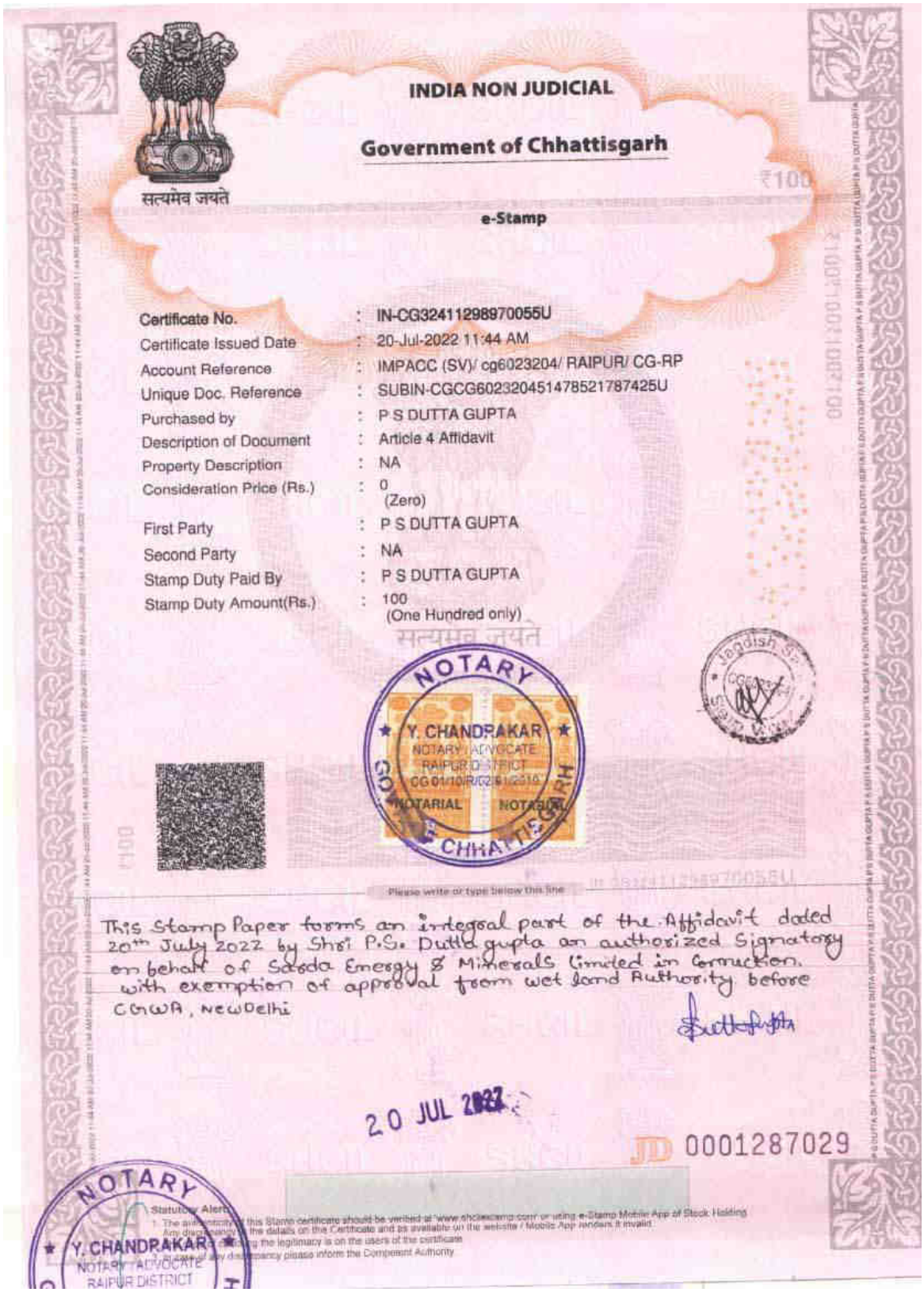
(Lalit Bokolia)
Director

Copy to: -

1. The Principal Chief Conservator of Forests, Head of Forest Force, Madhya Pradesh Forest Department, Sapura Bhawan, 1st Floor, Bhopal (Madhya Pradesh)
2. The Member Secretary, Madhya Pradesh State Pollution Control Board, Paryavaran Parisar, E-5, Arera Colony, Bhopal -462 016 (Madhya Pradesh)
3. The District Collector, Shahdol, Government of Madhya Pradesh
4. The District Collector, Umariya, Government of Madhya Pradesh
5. Monitoring File/Guard File/Record File.
6. PARIVESH Portal

(Lalit Bokolia)
Director

Annexure 3 Wetland Affidavit



सत्यमेव जयते

INDIA NON JUDICIAL

Government of Chhattisgarh

e-Stamp

Certificate No.	:	IN-CG32411298970055U
Certificate Issued Date	:	20-Jul-2022 11:44 AM
Account Reference	:	IMPACC (SV)/ cg6023204/ RAIPUR/ CG-RP
Unique Doc. Reference	:	SUBIN-CGCG60232045147852178742 5U
Purchased by	:	P S DUTTA GUPTA
Description of Document	:	Article 4 Affidavit
Property Description	:	NA
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	P S DUTTA GUPTA
Second Party	:	NA
Stamp Duty Paid By	:	P S DUTTA GUPTA
Stamp Duty Amount(Rs.)	:	100 (One Hundred only)

