



To
The Additional Principal Chief Conservator of Forest,
Regional Office (Eastern Central Zone)
Ministry of Environment, Forests and Climate Change, Govt. of India
Bungalow No. A-2, Shyamali Colony,
Ranchi – 834002, Jharkhand.

RefNo. - JMB/ENV/DIG/37/ 169 /2019

May 23, 2019

Ref.: Environmental Clearance letter No.-J-11015/372/2010-IA.II(M)dated-30th September 2013.

SUB: Half Yearly Compliance Status Report of Environment Clearance conditions issued by MoEFCC, New Delhi to Digwadih Colliery, Tata Steel Limited, Dhanbad for the period October'18 to March'19.

Dear Sir,

We are enclosing herewith compliance report for the period **October'18 to March'19** for the EC granted vide letter no.- J-11015/372/2010-IA.II(M) dated- 30th September 2013 issued by Ministry of Environment, Forest and Climate Change, New Delhi.

Copy of the compliance report is also being sent in soft format through email at ro.ranchi-mef@gov.in for your kind perusal. We trust the information furnished is in line with your requirement.

Thanking you,

Yours faithfully,

Head (Planning)
Jharia Division, Tata Steel Ltd.

Encl: As above.

Copy to: Member Secretary, CPCB, Eastern Zonal Office, Southend Conclave, 502, 5th Floor
1582, Rajdanga Main Road, Kolkata -700107.

Copy to: Member Secretary, JSPCB, T.A. Division Building (Ground Floor), H.E.C, Dhurwa,
Ranchi - 834004.

TATA STEEL LIMITED

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HALF YEARLY COMPLIANCE REPORT
(PERIOD: OCTOBER'18 – MARCH'19)

DIGWADIH COLLIERY
(CAPACITY: EXPANSION FROM 0.38 TO 0.6 MTPA RAW COAL)
TEHSIL: JHARIA, DIST: DHANBAD, JHARKHAND



TATA STEEL LIMITED, JHARIA DIVISION

**P.O.- JAMADOBA, DIST. - DHANBAD,
STATE- JHARKHAND, PIN CODE – 828112**

**ENVIRONMENTAL CLEARANCE GRANTED VIDE LETTER NO. - J-11015/372/2010-
IA.II(M) DATED- 30.09.2013 ISSUED BY GOVT. OF INDIA, MINISTRY OF
ENVIRONMENT, FOREST AND CLIMATE CHANGE, NEW DELHI.**

Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013

S. No.	Condition	Compliance Status
Specific Condition		
(i)	The maximum production from the mines shall not exceed beyond that for which environmental clearance has been granted.	<p>It is being strictly followed. The EC capacity is for 0.6 MTPA raw coal while the raw coal production for Digwadih Colliery is well below the limit. The production details are:</p> <p>FY19 - 0.261 MTPA FY18 – 0.259 MTPA FY17 – 0.262 MTPA FY16 – 0.308 MTPA FY15 – 0.25 MTPA</p>
(ii)	The impact on the Damodar river due to mining activity which is at a distance of 2 km be studied through a reputed 3 rd Party and submitted to the SPCB and the regional office of the MoEF for monitoring.	<p>The underground coal mines operated by Tata Steel Ltd are adjacent to the Damodar River. Other coal mines of BCCL & SAIL are also in close proximity to the river basin. Major source of pollution of Damodar River is the flow of industrial effluents and untreated sewage water into the river. A number of OB dumps lie close to the river banks causing the flow of sediments into the river.</p> <p>As per the hydrology study conducted by Indian School of Mines, Dhanbad, the impact of the underground mines of Tata Steel Ltd is minimal. This is due to the following reasons</p> <ul style="list-style-type: none"> • The mining activity does not require any diversion of river/streams or natural drain. As land profile does not change appreciably in case of underground mines with backfilling of mined out areas, there is no change in surface drainage till date and unlikely to occur in future. • Surface water quality also does not undergo any change, as there is no discharge to surface drainage in dry season. In Monsoon, the excess mine water discharged gets mixed with storm water. • Large settling tanks are available for storage and sedimentation of mine water before its discharge to conform to the norms. The industrial wastewater generated during vehicle washing from the central workshop catering to all the mines is treated in oil and grease trap followed by recycling of water. • The two coal washeries of Tata Steel are operating on Zero Liquid discharge (ZLD) principle. • Sewage water generated from our townships is treated in Soak pit and Septic tank arrangement. Now we are replacing it with Packaged Sewage Treatment Plant (PSTP). Already one STP of 200 KLD has been installed in one colony and remaining colonies are also proposed to be covered with STP.

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(iii)	Details of underground transportation of coal from mine to coal yard/ rail yard be submitted to the MoEF for record.	Coal from the mine is sent to the captive Jamadoba coal washery for beneficiation purpose through a network of underground conveyor belts. The detailed diagram of transportation network has already been submitted in earlier compliance report.
(iv)	Adequate care be taken to prevent sand spillages from the trucks/tippers.	The trucks that are being used for the transportation of sand are properly covered using tarpaulin sheets. Larger trucks have been engaged for reducing no of cycles. To ensure the compliance, every vehicle is checked as per vehicle checklist on PUC, Tyre/body condition, emission check at every entry point. Quality checks are done on trucks to ensure its health and punitive action is taken against defaulters by the management.
(v)	The test results of the study of leaching of heavy metals from bottom-ash be submitted to SPCB and the regional office of the MoEF for monitoring.	A study conducted in 2013, by Indian School of Mines, Dhanbad to assess the leachability characteristics of fly ash and bottom ash samples taken from our, has determined that the concentration of heavy metals in the leachates were invariably well below the permissible limits for discharge of effluents as per the Indian standards IS 2490 (1993). The test results have already been submitted in December'13 and also re-submitted in April'18.
(vi)	The CSR activities shall be need based and detailed CSR plan be prepared for implementation.	The CSR plan for each financial year is prepared by TSRDS (Tata Steel Rural Development Society) only after proper discussions to assess the needs have been held with the elected/ senior members of the communities where our CSR activities are to be undertaken.
(vii)	The detailed breakup of funds during 2012-13 be submitted to the MoEF for record. A social audit to be got done annually by a reputed institute and uploaded on the company's website.	The detailed breakup has already been submitted to MOEF. The Corporate Sustainability Reports viz. Integrated Reports are made annually for the company which is certified by an assurance agency. It also includes the Social Audit of the company. All the reports are uploaded on the Tata Steel website. Further, an internal Social audit is also conducted once in five years. In 2012, a HDI (Human Development Index) survey of surrounding villages was conducted with the help of XLRI, Jamshedpur.
(viii)	There should be no OB dumps at the end of the mining.	Since this is an underground mine, it is not applicable.
(ix)	Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water	Regular monitoring of subsidence is done by Central Institute for Mining and Fuel Research, Dhanbad. According to the subsidence reports, the impact of subsidence is negligible since the underground mine workings are now at great depth and proper filling of

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	bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate effective corrective measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil/suitable material.	voids through sand stowing is being done. The latest subsidence report has been submitted to MoEFCC, Regional Office, Ranchi in hard copy and soft copy vide mail dt. 19.04.2018. The latest subsidence study report is attached here.
(x)	If subsidence is found exceeding the permitted limits, then the landowners shall be adequately compensated with mutual agreement of the landowners.	It will be strictly followed.
(xi)	Mining shall be carried out as per statuette at a safe distance from the river/nallah flowing adjacent to the lease boundary.	Since this is an underground project, there is hardly any impact on the river/ nallah. The closest jore is at a distance of about 2kms from the mine office area. Therefore, no impact on the course of flow in the jore is anticipated.
(xii)	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	Impact on land by subsidence has been found to be negligible as per the subsidence monitoring reports prepared by CIMFR, Dhanbad.
(xiii)	Coal extraction shall also be optimized in areas where agricultural production is continuing. Some pillars shall be left below the agricultural land. No depillaring & coal extraction should be carried out below habitation, H.T. Lines & beneath road, water bodies.	It will be strictly followed.
(xiv)	Subsidence shall be monitored closely and if subsidence is found exceeding the permitted limits, then the landowners shall be adequately compensated with mutual agreement with the landowners.	Regular monitoring of subsidence is being done by CIMFR, Dhanbad.
(xv)	3-tier plantation should be developed 2 km stretch of road from the mine using native species.	Plantation along stretches of road has been done. 3-tier plantation is not feasible due to presence of private land around the periphery of colliery. Details on greenbelt developed is provided in Annexure-I.