NOTARY Y. CHANDRAKAR NOTARY / ADVOCATE RAIPUR DISTRICT CG 01/10/R/02[illegible]/2018 NOTARIAL

Please write or type below this line

This Stamp Paper forms an integral part of the Affidavit dated 20th July 2022 by Shri P.S. Dutta gupta an authorized Signatory on behalf of Sarda Energy & Minerals Limited in Connection with exemption of approval from wet land Authority before CGWA, NewDelhi

20 JUL 2022

JD 0001287029

NOTARY Y. CHANDRAKAR NOTARY / ADVOCATE RAIPUR DISTRICT

Statutory Alert:
1. The authenticity of this Stamp certificate should be verified at "www.shcilestamp.com" or using e-Stamp Mobile App of Stock Holding. Any discrepancy in the details on the Certificate and as available on the website / Mobile App renders it invalid.
2. The onus of checking the legitimacy is on the users of the certificate.
3. In case of any discrepancy please inform the Competent Authority.

Affidavit for exemption of approval from Wet land Authority
Before the Central Ground Water Authority, New Delhi

AFFIDAVIT

I, Partha Sarthi Duttagupta, S/o. Shri Piyushkanti Duttagupta, aged 63 years R/o 59, Navjivan Housing Society, Pachpedinake, Raipur (CG), Pin. 492001 Authorized Signatory on behalf of M/s Sarda Energy & Minerals Limited hereby solemnly affirm and declare as under:

1. That the present affidavit is sworn in by me in my capacity as an authorized person on behalf of M/s SARDA ENERGY & MINERALS LIMITED (a company registered under the Companies Act, [1956/2013]) having its registered office at 73/A, Central Avenue, Nagpur (Maharashtra) - 440018 for ground water extraction from its proposed Sahapur West UG Coal mine Project located in Village Khamhariya Khurd, Kushmaha Khurd, Sahapur, Tehsil – Pali of Umaria District and Village, Khamhariya Kala, Kathotiya, Tehsil – Sohagpur of Shahdol District, Madhya Pradesh in accordance with CGWA guideline.

2. I hereby undertake that the above said project is located more than 500 m away from the periphery of any demarcated wetland areas declared by State/Central Wetland Authority/Department.

DEPONENT

VERIFICATION

Verified at Raipur, on this the 20th day of July 2022 that the contents of the above affidavit are true to the best of my knowledge and belief and that it conceals nothing and that no part of it is false. I understand that if any information furnished by me is found to be false, Central Ground Water Authority can take punitive action against me.

DEPONENT

NOTARY
Y. CHANDRAKAR
NOTARY ADVOCATE
RAIPUR DISTRICT
CG 01/10/R/02/01/2019
GOVT. OF CHHATTISGARH

ATTESTED
Yudhishthir Chandrakar
NOTARY / ADVOCATE
RAVIGRAM, RAIPUR (C.G.)
CG 01/10/R/02/01/2019

20 JUL 2022

GOVT. OF CHHATTISGARH

Annexure 4: Ground water Quality report

EKO PRO ENGINEERS PVT. LTD.
Environmental Consultants and Analytical Laboratory
(An ISO 9001:2015 Certified Company)
Contact : +91 - 9810243870
Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No : EKO/117/111221 Issue Date : 17/12/2021

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	: Ground Water
Sample Drawn on	: 02/12/2021
Sample Drawn by	: Given by Client
Sample Received on	: 11/12/2021
Sampling Location	: From Borewell (Malchua)
Sampling Plan & Procedure	: NA
Sample Quantity	: 1.0 Litre
Environmental Conditions	: NA
Analysis Duration	: 11/12/2021 To 16/12/2021
Remark (if any)	: Sample Code : SEML/01

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.22	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	416.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	170.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	40.9	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	32.8	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	270.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	16.52	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	48.2	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	2.18	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	164.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. This test report will not be generated again, either wholly or in part, without prior written permission of the Laboratory.
3. The test report will not be used for any publicity/legal purpose.
4. The test samples will be disposed off after 15 days from the date of issue of test report, unless until specified by the customer. Sample received for biological tests will be destroyed after 7 days from the date of issue of test report.
5. Responsibility of the Laboratory is limited to the invoiced amount only.

End of Report

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAIZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1

EKO PRO ENGINEERS PVT. LTD.
Environmental Consultants and Analytical Laboratory
(An ISO 9001:2015 Certified Company)
Contact : +91 - 9810243870
Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No : EKO/118/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	: Ground Water
Sample Drawn on	: 02/12/2021
Sample Drawn by	: Given by Client
Sample Received on	: 11/12/2021
Sampling Location	: From Borewell (Lamro)
Sampling Plan & Procedure	: NA
Sample Quantity	: 1.0 Litre
Environmental Conditions	: NA
Analysis Duration	: 11/12/2021 To 16/12/2021
Remark (if any)	: Sample Code : SEML/02

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.09	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	523.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	240.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	57.7	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	49.6	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	340.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	23.33	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	81.4	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	3.18	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	210.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAIZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1

Analytical Services - Analysis of Environment, Food, AYUSH, Cosmetics, Toy & Material, Leather Products, Petroleum & Building Material Samples in Biological, Chemical, Electrical & Mechanical Disciplines.

EKO PRO ENGINEERS PVT. LTD.
Environmental Consultants and Analytical Laboratory
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Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No : EKO/119/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	:	Ground Water
Sample Drawn on	:	02/12/2021
Sample Drawn by	:	Given by Client
Sample Received on	:	11/12/2021
Sampling Location	:	From Borewell (Kalyanpur KVK-Shahdol)
Sampling Plan & Procedure	:	NA
Sample Quantity	:	1.0 Litre
Environmental Conditions	:	NA
Analysis Duration	:	11/12/2021 To 16/12/2021
Remark (if any)	:	Sample Code : SEML/03

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.32	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	338.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	152.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	36.5	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	39.8	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	220.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	14.82	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	45.6	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	1.12	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	142.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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5. Responsibility of the Laboratory is limited to the invoiced amount only.

****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAIZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

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Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No : EKO/120/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	: Ground Water
Sample Drawn on	: 02/12/2021
Sample Drawn by	: Given by Client
Sample Received on	: 11/12/2021
Sampling Location	: From Borewell (Khamaria Kalan)
Sampling Plan & Procedure	: NA
Sample Quantity	: 1.0 Litre
Environmental Conditions	: NA
Analysis Duration	: 11/12/2021 To 16/12/2021
Remark (if any)	: Sample Code : SEML/04

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.14	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	320.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	140.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	33.7	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	37.2	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	210.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	13.61	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	41.2	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	1.19	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	140.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. This test report will not be generated again, either wholly or in part, without prior written permission of the Laboratory.
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****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAJZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
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TEST REPORT

Water Sample Analysis

Test Report No : EKO/121/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	:	Ground Water
Sample Drawn on	:	02/12/2021
Sample Drawn by	:	Given by Client
Sample Received on	:	11/12/2021
Sampling Location	:	From Borewell (Majhgawan)
Sampling Plan & Procedure	:	NA
Sample Quantity	:	1.0 Litre
Environmental Conditions	:	NA
Analysis Duration	:	11/12/2021 To 16/12/2021
Remark (if any)	:	Sample Code : SEML/05

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.16	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	470.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	184.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	44.1	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	45.6	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	310.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	17.98	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	72.9	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	2.46	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	180.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. This test report will not be generated again, either wholly or in part, without prior written permission of the Laboratory.
3. The test report will not be used for any publicity/legal purpose.
4. The test samples will be disposed off after 15 days from the date of issue of test report, unless until specified by the customer. Sample received for biological tests will be destroyed after 7 days from the date of issue of test report.
5. Responsibility of the Laboratory is limited to the invoiced amount only.

****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAIZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1

EKO PRO ENGINEERS PVT. LTD.
Environmental Consultants and Analytical Laboratory
(An ISO 9001:2015 Certified Company)
Contact : +91 - 9810243870
Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No : EKO/122/111221 Issue Date : 17/12/2021

Issued To : M/S SARDA ENERGY & MINERALS LIMITED
Coal Mines Shahpur,
Distt. - Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	: Ground Water
Sample Drawn on	: 02/12/2021
Sample Drawn by	: Given by Client
Sample Received on	: 11/12/2021
Sampling Location	: From Borewell (Shahpur)
Sampling Plan & Procedure	: NA
Sample Quantity	: 1.0 Litre
Environmental Conditions	: NA
Analysis Duration	: 11/12/2021 To 16/12/2021
Remark (if any)	: Sample Code : SEML/06

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS: 10500-2012 (Amd.No.3 Feb-2021)	
					Acceptable	Permissible
1	Colour	IS: 3025 (P-4)	<1.0	Hazen	5.0	15.0
2	Odour	IS: 3025 (P-5)	Agreeable	–	Agreeable	Agreeable
3	Turbidity	IS: 3025 (P-10)	<1.0	NTU	1.0	5.0
4	pH	IS: 3025 (P-11)	7.19	–	6.5-8.5	No relaxation
5	Electrical Conductivity	IS: 3025 (P-14)	530.0	µs/cm	–	–
6	Total Hardness (as $CaCO_3$)	IS: 3025 P-21)	248.0	mg/L	200.0	600.0
7	Calcium (as Ca)	IS: 3025 (P-40)	59.7	mg/L	75.0	200.0
8	Iron (as Fe)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	1.0	No relaxation
9	Chloride (as Cl)	IS: 3025 (P-32)	52.8	mg/L	250.0	1000.0
10	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.0	1.5
11	Total Dissolved Solids	IS: 3025 (P-16)	360.0	mg/L	500.0	2000.0
12	Magnesium (as Mg)	IS: 3025 (P-46)	24.06	mg/L	30.0	100.0
13	Sulphate (as SO_4)	IS: 3025 (P-24)	78.2	mg/L	200.0	400.0
14	Nitrate (as NO_3)	IS: 3025 (P-34)	2.95	mg/L	45.0	No relaxation
15	Total Alkalinity (as $CaCO_3$)	IS: 3025 (P-23)	220.0	mg/L	200.0	600.0
16	Total Coliform	IS: 1622	Absent (<2)	MPN/100ml	Should be Absent	No relaxation

Remark:- Standard Applicable only for Drinking Water.