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(xvi)	Garland drains (size, gradient and length) around the safety areas such as mine shaft and low lying areas and sump capacity shall be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine sites. Sump capacity shall also provide adequate retention period to allow proper settling of silt material.	Garland drains of adequate size and gradient already exist around the colliery area to channelize the surface runoff. The details of size of garland drain mapped in surface plan has been submitted earlier in April'18.
(xviii)	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The smoke/dust emission varies from source to source (fuel wood, coal, flyash from TPPs, silica from natural dust, etc). Mineralogical composition study should be undertaken on the composition of the suspended particulate matter (PM10 and PM2.5) in Jharia Coalfields and also quantified. These studies would help ascertain source and extent of the air pollution, based on which appropriate mitigative measures could be taken.	The locations of monitoring stations for our colliery have already been finalized in consultation with JSPCB, Dhanbad. The mineralogical composition study has being carried out by an independent laboratory (recognized by MoEFCC and NABL) and the results are provided in Annexure-II.
(xix)	Water sprinkling system shall be provided to check fugitive emissions from loading operations, conveyor system, haulage roads, transfer points, etc. Major approach roads shall be black topped and properly maintained.	Water spraying arrangement is present in the underground mines at all transfer points. Water spraying via tankers is done on sand transportation routes. Major approach roads have been black-topped and maintained regularly.
(xx)	Transportation of coal from the mine to railway siding should be by 20T mechanically covered trucks.	Not applicable due to transportation of coal via underground belt conveyor network system directly to washery.

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<p>(xxi)</p>	<p>A progressive afforestation plan shall be prepared and implemented over the mine lease area acquired and shall include areas under green belt development, areas along roads, infrastructure, along ML boundary and township etc, by planting native species in consultation with the local DFO/Agriculture Department.</p>	<p>Tree plantation activities are carried out every year on the barren/ degraded areas, areas along road-side, infrastructure, etc of the colliery leasehold. Apart from these, fruit plants are distributed to employees and also to villagers, schools, institutions, etc. The environment department is responsible for implementing the afforestation plan which is prepared along with the mine management. In the last two years, about 10000 trees have been planted in the leasehold areas. High root density trees of native species are planted under annual plantation program this year. We have covered around 39 Nos of species under tree plantation jobs this year:</p> <table border="1" data-bbox="727 667 1455 1094"> <tr> <td>Babul</td> <td>Mango</td> <td>Areca palm</td> <td>Semal</td> </tr> <tr> <td>Bael</td> <td>Mahaneem</td> <td>Bargad</td> <td>Palash</td> </tr> <tr> <td>Kala siris</td> <td>Imli</td> <td>Guler/ Dumar</td> <td>Ammda</td> </tr> <tr> <td>Alostromia</td> <td>Karipatta</td> <td>Shisham</td> <td>Mahua</td> </tr> <tr> <td>Kaju</td> <td>Karma</td> <td>Gulmohar</td> <td>Bija</td> </tr> <tr> <td>Sitaphal</td> <td>Kadam</td> <td>Sal</td> <td>Togger</td> </tr> <tr> <td>Kathal</td> <td>Teak/ Sagwan</td> <td>Lagerstroemia</td> <td>Jamun</td> </tr> <tr> <td>Neem</td> <td>Radhachuda</td> <td>Pipal</td> <td>Arjun</td> </tr> <tr> <td>Kachnar</td> <td>Phoenix palm</td> <td>Guava</td> <td>Ber</td> </tr> <tr> <td>Jungle Jalebi</td> <td>Amla</td> <td>Ashoka</td> <td></td> </tr> </table>	Babul	Mango	Areca palm	Semal	Bael	Mahaneem	Bargad	Palash	Kala siris	Imli	Guler/ Dumar	Ammda	Alostromia	Karipatta	Shisham	Mahua	Kaju	Karma	Gulmohar	Bija	Sitaphal	Kadam	Sal	Togger	Kathal	Teak/ Sagwan	Lagerstroemia	Jamun	Neem	Radhachuda	Pipal	Arjun	Kachnar	Phoenix palm	Guava	Ber	Jungle Jalebi	Amla	Ashoka	
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<p>(xxii)</p>	<p>Regular monitoring of groundwater level and quality shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality in May. Data thus collected shall be submitted to the MoEF and to the CPCB quarterly within one month of monitoring.</p>	<p>The monitoring of groundwater level and quality is done four times a year. The groundwater quality report & groundwater level for the Post-Monsoon (November) and winter season (January) are provided in Annexure-I.</p>																																								
<p>(xxiii)</p>	<p>Acid Water Treatment Plant, volume of water to be treated and disposal of brine should be provided.</p>	<p>Not applicable.</p>																																								

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(xxiv)	Mine discharge water outside the ML shall be monitored, particularly for TDS and treated to conform to prescribed levels before discharge into the natural environment.	<p>There is one mine-water outlet point in the colliery which is regularly monitored by the Environmental Laboratory. The analysis results are given below:</p> <table border="1" data-bbox="727 327 1464 741"> <thead> <tr> <th>Month</th> <th>Temp</th> <th>pH</th> <th>TSS</th> <th>TDS</th> <th>BOD</th> <th>COD</th> <th>Oil & Grease</th> </tr> </thead> <tbody> <tr> <td>Limits</td> <td><40°C</td> <td>5.5-9.0</td> <td>100 mg/l</td> <td>2100 mg/l</td> <td>30mg/l</td> <td>250 mg/l</td> <td>10 mg/l</td> </tr> <tr> <td>Oct'18</td> <td colspan="7">No Discharge</td> </tr> <tr> <td>Nov'18</td> <td>28</td> <td>7.4</td> <td>14</td> <td>596</td> <td>3.2</td> <td>16</td> <td>1.3</td> </tr> <tr> <td>Dec'18</td> <td>33</td> <td>7.4</td> <td>12</td> <td>700</td> <td>3.0</td> <td>16</td> <td>1.2</td> </tr> <tr> <td>Jan'19</td> <td>30</td> <td>7.7</td> <td>12</td> <td>704</td> <td>3.4</td> <td>16</td> <td>0.8</td> </tr> <tr> <td>Feb'19</td> <td colspan="7">No Discharge</td> </tr> <tr> <td>Mar'19</td> <td colspan="7">No Discharge</td> </tr> <tr> <td>Min</td> <td>28</td> <td>7.4</td> <td>12</td> <td>596</td> <td>3.0</td> <td>16</td> <td>0.8</td> </tr> <tr> <td>Max</td> <td>33</td> <td>7.7</td> <td>14</td> <td>704</td> <td>3.4</td> <td>16</td> <td>1.3</td> </tr> <tr> <td>Average</td> <td>30.33</td> <td>7.5</td> <td>12.66</td> <td>666.66</td> <td>3.2</td> <td>16</td> <td>1.1</td> </tr> </tbody> </table>	Month	Temp	pH	TSS	TDS	BOD	COD	Oil & Grease	Limits	<40°C	5.5-9.0	100 mg/l	2100 mg/l	30mg/l	250 mg/l	10 mg/l	Oct'18	No Discharge							Nov'18	28	7.4	14	596	3.2	16	1.3	Dec'18	33	7.4	12	700	3.0	16	1.2	Jan'19	30	7.7	12	704	3.4	16	0.8	Feb'19	No Discharge							Mar'19	No Discharge							Min	28	7.4	12	596	3.0	16	0.8	Max	33	7.7	14	704	3.4	16	1.3	Average	30.33	7.5	12.66	666.66	3.2	16	1.1
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(xxv)	The Company shall put up artificial groundwater recharge measures for augmentation of groundwater resource, in case water table shows a declining trend. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.	<p>More than 50% of the water pumped out during underground mining activity is re-circulated back into the mine for the purpose of stowing. Backfilling of mine voids by stowing is done using sand which is having the porosity to hold the underground water thus helping aquifer to retain the underground water.</p> <p>Further, there are a number of ponds existing on the surface of the mining lease which act as natural reservoirs for recharging ground water. These ponds/ tanks are regularly cleaned and maintained by our CSR department. As per the hydro-geological report, the variation in the ground water level is only seasonal.</p> <p>The water requirement of the nearby villages is being met by the company already. Now piped drinking water is being provided.</p>																																																																																								
(xxvi)	Besides carrying out regular periodic health checkup of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health checkup for occupational diseases and hearing impairment, if any, through an agency such as NIOH, Ahmedabad within a period of one year and the results reported to this Ministry and to DGMS.	The periodic health checkup of the workers is done regularly by our Occupational Health Department, Tata Central Hospital, Jamadoba. We have a PME (Periodic Medical Examination) centre approved by DGMS where 20 % of the workers identified from workforce engaged in active mining operations are subjected to full medical checkup including hearing impairment checkup, etc. These results are regularly submitted to DGMS as per mines rules. Some sample reports and as well as past records have been submitted in previous compliance report.																																																																																								
(xxvii)	The mining in the existing mines would be phased out after expiry of the current mining lease and	It is not applicable in our case.																																																																																								