Notes:

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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5. Responsibility of the Laboratory is limited to the invoiced amount only.

End of Report

For EKO PRO ENGINEERS PVT. LTD.
SHIVANGI SINGH RAIZADA
SECTION INCHARGE MICROBIOLOGY
(Authorised Signatory)

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1

Annexure 5 Surface Water Quality results

Contact : +91 - 9810243870

EKO PRO ENGINEERS PVT. LTD.

Environmental Consultants and Analytical Laboratory

(An ISO 9001:2015 Certified Company)

Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No. : EKO/123/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED.
Coal Mines Shahpur
Distt.- Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	:	Surface Water
Sample Drawn on	:	03/12/2021
Sample Drawn by	:	Given by Client
Sample Received on	:	11/12/2021
Sampling Location	:	Nala/Nadi Water (Ghughara Nala)
Sampling Plan & Procedure	:	NA
Sample Quantity	:	1.0 Litre
Environmental Condition	:	NA
Analysis Duration	:	11/12/2021 To 16/12/2021
Remark (if any)	:	Sample Code : SEML/07

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS : 2296-1982
1	pH	IS: 3025 (P-11)	7.11	-	6.5-8.5
2	Chloride (as Cl)	IS: 3025 (P-32)	49.2	mg/L	600
3	Electrical Conductivity	IS: 3025 (P-14)	446.0	µs/cm	–
4	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.5
5	Total Dissolved Solids	IS: 3025 (P-16)	290.0	mg/L	1500
6	Sulphate (as SO4)	IS: 3025 (P-24)	59.8	mg/L	400.0
7	Lead (as Pb)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	0.1
8	Zinc (as Zn)	EKO/CHEM/SOP-ICPMS/W-01	0.31	mg/L	15.0
9	Cadmium (as Cd)	APHA 3125 B	<0.001	mg/L	0.0
10	COD (as O2)	IS: 3025 (P-58)	20.5	mg/L	-
11	BOD	IS: 3025 (P-44)	2.6	mg/L	3.0
12	Dissolved Oxygen	IS: 3025 (P-38)	5.2	mg/L	4.0 (Min.)

Notes :

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. This test report will not be generated again, either wholly or in part, without prior written permission of the Laboratory.
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5. Responsibility of the Laboratory is limited to the invoiced amount only.

****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1.

EKO PRO ENGINEERS PVT. LTD.
Contact : +91 - 9810243870
Environmental Consultants and Analytical Laboratory
(An ISO 9001:2015 Certified Company)
Office & Laboratory : 32/41, South Side of G. T. Road, UPSIDC Industrial Area, Ghaziabad - 201 009 (Delhi-NCR) INDIA.
Contact No.: 9818405427, 9810240678, 8826344487 E-mail : email@ekopro.in, ekoproengineers@gmail.com, website : www.ekopro.in

TEST REPORT

Water Sample Analysis

Test Report No. : EKO/124/111221 **Issue Date : 17/12/2021**

Issued To : M/S SARDA ENERGY & MINERALS LIMITED.
Coal Mines Shahpur
Distt.- Shahdol
(Madhya Pradesh)
Through : M.K. Associates, Jabalpur (M.P.)

Sample Description	:	Surface Water
Sample Drawn on	:	03/12/2021
Sample Drawn by	:	Given by Client
Sample Received on	:	11/12/2021
Sampling Location	:	Pond Water (Khamaria Khurdh Pond)
Sampling Plan & Procedure	:	NA
Sample Quantity	:	1.0 Litre
Environmental Condition	:	NA
Analysis Duration	:	11/12/2021 To 16/12/2021
Remark (if any)	:	Sample Code : SEML/08

RESULTS

S. No.	Parameters	Test Methods	Results	Units	Limits as per IS : 2296-1982
1	pH	IS: 3025 (P-11)	7.16	-	6.5-8.5
2	Chloride (as Cl)	IS: 3025 (P-32)	28.8	mg/L	600
3	Electrical Conductivity	IS: 3025 (P-14)	169.0	µs/cm	–
4	Fluoride (as F)	IS: 3025 (P-60)	<1.0	mg/L	1.5
5	Total Dissolved Solids	IS: 3025 (P-16)	110.0	mg/L	1500
6	Sulphate (as SO4)	IS: 3025 (P-24)	31.5	mg/L	400.0
7	Lead (as Pb)	EKO/CHEM/SOP-ICPMS/W-01	<0.005	mg/L	0.1
8	Zinc (as Zn)	EKO/CHEM/SOP-ICPMS/W-01	0.28	mg/L	15.0
9	Cadmium (as Cd)	APHA 3125 B	<0.001	mg/L	0.0
10	COD (as O2)	IS: 3025 (P-58)	24.9	mg/L	-
11	BOD	IS: 3025 (P-44)	2.8	mg/L	3.0
12	Dissolved Oxygen	IS: 3025 (P-38)	5.0	mg/L	4.0 (Min.)

Notes :

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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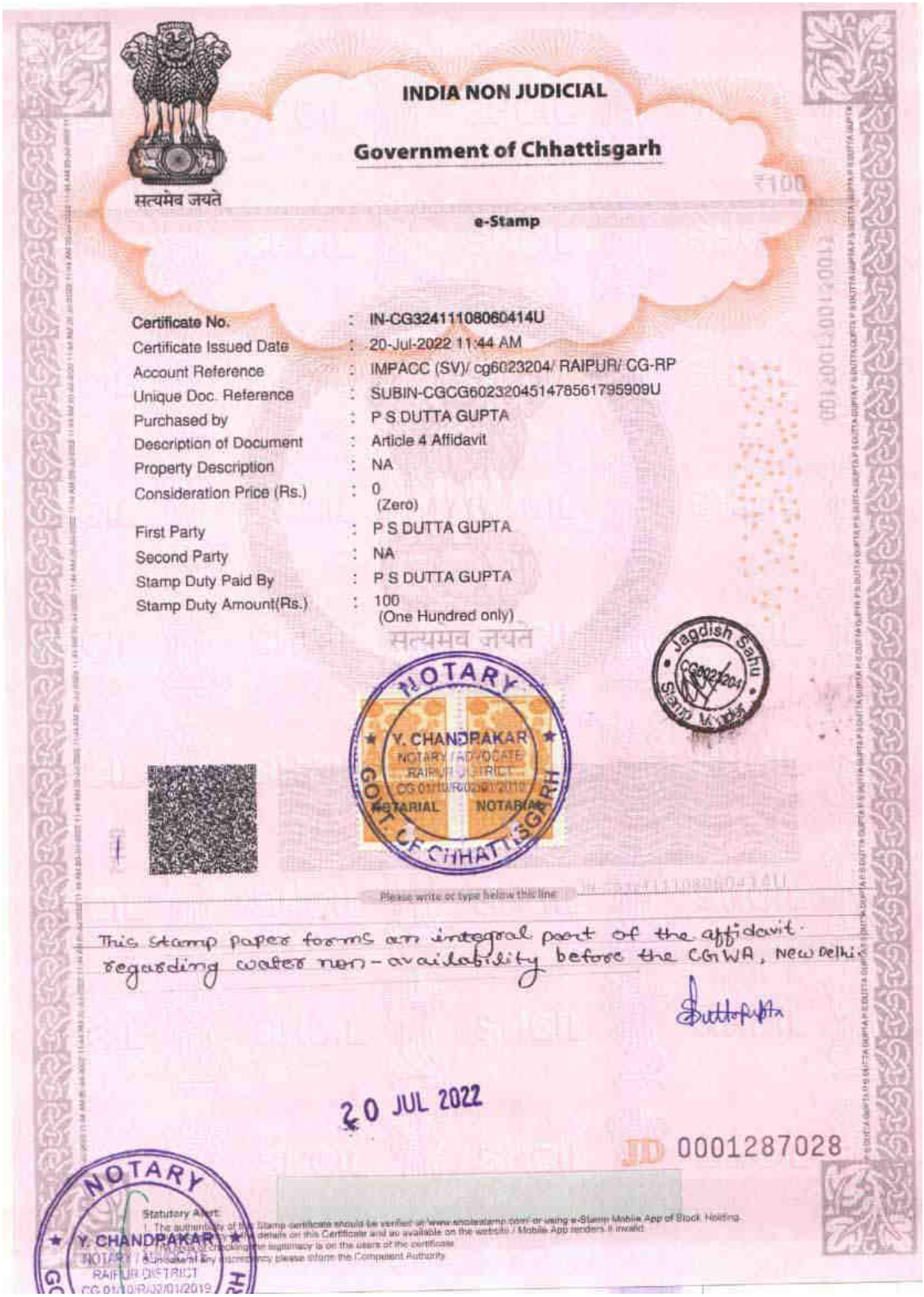
5. Responsibility of the Laboratory is limited to the invoiced amount only.

****End of Report****

For EKO PRO ENGINEERS PVT. LTD.
PURNIMA CHAUHAN
TECHNICAL MANAGER
(Authorised Signatory)

Page 1 of 1

Annexure 6: Non-Availability Affidavite



INDIA NON JUDICIAL

Government of Chhattisgarh

सत्यमेव जयते

e-Stamp

Certificate No.	:	IN-CG32411108060414U
Certificate Issued Date	:	20-Jul-2022 11:44 AM
Account Reference	:	IMPACC (SV)/ cg6023204/ RAIPUR/ CG-RP
Unique Doc. Reference	:	SUBIN-CGCG60232045147856179590 9U
Purchased by	:	P S DUTTA GUPTA
Description of Document	:	Article 4 Affidavit
Property Description	:	NA
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	P S DUTTA GUPTA
Second Party	:	NA
Stamp Duty Paid By	:	P S DUTTA GUPTA
Stamp Duty Amount(Rs.)	:	100 (One Hundred only)

NOTARY Y. CHANDRAKAR NOTARY / ADVOCATE RAIPUR DISTRICT NOTARIAL GOVT. OF CHHATTISGARH

Jagdish Sahu

Please write or type below this line

This stamp papers forms an integral part of the affidavit regarding water non-availability before the CGWA, New Delhi.