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	after reclamation of mined over area. The operating mines may be analyzed and monitored for compliance of conditions, having bearing with movement of wild life until such time they are closed/ phased out.																													
(xxviii)	Project specific CSR for an amount of Rs 5/Tonne of coal production should be provided for the activities under CSR undertaken for the neighboring villages shall be for not less than Rs 10 per tonne of coal and the progress made thereon shall be uploaded by the company annually on the company website. Monitoring of the impacts of activities under CSR shall be carried out periodically.	<p>The proposed CSR expenditure for the entire company is decided as per the new Company Rules. Once the CSR budget for company is fixed, a share of that amount is dedicated and utilized for implementing the CSR activities at our Jharia Division level. The CSR expenditure for FY19 is Rs.5.65 crores.</p> <p>CSR data submitted is for Jharia Division which comprises all 5 collieries and 2 washeries. Jamadoba Washery, Digwadih Colliery and 6&7 Pits Colliery are adjacent to each other and fall under same leasehold area i.e. Jamadoba group of collieries. The core zone and buffer zone of all above units overlap to each other and in many cases, the villages are same where CSR work is going on. Therefore, we have a central budget for CSR which is managed by a team of experts who are dedicatedly involved in providing benefits and improving standard of living in over 50+ villages and municipal wards. Hence, separate CSR expenditure for individual unit cannot be estimated. For calculation/ statutory reporting purpose, the consolidated CSR expenditure can be divided into unit-wise based on size of leasehold area of individual units.</p> <table border="1"> <thead> <tr> <th>S. No.</th> <th>Unit</th> <th>Area (Ha)</th> <th>CSR expenditure in FY19 (in Lakhs)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Jamadoba Colliery and Jamadoba Coal Washery</td> <td>927.17</td> <td>240.60</td> </tr> <tr> <td>2</td> <td>Digwadih Colliery</td> <td>314.57</td> <td>81.63</td> </tr> <tr> <td>3</td> <td>6 & 7 Pits Colliery</td> <td>168.12</td> <td>43.63</td> </tr> <tr> <td>4</td> <td>Bhelatand A. Colliery and BCPP</td> <td>529.68</td> <td>137.45</td> </tr> <tr> <td>5</td> <td>Sijua Colliery</td> <td>238.66</td> <td>61.93</td> </tr> <tr> <td></td> <td>Total</td> <td>2178.2</td> <td>565.24</td> </tr> </tbody> </table> <p>The progress report is uploaded every year on the company website. Internal social audits are carried out regularly to assess the impact of CSR activities. The CSR report with photographs are provided in Annexure.</p>	S. No.	Unit	Area (Ha)	CSR expenditure in FY19 (in Lakhs)	1	Jamadoba Colliery and Jamadoba Coal Washery	927.17	240.60	2	Digwadih Colliery	314.57	81.63	3	6 & 7 Pits Colliery	168.12	43.63	4	Bhelatand A. Colliery and BCPP	529.68	137.45	5	Sijua Colliery	238.66	61.93		Total	2178.2	565.24
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(xxix)	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of	Mine Closure Plan has been approved by Ministry of Coal, New Delhi. Details on deposition of closure cost in escrow account along with expenditure incurred for																												

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	Environment & Forests 5 years in advance of final mine closure for approval.	progressive closure is regularly submitted to Office of Coal controller. Final mine closure along with details of corpus fund will be submitted to MoEFCC 5 years in advance.
(xxx)	<p>Corporate Environment Responsibility:</p> <p>a)The Company shall have a well laid down Environment Policy approved by the Board of Directors.</p> <p>b)The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.</p> <p>c)The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.</p> <p>d) To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.</p>	<p>The Company already has an Environment Policy approved by the Managing Director and it addresses all the issues mentioned. Tata Steel Environmental Policy is attached as Annexure-IV.</p> <p>The status of adherence to the policy and compliance to Environmental laws and regulations is regularly discussed at higher levels. Any non-compliance noticed is corrected at divisional level. If any issue is beyond our control, it is brought to the notice of higher management.</p> <p>Moreover, Digwadih Colliery is IMS (Integrated Management System: Quality Management System, Environment Management System and OHSAS) certified unit addressing all environment aspects, impacts and needs and expectation of interested parties with respect to environment protection.</p>

Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013

B.	GENERAL CONDITIONS	
(i)	No change in technology and scope of working shall be made without prior approval of the MoEF.	It is being strictly followed. Bord and Pillar method is being used for mining.
(ii)	No change in the calendar plan including quantum of mineral coal and waste being produced shall be made.	It will be strictly followed.
(iii)	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring PM10, PM2.5, SO2 and NOx. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, in RSPM etc. shall be carried out at least once in six months.	<p>The Air quality monitoring stations are:</p> <ul style="list-style-type: none"> (i) Jamadoba Group Office (Core Zone) (ii) New Village Colony, Jamadoba (Buffer Zone) (iii) Digwadih 12 No. Colony (Buffer Zone) (iv) 6&7 Pits Kalimandir area (Buffer Zone) <p>Monitoring of heavy metals in ambient air is being performed by an independent laboratory (recognized by MoEFCC/NABL) once in six months. The results are enclosed as Annexure-II.</p>
(iv)	Data on ambient air quality (PM10, PM2.5, SO2 and NOx and heavy metals such as Hg, As, Ni, Cr, etc) and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhubaneswar and to the SPCB and the CPCB once in six months. Random verification of samples through analysis from independent laboratories recognised under the EP Rules, 1986 shall be furnished as part of the compliance report.	Ambient air quality report (PM10, PM 2.5, SO2 and NOx) for the period from Oct'18 to Mar'19 is attached as Annexure-I. Additionally, M/s Ecomen Laboratories Pvt. Ltd (an MoEFCC and NABL recognised Laboratory) has done monitoring on ambient air quality (PM10, PM 2.5, SO2, NOx, CO, NH3, O3) and heavy metals (As, Ni, Cd and Cr) in the month of Aug'18. The results are enclosed as Annexure-II.

Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013

<p>(v)</p>	<p>Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs/muffs.</p>	<p>Regular noise survey is being conducted in the underground work environment. Workers are provided with ear-plugs/ muffs in high noise areas. The noise levels monitored in the month of February'19 is given below:</p> <table border="1" data-bbox="703 363 1472 968"> <thead> <tr> <th>S. No.</th> <th>Unit / Place</th> <th>Equipment / Location</th> <th>Distance (meter away)</th> <th>Leq (dB 'A')</th> <th>Exposure Hours</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td>Pit Bottom</td> <td>-</td> <td>61.6</td> <td>8 hrs./shift</td> </tr> <tr> <td>2</td> <td rowspan="4">8 Seam (S)</td> <td>Heat Exchange Station – 3rd D / 2 ½</td> <td>-</td> <td>59.4</td> <td>8 hrs./shift</td> </tr> <tr> <td>3</td> <td>Auxiliary Fan, 6th L / 12th D</td> <td>-</td> <td>83.7</td> <td>8 hrs./shift</td> </tr> <tr> <td>4</td> <td>Transformer Room, 6th L / 6th D</td> <td>-</td> <td>61.2</td> <td>8 hrs./shift</td> </tr> <tr> <td>5</td> <td>Miner Station, 6th / 22nd D</td> <td>-</td> <td>58.7</td> <td>8 hrs./shift</td> </tr> <tr> <td>6</td> <td rowspan="3">Surface</td> <td>Pit top</td> <td>-</td> <td>68.4</td> <td>8 hrs./shift</td> </tr> <tr> <td>7</td> <td>Winder Room</td> <td>-</td> <td>75.6</td> <td>8 hrs./shift</td> </tr> <tr> <td>8</td> <td>Compressor Room for Winder</td> <td>-</td> <td>80.1</td> <td>8 hrs./shift</td> </tr> </tbody> </table>	S. No.	Unit / Place	Equipment / Location	Distance (meter away)	Leq (dB 'A')	Exposure Hours	1		Pit Bottom	-	61.6	8 hrs./shift	2	8 Seam (S)	Heat Exchange Station – 3 rd D / 2 ½	-	59.4	8 hrs./shift	3	Auxiliary Fan, 6 th L / 12 th D	-	83.7	8 hrs./shift	4	Transformer Room, 6 th L / 6 th D	-	61.2	8 hrs./shift	5	Miner Station, 6 th / 22 nd D	-	58.7	8 hrs./shift	6	Surface	Pit top	-	68.4	8 hrs./shift	7	Winder Room	-	75.6	8 hrs./shift	8	Compressor Room for Winder	-	80.1	8 hrs./shift
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<p>(vi)</p>	<p>Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, and treated so as to conform to the standards including for heavy metals before discharge prescribed under GSR 422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time. Oil and grease trap shall be installed before discharge of workshop effluents.</p>	<p>No industrial wastewater is generated in 6&7 Pits Colliery premises. There is a central workshop and garage in Jamadoba where Effluent Treatment Plant having oil and grease trap facility has been provided.</p>																																																	
<p>(vii)</p>	<p>Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transportation of the mineral shall be covered with tarpaulins and optimally loaded.</p>	<p>Only the vehicles having valid PUC certificates are being allowed to operate for sand transportation. Some of the vehicle fitness certificates and PUC certificates have been shared in hard copies and over mail at <i>ro.ranchi-mef@gov.in</i>. Coal transportation is done through underground belt network. Only sand transportation is done through trucks which are covered with tarpaulins as well as optimally loaded.</p>																																																	

Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013


(viii)	Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with SPCB and data got analysed through a laboratory recognised under EP Rules, 1986.	<p>We have a fully equipped Environment Cell Laboratory with qualified personnel. Laboratory has been recognized and registered with the Jharkhand State Pollution Control Board vide letter ref no. B-3922, dated-30.08.2012. The monitoring and analysis is also done at regular intervals by M/s Ecomen Laboratories Pvt. Ltd., an MoEF recognised laboratory (vide its notification 03.01.2014).</p> <p>We have also installed a Continuous Ambient Air Quality Monitoring Station at Jamadoba for real time monitoring.</p>												
(ix)	Monitoring of outlet points should be carried out and records of same should be maintained and submitted to the Regional Office of the MOEF as part of the Compliance Report.	There is one mine-water outlet point in the colliery which is regularly monitored by the Environmental Laboratory. The analysis results has been provided in point no. (xxiv) of specific condition.												
(x)	There is one mine-water outlet point in the colliery which is regularly monitored by the Environmental Laboratory. The analysis results has been provided in point no. (xxiv) of specific condition.	Persons working in dusty area have been provided with dust masks & have been given awareness training on safety & health aspects. Regular PME (Periodic Medical Examinations) are being done. The details have been provided earlier. IME and PME records of last three years have been shared in hard copies and over mail at <i>ro.ranchi-mef@gov.in</i> earlier.												
(xi)	A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.	We have a separate Environmental Management Cell with four qualified personnel (One Head and Two Senior Managers and One Manager). The reporting of Environmental Cell is directly to General Manager of the Division.												
(xii)	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.	<p>The Environment Cell has a separate fund for Environmental protection measures and for complying with legal requirements. The annual environmental expenditure for the financial year 2017-18 is Rs. 795.27 lakhs. The details are given below-</p> <table border="1" data-bbox="803 1585 1437 1879"> <thead> <tr> <th>S. No.</th> <th>Environment Management Activity</th> <th>Expenditure in Lakhs</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Stowing activities i.e filling of U/G voids for surface protection and prevention of subsidence</td> <td>699.23</td> </tr> <tr> <td>2.</td> <td>Fire Control measures (Fire/Isolation Stopping and Nitrogen plant)</td> <td>43.84</td> </tr> <tr> <td>3.</td> <td>Goaf Filling activities, drain repairing and maintenance, settling tank maintenance jobs</td> <td>4.03</td> </tr> </tbody> </table>	S. No.	Environment Management Activity	Expenditure in Lakhs	1.	Stowing activities i.e filling of U/G voids for surface protection and prevention of subsidence	699.23	2.	Fire Control measures (Fire/Isolation Stopping and Nitrogen plant)	43.84	3.	Goaf Filling activities, drain repairing and maintenance, settling tank maintenance jobs	4.03
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Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013

		4.	Water spraying costs in underground and surface	5.66
		5.	Making potable water in Water Treatment Plant & Supply to colonies	24.77
		6.	Horticultural activities including green belt development and regular lawn and garden maintenance	16.71
		7.	Plantation of saplings and maintenance	1.04
			Total Cost incurred	795.27
(xiii)	The Project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in .	It has been complied with. Details are provided in Annexure.		
(xiv)	A copy of the environmental clearance letter shall be marked to concerned Panchayat/Zila Parishad, Municipal Corporation or Urban Local Body and local NGO, if any, from whom any suggestion/representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on the company's website.	It has been complied with. Details are provided in Annexure.		
(xv)	A copy of the clearance letter shall be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Centre and Collector's Office/Tehsildar's Office for 30 days.	It has been complied with.		
(xvi)	The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated EC conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in the public domain. The monitoring data of environmental quality parameters (air,	The clearance letter has been uploaded on the company's website. The compliance status (as Half-yearly compliance report) is being uploaded in company's website (Enclosed as Annexure-III). The display of information near the mine's office has been done.		

Compliance status of Digwadih Colliery of M/s Tata Steel Ltd. for (Expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/372/2010-IA.II (M) dated September 30, 2013

	water, noise and soil) and critical pollutants such as PM10, PM2.5, SO2 and NOx (ambient and stack if any) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mines office and in corporate office and on the company's website.	
(xvii)	The project proponent shall submit six monthly reports on the status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the MOEF, the respective Zonal offices of CPCB and the SPCB.	It is being complied
(xviii)	The Regional Office of this Ministry located at Bhopal shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.	It will be complied with.
(xix)	The environmental statement for each financial year ending 31st March in Form-V is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MOEF by E-mail.	The environmental statement for financial year 2017-18 has been submitted to JSPCB on 24th September 2018 and it is also uploaded on the company website (Annexure- III). The soft copy of Environment Statement is also sent to MOEF by email at ro.ranchi-mef@gov.in.


Head Planning
Tata Steel Limited,
Jharia Division

AIR QUALITY REPORT

Core zone & Buffer zone

Period- October'18 to December'18

No. of sampling points: 4

Core zone (as per Air quality standards for coal mines in EPA Notification, 1988)									
Location	Latitude/ Longitude	Date	Weather Condition	SPM 24 Hourly Limit- 700 µg/m ³	RSPM 24 Hourly Limit- 300 µg/m ³	SO ₂ 24 Hourly Limit- 120 µg/m ³	NO _x 24 Hourly Limit- 120 µg/m ³		
Jamadoba Group Office	23°42'15.3" N/ 86°24'11" E	05.10.18	Clear	162.6	70.3	14.1	15.5		
		28.11.18	Clear	172.84	72.1	14.2	14.8		
		10.12.18	Clear	163.64	77.84	15.2	12.3		
Buffer zone (as per NAAQS 2009 for ambient air quality standards)									
Location	Latitude/ Longitude	Date	Weather Condition	PM10 24 Hourly Limit- 100µg/m ³	PM2.5 24 Hourly Limit- 60µg/m ³	SO ₂ 24 Hourly Limit- 80µg/m ³	NO ₂ 24 Hourly Limit- 80µg/m ³		
Digwadih 12 No. Colony	23°41'42" N/ 86°24'45.3" E	11.10.18	Rainy	73.1	49.1	9.2	9.2		
		16.11.18	Clear	72.4	45.3	9.1	10.1		
		24.12.18	Clear	77.43	43.7	9.6	11.8		
New Village Colony, Jamadoba	23°41'51" N/ 86°23'19" E	09.10.18	Clear	80.4	46.3	7.4	8.4		
		22.11.18	Clear	82.5	47.8	7.8	8.8		
		03.12.18	Clear	83.42	48.5	7.7	8.9		
6&7 Pits Kalimandir colony	23°43'15" N/ 86°24'12" E	30.10.18	Clear	82.6	51.4	8.6	7.6		
		08.11.18	Clear	73.7	50.2	8.3	7.7		
		17.12.18	Rainy	69.32	51.3	8.8	9.6		



Sr. Manager (Environment)

AIR QUALITY REPORT

Core zone & Buffer zone

Period- January' 19 to March' 19

No. of sampling points: 4

Core zone (as per Air quality standards for coal mines in EPA Notification, 1988)									
Location	Latitude/ Longitude	Date	Weather Condition	SPM 24 Hourly Limit- 700 µg/m ³	RSPM 24 Hourly Limit- 300 µg/m ³	SO ₂ 24 Hourly Limit- 120 µg/m ³	NO _x 24 Hourly Limit- 120 µg/m ³		
Jamadoba Group Office	23°42'15.3" N/ 86°24'11" E	14.01.19	Clear	181.4	81.9	13.6	13.4		
		11.02.19	Clear	177.6	80.2	14.1	15.9		
		18.03.19	Clear	167.3	78.4	12.4	15.2		
Buffer zone (as per NAAQS 2009 for ambient air quality standards)									
Location	Latitude/ Longitude	Date	Weather Condition	PM10 24 Hourly Limit- 100µg/m ³	PM2.5 24 Hourly Limit- 60µg/m ³	SO ₂ 24 Hourly Limit- 80µg/m ³	NO ₂ 24 Hourly Limit- 80µg/m ³		
Digwadh 12 No. Colony	23°41'42" N/ 86°24'45.3" E	21.01.19	Clear	79.7	42.9	9.1	12.3		
		15.02.19	Clear	78.3	43.4	9.2	11.7		
		25.03.19	Clear	77.2	41.2	10.3	11.9		
New Village Colony, Jamadoba	23°41'51" N/ 86°23'19" E	18.01.19	Clear	74.2	41.3	8.7	9.6		
		25.02.19	Rainy	72.7	47.3	8.4	10.2		
		04.03.19	Rainy	74.6	45.8	9.4	10.5		
6&7 Pits Kalimandir colony	23°43'15" N/ 86°24'12" E	28.01.19	Clear	83.7	50.2	9.6	8.7		
		18.02.19	Clear	79.6	44.8	10.5	8.5		
		22.03.19	Clear	80.7	42.7	11.2	12.9		



Sr. Manager (Environment)