Dutta Gupta

20 JUL 2022

JD 0001287028

NOTARY Y. CHANDRAKAR NOTARY / ADVOCATE RAIPUR DISTRICT

Statutory Alert:
1. The authenticity of this Stamp certificate should be verified at www.shcilestamp.com/ or using e-Stamp Mobile App of Stock Holding. Any discrepancy in the details on this Certificate and as available on the website / Mobile App renders it invalid.
2. The onus of checking the legitimacy is on the users of the certificate.
3. In case of any discrepancy please inform the Competent Authority.

AFFIDAVIT REGARDING WATER NON- AVAILABILITY (IN CASE OF GROUND WATER REQUIREMENT IS MORE THAN 10 KLD) BEFORE THE CENTRAL GROUND WATER AUTHORITY, NEW DELHI

AFFIDAVIT

I, Partha Sarthi Duttagupta, S/o. Shri Piyushkanti Duttagupta, aged 63 years R/o 59, Navjivan Housing Society, Pachpedinake, Raipur (CG), Pin. 492001 Authorized Signatory on behalf of M/s Sarda Energy & Minerals Limited hereby solemnly affirm and declare as under:

1. That the present affidavit is sworn in by me in my capacity as an authorized person on behalf of M/s SARDA ENERGY & MINERALS LIMITED (a company registered under the Companies Act, [1956/2013]) having its registered office at 73/A, Central Avenue, Nagpur (Maharashtra) - 440018 for ground water extraction from its proposed Sahapur West UG Coal mine Project located in Village Khamhariya Khurd, Kushmaha Khurd, Sahapur, Tehsil – Pali of Umaria District and Village, Khamhariya Kala, Kathotiya, Tehsil – Sohagpur of Shahdol District, Madhya Pradesh in accordance with CGWA guideline.

2. That groundwater withdrawal for above said project is more than 10 KLD.

3. That the office of Gram Panhay Khamariya Kalan and Gram Panchayat Khamhariya Khurd are not providing any water supply to the firm M/s Sarda Energy & Minerals Limited Located at village Khamhariya Kala, Kathotiya, Block – Sohagpur of Shahdol District, Madhya Pradesh.

4. I hereby undertake that I will submit the non availability certificate in respect of Sahapur West UG Coal mine Project located in Village Khamhariya Khurd, Kushmaha Khurd, Sahapur, Tehsil – Pali of Umaria District and Village Khamhariya Kala, Kathotiya, Tehsil – Sohagpur of Shahdol District, Madhya Pradesh from the concerned authorities.

NOTARY Y. CHANDRAKAR NOTARY ADVOCATE RAIPUR DISTRICT CG 01/10/R/02/01/2019 GOVT. OF CHHATTISGARH

DEPONENT

VERIFICATION

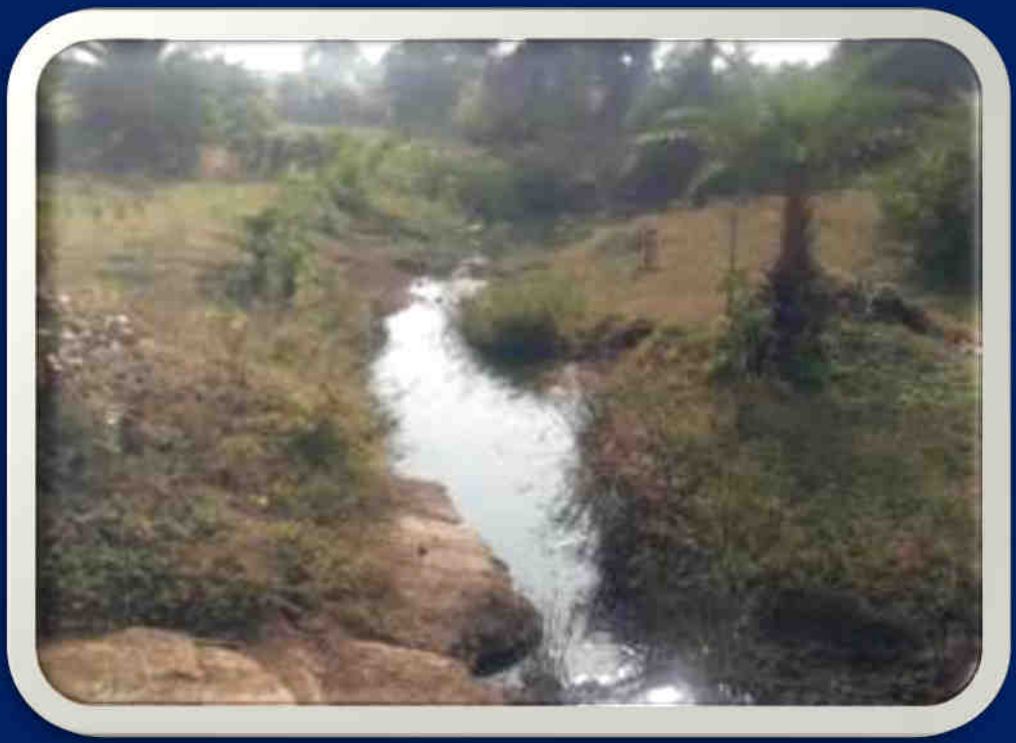
Verified at Raipur, on this the 20th day of July 2022 that the contents of the above affidavit are true to the best of my knowledge and belief and that it conceals nothing and that no part of it is false. I understand that if any information furnished by me is found to be false, Central Ground Water Authority can take punitive action against me.