**Ground Water Quality Analysis (Hand Pump & Dugwell)
Post-Monsoon Season- November' 2018**

S.No	Date	Location	Time	Sample Parameter			
				Depth in meter (m)	pH	Electrical Conductivity, $\mu\text{S/m}$	Total Hardness (as CaCO_3), mg/l
1	09.11.18	Purnadih (Jorapokhar)	11:00AM	4.80	7.8	584	460
2	09.11.18	Bhowra 13 No	09:40AM	1.90	7.3	612	484
3	09.11.18	Mohalbani Basti	09:50AM	5.62	7.4	648	496
4	09.11.18	Digwadih 12 No	10:15AM	4.16	7.5	632	530
5	09.11.18	Digwadih 10 No F & J	10:30AM	4.04	7.4	588	444
6	09.11.18	Kalimela Shivmandir	11:35AM	1.10	7.6	596	402
7	09.11.18	Kalimela Kalimandir	11:45AM	2.06	7.3	560	408
8	09.11.18	Lower Dungari	12:10PM	5.82	7.2	846	588
9	09.11.18	Upper Dungari	12:30PM	2.41	7.1	730	512
10	09.11.18	Pattia Basti	01:05PM	2.97	7.3	568	416
11	09.11.18	Kenduadih Basti	01:15PM	1.84	7.5	612	452
12	09.11.18	Jorapokhar Kushtand	11:20AM	2.47	7.6	604	448
13	09.11.18	Jamadoba 3 No	01:50PM	2.64	7.5	632	416
14	09.11.18	6&7 Pits (Ayodhya Nagri)	01:35PM	2.00	7.2	608	446


Sr. Manager (Environment)

**Ground Water Quality Analysis (Hand Pump & Dugwell)
Winter Season- January' 2019**

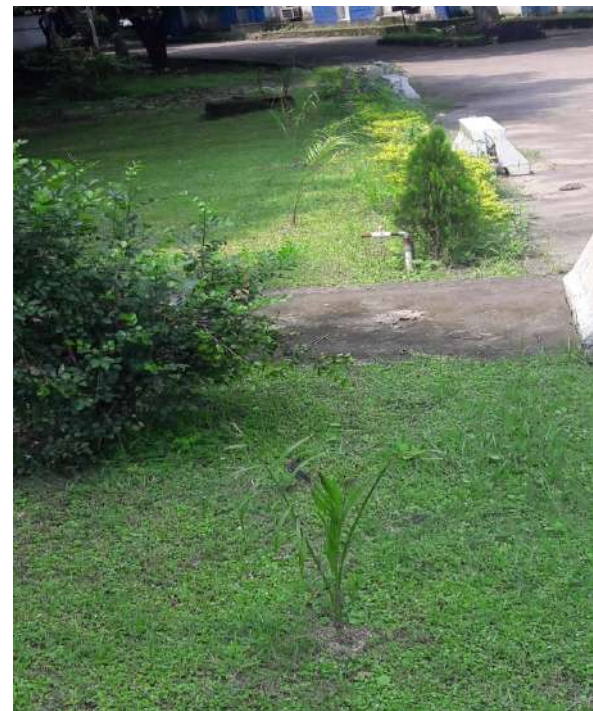
S.No	Date	Location	Time	Sample Parameter			
				Depth in meter (m)	pH	Electrical Conductivity, $\mu\text{S/m}$	Total Hardness (as CaCO_3), mg/l
1	08.01.19	Purnadih (Jorapokhar)	11:25AM	6.30	7.2	696	560
2	08.01.19	Bhowra 13 No	11:35AM	1.95	7.0	648	494
3	08.01.19	Mohalbani Basti	11:50AM	7.70	7.3	710	524
4	08.01.19	Digwadih 12 No	12:05PM	4.60	7.2	500	432
5	08.01.19	Digwadih 10 No F & J	12:15PM	5.60	7.0	792	610
6	14.01.19	Kalimela Shivmandir	02:35PM	1.22	7.2	747	632
7	14.01.19	Kalimela Kalimandir	02:27PM	3.81	7.3	786	616
8	14.01.19	Lower Dungari	02:15PM	6.35	7.3	590	548
9	14.01.19	Upper Dungari	02:00PM	3.19	7.2	610	568
10	08.01.19	Pattia Basti	01:00PM	3.05	7.2	544	488
11	08.01.19	Kenduadih Basti	01:25PM	2.10	7.0	612	576
12	08.01.19	Jorapokhar Kushtand	02:00PM	2.68	7.1	682	612
13	08.01.19	Jamadoba 3 No	02:35PM	2.78	7.2	640	612
14	08.01.19	6&7 Pits (Ayodhya Nagri)	12:45PM	2.00	7.1	596	548



Sr. Manager (Environment)

Annexure- Greenbelt Development Report Annexure-I

Glimpses of already existing green belt and plantation activities done in this monsoon season in and around Digwadih colliery premises to enhance the green cover have been depicted in the pictures below:



Picture: Plantation done in this monsoon season in and around Digwadih Colliery premises



Picture: Developed Green belt in and around Digwadih Colliery premises



Picture: Developed Green belt in and around Digwadih Colliery premises

ECOMEN LABORATORIES PVT. LTD.

Flat No. 8, 2nd Floor, Arif Chamber-V, Sector H, Aliganj, Lucknow - 226 024

Phone No. : (91-522) 2746282, 2745726 Telefax No.: (91 - 522) 2745726

E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1Z1



An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO LAB/AAQ-1/02/19

TEST REPORT ISSUE DATE: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer : Tata Steel Colliery (Jamadoba Grup)
 Address of the Customer : Jamadoba, Distt. Dhanbad
 Jharkhand
 Date of Sampling : 27.02.2019
 Sample Collected By : Ecomen Teem
 Sampling Method : IS: 5182
 Instrument Used : RDS & FDS
 Location : Central Work Shop Area, Jamadoba

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18 th , 2009
1.	PM _{2.5} (µg/m ³)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	39.73	12.5-1000	60
2.	PM ₁₀ (µg/m ³)	IS:5182 (Part-23)	85.91	12.5-1000	100
3.	SO ₂ (µg/m ³)	IS:5182 (Part-2)	16.71	9-200	80
4.	NO ₂ (µg/m ³)	IS:5182 (Part-6)	29.22	6-200	80
5.	NH ₃ (µg/m ³)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	18.35	2-700	400
6.	O ₃ (µg/m ³)	IS:5182(Part-9)	26.52	2-200	180
7.	CO (mg/m ³)	IS:5182 (Part-10)	1.16	0.2-500	04
8.	Pb(µg/m ³)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr (µg/m ³)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd (µg/m ³)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m ³)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m ³)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst

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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO Lab/AAQ-2/02/19

Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer : Tata Steel Colliery (Jamadoba Grup)
 Address of the Customer : Jamadoba, Distt. Dhanbad
 Jharkhand
 Date of Sampling : 27.02.2019
 Sample Collected By : Ecomen Teem
 Sampling Method : IS: 5182
 Instrument Used : RDS & FDS
 Location : Officers Colony, 12 No. Digwadih

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18 th , 2009
1.	PM _{2.5} (µg/m ³)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	33.98	12.5-1000	60
2.	PM ₁₀ (µg/m ³)	IS:5182 (Part-23)	77.53	12.5-1000	100
3.	SO ₂ (µg/m ³)	IS:5182 (Part-2)	14.61	9-200	80
4.	NO ₂ (µg/m ³)	IS:5182 (Part-6)	26.22	6-200	80
5.	NH ₃ (µg/m ³)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	15.35	2-700	400
6.	O ₃ (µg/m ³)	IS:5182(Part-9)	19.44	2-200	180
7.	CO (mg/m ³)	IS:5182 (Part-10)	0.72	0.2-500	04
8.	Pb(µg/m ³)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr (µg/m ³)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd (µg/m ³)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m ³)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m ³)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

 Analyst


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FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO Lab/AAQ-3/02/19

Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer : Tata Steel Colliery (Jamadoba Grup)
 Address of the Customer : Jamadoba, Distt. Dhanbad
 Jharkhand
 Date of Sampling : 26.02.2019
 Sample Collected By : Ecomen Teem
 Sampling Method : IS: 5182
 Instrument Used : RDS & FDS
 Location : General Manager's Office Area

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18 th , 2009
1.	PM _{2.5} (µg/m ³)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	42.15	12.5-1000	60
2.	PM ₁₀ (µg/m ³)	IS:5182 (Part-23)	84.18	12.5-1000	100
3.	SO ₂ (µg/m ³)	IS:5182 (Part-2)	15.66	9-200	80
4.	NO ₂ (µg/m ³)	IS:5182 (Part-6)	28.77	6-200	80
5.	NH ₃ (µg/m ³)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	16.21	2-700	400
6.	O ₃ (µg/m ³)	IS:5182(Part-9)	25.21	2-200	180
7.	CO (mg/m ³)	IS:5182 (Part-10)	0.87	0.2-500	04
8.	Pb (µg/m ³)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr (µg/m ³)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd (µg/m ³)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m ³)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m ³)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

 Analyst


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FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO Lab/AAQ-4/02/19

Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer : Tata Steel Colliery (Jamadoba Grup)
 Address of the Customer : Jamadoba, Distt. Dhanbad
 Jharkhand
 Date of Sampling : 28.02.2019
 Sample Collected By : Ecomen Teem
 Sampling Method : IS: 5182
 Instrument Used : RDS & FDS
 Location : Jamadoba Colliery

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18 th , 2009
1.	PM _{2.5} (µg/m ³)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	45.31	12.5-1000	60
2.	PM ₁₀ (µg/m ³)	IS:5182 (Part-23)	86.93	12.5-1000	100
3.	SO ₂ (µg/m ³)	IS:5182 (Part-2)	18.37	9-200	80
4.	NO ₂ (µg/m ³)	IS:5182 (Part-6)	35.29	6-200	80
5.	NH ₃ (µg/m ³)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	17.28	2-700	400
6.	O ₃ (µg/m ³)	IS:5182(Part-9)	24.32	2-200	180
7.	CO (mg/m ³)	IS:5182 (Part-10)	1.21	0.2-500	04
8.	Pb (µg/m ³)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr (µg/m ³)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd (µg/m ³)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m ³)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m ³)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst

Authorized Signatory

Quality Manager

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FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO LAB/AAQ-1/03/19

TEST REPORT ISSUE DATE: 11.03.2019

TEST REPORT OF AMBIENT NOISE LEVEL

Name of the Customer : Tata Steel Colliery (Jamadoba Grup)
 Address of the Customer : Jamadoba, Distt. Dhanbad
 Jharkhand
 Sample Collected By : Ecomen Team
 Instrument Used : Noise Meter (HTC)

Sl. No.	Locations	Date of Monitoring	Day Time			Night Time		
			Max.	Min.	Leq.	Max.	Min.	Leq.
1.	Central Work Shop Area Jamadoba	28-01.03.2019	65.3	59.7	60.4	59.6	53.8	54.2
2.	Officer's Colony, 12 No. Digwadih	27-28.02.2019	56.9	51.5	52.7	49.8	46.1	47.8
3.	General Manager's Office Area	26-27.02.2019	62.7	56.8	57.3	54.6	49.8	50.1
4.	Jamadoba Colliery	26-27.02.2019	66.3	62.4	63.1.9	62.9	57.6	58.3

Noise (Ambient Standard)

Area Code	Category of area	Limit in dB (A) Leq	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note:

1. Day time is reckoned in between 6:00 AM and 10:00 PM.
2. Night time is reckoned in between 10:00 PM and 6:00 AM
3. Silence zone is defined as area up to 100m around such premises as hospitals, Educational institutions & courts. The silence zones are to be declared by a competent authority.
4. Mixed categories of areas should be declared as one of the four above-mentioned Categories by the competent authority and the corresponding standard shall apply.

Ravi Bhargava
Analyst

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FORMAT NO. ECO/QS/FORMAT/10

TEST REPORT NO: ECO LAB/MCPM/02/19

TEST REPORT ISSUE DATE: 11.03.2019

MINERALOGICAL COMPOSITION OF PARTICULATE MATTER

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Month : February, 2019

S.NO.	Locations	Date of Sampling	Mineralogical Composition (in %)			
			Silica (SiO ₂)	Ferrous oxide (FeO)	Alumina (Al ₂ O ₃)	Calcium Oxide CaO
1	Officers Colony, 12 No. Digwadih	27.02.2019	1.77	0.07	1.22	2.58
2	Central Work Shop Area, Jamadoba	28.02.2019	2.12	0.16	1.46	3.20


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FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/WW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF WASTE WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 28.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Digwadih Colliery

Sl. No.	TESTS	PROTOCOL	RESULT	Range of Testing / Limits of Detection	G.S.R 422(E)
					Desirable Limit
1	pH	APHA, 23rd Ed. 2017, 4500H' A+B	8.02	2-12	5.5-9.0
2	Total Suspended Solid as TSS (mg/l)	APHA, 23rd Ed. 2017, 2540D	16.0	5-5000	100.0
3	Total Dissolved Solids as TDS (mg/l)	APHA, 23rd Ed. 2017, 2540C	1008.0	10-10,000	-
4	Oil & Grease as O & G (mg/l)	APHA, 23rd Ed. 2017, 5520 (A+D)	BDL	5-600	10.0
5	Biochemical Oxygen Demand as BOD (mg/l) 3days at 27°C	APHA, 23rd Ed. 2017,5210 A+B	3.7	5-10000	30.0
6	Chemical Oxygen Demand as COD (mg/l)	APHA, 23rd Ed. 2017, 5220 A+B	16.4	5-50000	250.0

*The result are related only to item tested.

BDL = Below Detection Limit


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FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 25.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Bhowra 13 No. (well)
Ground Water Level : 10.0 Meter


Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA, 23rd Ed. 2017, (2550 A+B)	26.3	10-100	-	-
3.	Electrical Conductivity (μ mhos/cm)	APHA, 23rd Ed. 2017, 2510-A+B	1012.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA, 23rd Ed. 2017 (2540B)	685.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.92	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+B	252.0	5-1500	200	600
7.	Total Hardness as CaCO ₃ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	352.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	100.8	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	24.3	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.14	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	112.0	5-1000	250.0	1000.0
13.	Sulfate as SO ₄ (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	82.3	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO ₃ (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	14.2	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.32	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.21	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN , A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.

BDL = Below Detection Limit


Analyst


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FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
 Address of the Customer : Jamadoba,
 Distt. Dhanbad - 828 112
 Sampling Method : APHA, 23rd Ed. 2017
 Sample Collected by : Mr.R. K. Pandey
 Sample Quantity : As per requirement
 Date of Sampling : 25.02.2019
 Date of Sample Receiving : 02.03.2019
 Date of Analysis : 02.03.2019 to 09.03.2019
 Source of Sample : Mohalbari Basti (Hand Pump)
 Ground Water Level : 56.0Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991 (Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA, 23rd Ed. 2017, (2550 A+B)	26.4	10-100	-	-
3.	Electrical Conductivity (μ mhos/cm)	APHA, 23rd Ed. 2017, 2510-A+B	845.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA, 23rd Ed. 2017 (2540B)	510.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.72	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	216.0	5-1500	200	600
7.	Total Hardness as CaCO ₃ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	280.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	78.4	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	20.41	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.16	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	90.0	5-1000	250.0	1000.0
13.	Sulfate as SO ₄ (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	42.3	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO ₃ (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	19.0	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.49	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.12	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN, A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.

BDL = Below Detection Limit


 Analyst


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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
 Address of the Customer : Jamadoba,
 Distt. Dhanbad - 828 112
 Sampling Method : APHA, 23rd Ed. 2017
 Sample Collected by : Mr.R. K. Pandey
 Sample Quantity : As per requirement
 Date of Sampling : 25.02.2019
 Date of Sample Receiving : 02.03.2019
 Date of Analysis : 02.03.2019 to 09.03.2019
 Source of Sample : Jamadoba 3No.
 Ground Water Level : 10.0 Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991 (Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA, 23rd Ed. 2017, (2550 A+B)	26.5	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA, 23rd Ed. 2017, 2510-A+B	760.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA, 23rd Ed. 2017 (2540B)	480.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.90	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	212.0	5-1500	200	600
7.	Total Hardness as CaCO ₃ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	248.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	64.0	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	21.38	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.11	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	60.0	5-1000	250.0	1000.0
13.	Sulfate as SO ₄ (mg/l)	APHA, 23rd Ed. 2017, 4500-SO ₄ -E	43.3	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO ₃ (mg/l)	APHA, 23rd Ed. 2017, 4500-NO ₃ - B	11.5	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.39	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax.
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax.
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax.
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.12	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-50	0.05	No Relax.
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN, A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.

BDL = Below Detection Limit

Analyst

Authorized Signatory

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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 25.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Lower Dungari, (Well)
Ground Water Level : 11.0 Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA, 23rd Ed. 2017, (2550 A+B)	26.9	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA, 23rd Ed. 2017, 2510-A+B	932.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA, 23rd Ed. 2017 (2540B)	602.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.95	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	252.0	5-1500	200	600
7.	Total Hardness as CaCO ₃ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	268.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	72.0	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	21.38	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.17	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	66.0	5-1000	250.0	1000.0
13.	Sulfate as SO ₄ (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	42.2	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO ₃ (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	9.65	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.37	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.14	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN, A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.

BDL = Below Detection Limit


Analyst


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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19

TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 25.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Jorapokhra kushtand (Hand Pump)
Ground Water Level : 47.0 Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA, 23rd Ed. 2017, (2550 A+B)	26.3	10-100	-	-
3.	Electrical Conductivity (μ mhos/cm)	APHA, 23rd Ed. 2017, 2510-A+B	698.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA, 23rd Ed. 2017 (2540B)	506.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.56	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	204.0	5-1500	200	600
7.	Total Hardness as CaCO ₃ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	276.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	70.4	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	24.3	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.20	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	54.0	5-1000	250.0	1000.0
13.	Sulfate as SO ₄ (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	38.9	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO ₃ (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	13.6	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.32	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax.
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax.
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax.
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.12	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-50	0.05	No Relax.
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN, A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.

BDL = Below Detection Limit


Analyst


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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO: ECO LAB/SW/02/19

TEST REPORT ISSUE DATE: 09.03.2019

TEST REPORT OF SURFACE WATER

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Damoder River Up Stream

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	IS:2296 Class-C
1.	pH	APHA, 23 rd Ed. 2017, 4500H+A+B,	7.79	2-12	8.5
2.	Turbidity as (NTU)	APHA, 23 rd Ed. 2017, 2130-A+B	BDL	1-100	-
3.	Total Dissolved Solids as TDS (mg/l)	APHA, 23 rd Ed. 2017 (2540C)	245.0	5-10000	1500
4.	Dissolved Oxygen as DO (mg/l)	APHA, 23 rd Ed. 2017 (4500 A+C)	6.1	2-10	4.0
5.	Biochemical Oxygen Demand as BOD (mg/l)	APHA, 23 rd Ed. 2017 (5210A+ B)	BDL	5-10000	3.0
6.	Chloride as Cl (mg/l)	APHA, 23 rd Ed. 2017, 4500 Cl A+B	28.0	5-1000	-
7.	Fluorides as F (mg/l)	APHA, 23 rd Ed. 2017 (4500 -C)	0.62	0.05-10	1.5
8.	Sulfate as SO ₄ (mg/l)	APHA, 23 rd Ed. 2017 (4500 -SO ₄ ²⁻ E)	20.2	1.0-250	400.0

*The result are related only to item tested - The parameters are not included in IS: 2296 Class-C
BDL - Below Detection Limit


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FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO: ECO LAB/SW/02/19

TEST REPORT ISSUE DATE: 09.03.2019

TEST REPORT OF SURFACE WATER

Name of the Customer : M/s Tata Steel Ltd. (Jamadoba Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad - 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Damoder River Down Stream

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	IS:2296 Class-C
1.	pH	APHA, 23 rd Ed. 2017, 4500H+A+B,	7.86	2-12	8.5
2.	Turbidity as (NTU)	APHA, 23 rd Ed. 2017, 2130-A+B	BDL	1-100	-
3.	Total Dissolved Solids as TDS (mg/l)	APHA, 23 rd Ed. 2017 (2540C)	326.0	5-10000	1500
4.	Dissolved Oxygen as DO (mg/l)	APHA, 23 rd Ed. 2017 (4500 A+C)	6.5	2-10	4.0
5.	Biochemical Oxygen Demand as BOD (mg/l)	APHA, 23 rd Ed. 2017 (5210A+ B)	BDL	5-10000	3.0
6.	Chloride as Cl (mg/l)	APHA, 23 rd Ed. 2017, 4500 Cl A+B	32.0	5-1000	-
7.	Fluorides as F (mg/l)	APHA, 23 rd Ed. 2017 (4500 - C)	0.66	0.05-10	1.5
8.	Sulfate as SO ₄ (mg/l)	APHA, 23 rd Ed. 2017 (4500 -SO ₄ ²⁻ E)	23.0	1.0-250	400.0

*The result are related only to item tested - The parameters are not included in IS: 2296 Class-C
BDL - Below Detection Limit


Analyst


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GM (J) Chief (HR/IR)

Publication

DAINIK BHASKAR, DHANBAD Date 11-10-13



TATA

TATA STEEL

सूचना

जन साधारण को सूचित किया जाता है कि भारत सरकार, वन एवं पर्यावरण मंत्रालय के पत्रांक संख्या- J -11015/372/2010-IA.II(M) डिगवाडीह कोलियरी (0.38 मिलियन टन प्रति वर्ष से 0.6 मिलियन टन प्रति वर्ष, विस्तारीकरण परियोजना) मेसर्स टाटा स्टील लिमिटेड, डिगवाडीह, जिला-धनबाद को पर्यावरण स्वीकृति प्रदान की गई है। जिसकी प्रतिलिपि क्षेत्रीय कार्यालय, झारखंड राज्य प्रदूषण नियंत्रण परिषद, धनबाद में उपलब्ध है तथा भारत सरकार, वन एवं पर्यावरण मंत्रालय के इंटरनेट साइट :- <http://envfor.nic.in> में भी देखी जा सकती है।

महाप्रबंधक (झरिया)

टाटा स्टील, जामाडोबा (धनबाद)

GM (J)

Chief (HR/IR)

Publication

PRABHAT KHABAR, DHANBAD Date **11-10-13**



TATA STEEL
सूचना

जन साधारण को सूचित किया जाता है कि भारत सरकार, वन एवं पर्यावरण मंत्रालय के पत्रांक संख्या- J -11015/372/2010-IA.II(M) डिगवाडीह कोलियरी (0.38 मिलियन टन प्रति वर्ष से 0.6 मिलियन टन प्रति वर्ष, विस्तारीकरण परियोजना) मेसर्स टाटा स्टील लिमिटेड, डिगवाडीह, जिला-धनबाद को पर्यावरण स्वीकृति प्रदान की गई है। जिसकी प्रतिलिपि क्षेत्रीय कार्यालय, झारखंड राज्य प्रदूषण नियंत्रण परिषद्, धनबाद में उपलब्ध है तथा भारत सरकार, वन एवं पर्यावरण मंत्रालय के इंटरनेट साइट :- <http://envfor.nic.in> में भी देखी जा सकती है।

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GM (J) Chief (HR/IR)

Publication HINDUSTAN, DHANBAD Date 11-10-13



TATA STEEL
सूचना

जन साधारण को सूचित किया जाता है कि भारत सरकार, वन एवं पर्यावरण मंत्रालय के पत्रांक संख्या- J -11015/372/2010-IA.II(M) डिगवाडीह कोलियरी (0.38 मिलियन टन प्रति वर्ष से 0.6 मिलियन टन प्रति वर्ष, विस्तारीकरण परियोजना) मेसर्स टाटा स्टील लिमिटेड, डिगवाडीह, जिला-धनबाद को पर्यावरण स्वीकृति प्रदान की गई है। जिसकी प्रतिलिपि क्षेत्रीय कार्यालय, झारखंड राज्य प्रदूषण नियंत्रण परिषद्, धनबाद में उपलब्ध है तथा भारत सरकार, वन एवं पर्यावरण मंत्रालय के इंटरनेट साइट :- <http://envfor.nic.in> में भी देखी जा सकती है।

महाप्रबंधक (झरिया)
टाटा स्टील, जामाडोबा (धनबाद)

GM (J) Chief (HR/IR)

Publication DAINIK JAGRAN, DHANBAD Date 11-10-13



TATA

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सूचना

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महाप्रबंधक (झरिया)

टाटा स्टील, जामाडोबा (धनबाद)

Annexure III Acknowledgment of EC receipt at Municipal Commissioner office

Municipal Commissioner,
Dhanbad.

Ref No.: JMB/ENV/DIG/37/ 805 /2018

September 17 , 2018

Sub: Submission of copy of Environmental Clearance granted to units of M/s Tata Steel Limited

Dear Sir,

Please find enclosed the letter of Environmental Clearance (EC) granted by MoEFCC to various units of Tata Steel Limited, Jharia Division, Dhanbad as per the following details-

1. Digwadih Colliery (for expansion from 0.38 MTPA to 0.6 MTPA in ML area 314.57 ha), dist. Dhanbad, Jharkhand.
2. 6 & 7 Pits Colliery (for expansion from 0.28 MTPA to 0.6 MTPA in ML area 168.12 ha), dist. Dhanbad, Jharkhand.
3. Jamadoba Coal Washery (for expansion from 1 MTPA to 2 MTPA in 7 Ha area), dist. Dhanbad, Jharkhand.

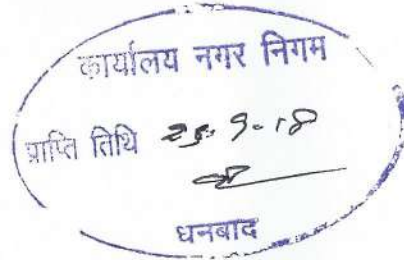
The copy of EC letter and its compliance is also uploaded in website (<http://www.tatasteel.com/sustainability/environment-compliance-reports/>) for your kind perusal.

Thanking You,

Yours faithfully,



Head, Planning
Jharia Division



ENVIRONMENTAL POLICY

Tata Steel's environmental responsibilities are driven by our commitment to preserve the environment and are integral to the way we do business.

1. We are committed to deal proactively with Climate Change issue by efficient use of natural resources & energy; reducing and preventing pollution; promoting waste avoidance and recycling measures; and product stewardship.
 - We shall identify, assess and manage our environment impact.
 - We shall regularly monitor, review and report publicly our environmental performance.
 - We shall develop & rehabilitate abandoned sites through afforestation and landscaping and shall protect and preserve the biodiversity in the areas of our operations.
 - We shall enhance awareness, skill and competence of our employees and contractors so as to enable them to demonstrate their involvement, responsibility and accountability for sound environmental performance.
2. We are committed to continual improvement in our environmental performance.
 - We shall set objective-targets, develop, implement and maintain management standards and systems, and go beyond compliance of the relevant industry standards, legal and other requirements.
3. We will truly succeed when we sustain our environmental achievement and are valued by the communities in which we work.