DEPONENT

ATTESTED

Yudhishthir Chandrakar
NOTARY / ADVOCATE
RAVIGRAM, RAIPUR (C.G.)
CG 01/10/R/02/01/2019

20 JUL 2022



SARDA ENERGY AND MINERALS LIMITED,
73A, Central Avenue,
Nagpur,
Maharashtra 440018,
India

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल प्राधिकरण
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvenation
Central Ground Water Authority

(भूजल निकासी हेतु अनापत्ति प्रमाण पत्र)
NO OBJECTION CERTIFICATE (NOC) FOR GROUND WATER ABSTRACTION

Project Name:	Sarda Energy And Minerals Ltd		
Project Address:	Shahpur West Coal Block, Khamaria Kalan, Sohagpur, Shahdol		
Village:	Khamhariya Kalan	Block:	Sohagpur
District:	Shahdol	State:	Madhya Pradesh
Pin Code:			
Communication Address:	1st Floor, Vanijya Bhawan, Devendra Nagar Square, Jail Road, Dharsiwa, Raipur, Chhattisgarh - 492001		
Address of CGWB Regional Office :	Central Ground Water Board North Central Region, Block-1, 4th Floor, Paryawas Bhawan, Area Hills, Jail Road, Bhopal, Madhya Pradesh - 462011		

1.	**NOC No.:**	CGWA/NOC/MIN/ORIG/2022/17433			
2.	Application No.:	21-4/1480/MP/MIN/2022	3.	Category: (GWRE 2020)	Safe
4.	Project Status:	New Project	5.	NOC Type:	New
6.	**Valid from:**	29/12/2022	7.	**Valid up to:**	28/12/2024

8. Ground Water Abstraction Permitted:

Fresh Water		Saline Water		Dewatering		Total	
m³/day	m³/year	m³/day	m³/year	m³/day	m³/year	m³/day	m³/year
1804.00	658460.00			1772.00	646733.00		

9. Details of ground water abstraction /Dewatering structures

	Total Existing No.:0						**Total Proposed No.:3**					
	DW	DCB	BW	TW	MP	MPu	DW	DCB	BW	TW	MP	MPu
Abstraction Structure*	0	0	0	0	0	0	0	0	2	0	0	0
Dewatering Structure*	0	0	0	0	0	0	0	0	0	0	1	0

*DW- Dug Well; DCB-Dug-cum-Bore Well; BW-Bore Well; TW-Tube Well; MP-Mine Pit;MPu-Mine Pumps

10.	Ground Water Abstraction/Restoration Charges paid (Rs.):	1646150.00

11.	Number of Piezometers(Observation wells) to be constructed/ monitored & Monitoring mechanism.	No. of Piezometers	Monitoring Mechanism		
			Manual	DWLR**	DWLR With Telemetry
	**DWLR - Digital Water Level Recorder	2	0	1	1

(Compliance Conditions given overleaf)

This is an auto generated document & need not to be signed.

Validity of this NOC shall be subject to compliance of the following conditions:

Mandatory conditions:

1) Installation of tamper proof digital water flow meter with telemetry on all the abstraction structure(s) shall be mandatory for all users seeking No Objection Certificate and intimation regarding their installation shall be communicated to the CGWA within 30 days of grant of No Objection Certificate.

2) Proponents shall mandatorily get water flow meter calibrated from an authorized agency once in a year.

3) Construction of purpose-built observation wells (piezometers) for ground water level monitoring shall be mandatory as per Section 14 of Guidelines. Water level data shall be made available to CGWA through web portal. Detailed guidelines for construction of piezometers are given in Annexure-II of the guidelines.

4) Proponents shall monitor quality of ground water from the abstraction structure(s) once in a year. Water samples from bore wells/ tube wells / dug wells shall be collected during April/May every year and analysed in NABL accredited laboratories for basic parameters (cations and anions), heavy metals, pesticides/ organic compounds etc. Water quality data shall be made available to CGWA through the web portal.

5) In case of mining projects, additional key wells shall be established in consultation with the Regional Director, CGWB for ground water level monitoring four (4) times a year (January, May, August and November) in core as well as buffer zones of the mine.

6) In case of mining project the firm shall submit water quality report of mine discharge/ seepage from Govt. approved/ NABL accredited lab.

7) The firm shall report compliance of the NOC conditions online in the website (www.cgwa-noc.gov.in) within one year from the date of issue of this NOC.

8) Industries abstracting ground water in excess of 100 m 3 /d shall undertake annual water audit through certified auditors and submit audit reports within three months of completion of the same to CGWA. All such industries shall be required to reduce their ground water use by at least 20% over the next three years through appropriate means.

9) Application for renewal can be submitted online from 90 days before the expiry of NOC. Ground water withdrawal, if any, after expiry of NOC shall be illegal & liable for legal action as per provisions of Environment (Protection) Act, 1986.

10) This NOC is subject to prevailing Central/State Government rules/laws/norms or Court orders related to construction of tube well/ground water abstraction structure / recharge or conservation structure/discharge of effluents or any such matter as applicable.

General conditions:

11) No additional ground water abstraction and/or de-watering structures shall be constructed for this purpose without prior approval of the Central Ground Water Authority (CGWA).

12) The proponent shall seek prior permission from CGWA for any increase in quantum of groundwater abstraction (more than that permitted in NOC for specific period).

13) Proponents shall install roof top rain water harvesting in the premise as per the existing building bye laws in the premise.

14) The project proponent shall take all necessary measures to prevent contamination of ground water in the premises failing which the firm shall be responsible for any consequences arising thereupon.

15) In case of industries that are likely to contaminate the ground water, no recharge measures shall be taken up by the firm inside the plant premises. The runoff generated from the rooftop shall be stored and put to beneficial use by the firm.

16) Wherever feasible, requirement of water for greenbelt (horticulture) shall be met from recycled / treated waste water.

17) Wherever the NOC is for abstraction of saline water and the existing wells (s) is /are yielding fresh water, the same shall be sealed and new tubewell(s) tapping saline water zone shall be constructed within 3 months of the issuance of NOC. The firm shall also ensure safe disposal of saline residue, if any.

18) Unexpected variations in inflow of ground water into the mine pit, if any, shall be reported to the concerned Regional Director, Central Ground Water Board.

19) In case of violation of any NOC conditions, the applicant shall be liable to pay the penalties as per Section 16 of Guidelines.

20) This NOC does not absolve the proponents of their obligation / requirement to obtain other statutory and administrative clearances from appropriate authorities.

21) The issue of this NOC does not imply that other statutory / administrative clearances shall be granted to the project by the concerned authorities. Such authorities would consider the project on merits and take decisions independently of the NOC.

22) In case of change of ownership, new owner of the industry will have to apply for incorporation of necessary changes in the No Objection Certificate with documentary proof within 60 days of taking over possession of the premises.

23) This NOC is being issued without any prejudice to the directions of the Hon'ble NGT/court orders in cases related to ground water or any other related matters.

24) Proponents, who have installed/constructed artificial recharge structures in compliance of the NOC granted to them previously and have availed rebate of upto 50% (fifty percent) in the ground water abstraction charges/ground water restoration charges, shall continue to regularly maintain artificial recharge structures.

25) Industries which are likely to cause ground water pollution e.g. Tanning, Slaughter Houses, Dye, Chemical/ Petrochemical, Coal washeries, pharmaceutical, other hazardous units etc. (as per CPCB list) need to undertake necessary well head protection measures to ensure prevention of ground water pollution as per Annexure III of the guidelines.

26) In case of new infrastructure projects having ground water abstraction of more than 20 m3/day, the firm/entity shall ensure implementation of dual water supply system in the projects.

27) In case of infrastructure projects, paved/parking area must be covered with interlocking/perforated tiles or other suitable measures to ensure groundwater infiltration/harvesting.

28) In case of coal and other base metal mining projects, the project proponent shall use the advance dewatering technology (by construction of series of dewatering abstraction structures) to avoid contamination of surface water.

29) The NOC issued is conditional subject to the conditions mentioned in the Public notice dated 27.01.2021 failing which penalty/EC/cancellation of NOC shall be imposed as the case may be.
30) This NOC is issued subject to the clearance of Expert Appraisal Committee (EAC) (if applicable).

(Non-compliance of the conditions mentioned above is likely to result in the cancellation of NOC and legal action against the proponent.)

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An ISO 9001, ISO 14001 & OHSAS 18001
Certified Company

SARDA
SARDA ENERGY & MINERALS LTD.

Annexure – V

Ref No.- SEML/SW/FC/22

Date-06.10.2023

UNDERTAKING

I, Shiv Shankar Shrivastava, by the virtue of powers delegated to me by M/s Sarda Energy & Minerals Limited through Board Resolution dated 05th October 2021, undertake that Forest Diversion of Revenue Forest land falling in the proposed Coal Transportation Road outside the Mining Lease Area of Sahapur West Coal Block, will be sought separately in near future and we shall not use the said land without obtaining its Final approval under FCA 1980.

For, **Sarda Energy & Minerals Limited,**

6/10/2023

SS Shrivastava
Vice President – Coal Mines

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Annexure- VI

Ref No.- SEML/SW/FC/23

Date-06.10.2023

UNDERTAKING

I, Shiv Shankar Shrivastava, by the virtue of powers delegated to me by M/s Sarda Energy & Minerals Limited through Board Resolution dated 05th October 2021, undertake that we shall bear the 2% cost of project towards wildlife management plan and cost towards chain link fencing for the proposed forest land as recommend by the PCCF, Wildlife.

For, **Sarda Energy & Minerals Limited,**

6/X/2023

SS Shrivastava
Vice President – Coal Mines

SARDA ENERGY & MINERALS LTD. ★ RAIPUR ★