Date : November 1, 2017



T V Narendran
CEO & Managing Director



Annexure V

FOOD BASKET SURVEY

Food basket survey was conducted for 181 respondents of the neighbouring villages of Jamadoba and Bhelatand Group. The survey was conducted across 24 hamlets and wards nearby our operations area with the following objectives:-

1. To know the living conditions of the people.
2. To know the minimum wage of the people.
3. Develop an action plan to improve the living conditions by identifying gaps.

The following hamlets and municipal wards (24 villages) were surveyed:-

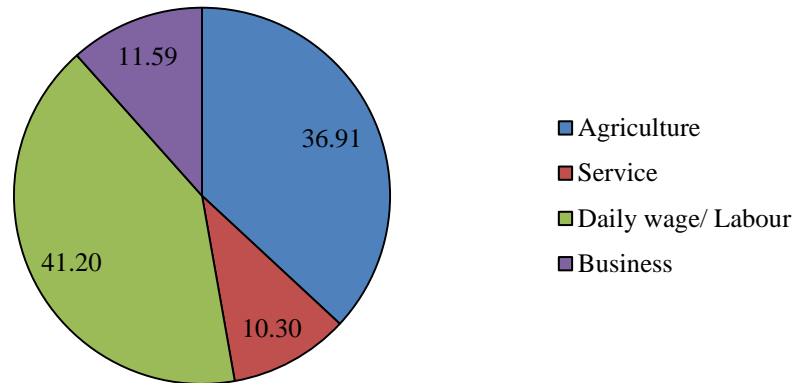
Baidnawadih, Banskapuria, Belubakhar, Bhelatand, Birajdih, Bustar, Chhatand, Debogram, Digwadiah-10 no., Dukhidih, Dumri-4 no., Jahajand, Jorapokhar, Kalimela, Kasiatand, Kushtand, Lalbungalow, Noonudih, Patia, Purnadih, Suyakanali, Tata Sijua-12 no, Tata Sijua 6 no., Upper Dungri.

Observations: -

- It was observed that there was a great skewedness in economic well among the population. The average income per Family is Rs. 8823.00 (181 beneficiaries).
- Out of 181 Households, 295 were earning members.
- The minimum earnings per day in unorganised sector and casual workers is approx. Rs208.00 (Total earning / total no. of earning members)
- No. of members per family is $991/181 = 5.47$
- Average Working persons per family is $295/181 = 1.63$
- The major demands that have come up is ameliorating unemployment and Drinking water and combating social evils like Alcoholism, Dowry and Domestic Violence. Unemployment is especially to the new generation who may not be having adequate number of jobs.
- The major livelihood is wage labour and also a substantial number of Population is engaged in Agriculture. Only a few are unemployed.

Livelihood	Numbers	Percentage (%)
Agriculture	86	36.90
Service	24	10.30
Daily wage/ Labour	96	41.20
Business	27	11.59
TOTAL	233	100%

LIVELIHOOD PATTERN %



Expenditure in (Rs) Per Family Per Month

S.No.	Expenditure Item	Expenditure in Rupees	Expenditure per family per month in Rupees
1	Transportation	49376	272
2	House	0	0
3	Electricity	24005	132.62
4	Water	3003	17.00
5	Education	65426	361.46
6	Medical	84259	465.37
7	Clothing	88034	486.37
8	Soc. Oblg.	25581.31	141.33
9	Food	3598.16	3598.16
10	Fuel	37851	209.12
	Total	381133.5	5683.43

- Total Expenditure per month- Rs 3,81,133.5
- Average expenditure per family per month- Rs 5683.58
- Average expenditure per member- (5683.58/5.4)= Rs 1052.4
- Income per family- Rs 8823
- Income per month per individual Earning member= Rs 208.00 x 26= Rs 5,408.00
- Expenditure Per person on food per month= Rs 3598.16/5.4= Rs 719.63
- % of Expenditure Spent on food by per person per month= 719.63/1052.40*100=68.37%

BASIC NEED WAGE:

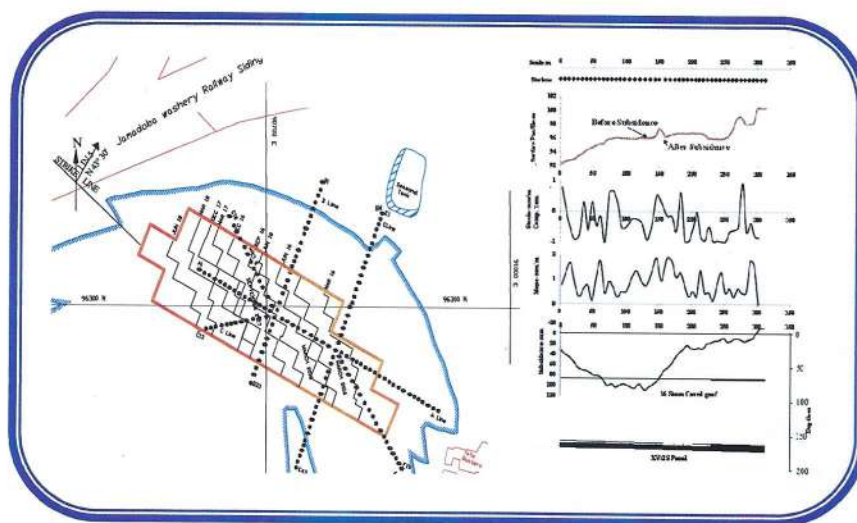
Basic food expense per person X 100/% expense on food X 1/Avg working persons per family X Avg Family Size X 1.1

$$=719.63 \times 100/68.37 \times 1/1.63 \times 5.4 \times 1.1 = \text{Rs}3835.68$$

So, The Basic Need Wage is Rs 3835.68

REPORT

On SAFETY EVALUATION OF DIFFERENT SURFACE FEATURES AND STRUCTURES DUE TO SUBSIDENCE MOVEMENTS AT TATA STEEL COLLIERIES IN JHARIA COALFIELD



January, 2019

MINE SUBSIDENCE AND SURVEYING
CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(A Constituent of Council of Scientific & Industrial Research)
Barwa Road, Dhanbad – 826015, Jharkhand

REPORT
On

**SAFETY EVALUATION OF DIFFERENT SURFACE FEATURES AND
STRUCTURES DUE TO SUBSIDENCE MOVEMENTS AT TATA
STEEL COLLIERIES IN JHARIA COALFIELD**

(Period: October, 2017 to September, 2018)

Project No. SSP/237/2017-2018
Project No. CNP/4622/2017-2018

PROJECT PERSONNEL

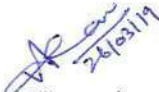
Sri Aniket Verma, Scientist
Sri Ajay Kumar, Pr. Tech. Officer
Dr. A. Prakash, Pr. Scientist
Sri S. N. Rajak, Sr. Technician
Dr. K. K. K. Singh, Chief Scientist

This Report is meant for internal use of your organisation only and it should not be published in full or part by your organisation or staff. It should not be communicated/circulated to outside parties except the concerned departments. Central Institute of Mining & Fuel Research, Dhanbad reserves the right to publish the results of this report for the benefit of the industry.

Signature of the Project Proponents



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Scientist/ Pr. Tech. Officer
Project Leaders
CSIR-CIMFR, Dhanbad



(Amar Prakash)
Pr. Scientist
Head
CSIR-CIMFR, Dhanbad



CSIR-CIMFR, Dhanbad



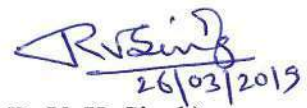
(S. K. Mandal)
Chief Scientist
HORG
CSIR-CIMFR, Dhanbad

CSIR-CIMFR, Dhanbad

CSIR-CIMFR, Authorized Signatories



(P. K. Mishra)
Principal Scientist & HOS,
Project Monitoring



(R. V. K. Singh)
Chief Scientist & HORG,
Business Development & Industrial Liaison

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EXECUTIVE SUMMARY

Subsidence investigations were conducted over 12 stowed panels during October, 2017 and September, 2018 at Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadih, Sijua and Bhelatand collieries of Tata Steel in Jharia Coalfield for the safety evaluation of different surface features and structures. All the panels were extracted by bord and pillar method of mining with 70-80 percent of coal extraction in conjunction with hydraulic sand stowing. Depillaring operations were carried out at depths varying from 133 m to 593 m. The width-depth ratio of the panels varied between 0.24 and 0.87, i.e., all the panels were under sub-critical width. All these panels were extracted under multi-seam mining condition with overlying old stowed and caved goaves. One panels namely IX/8S of Digwadih colliery was extracted completed during the study period. The important surface features over most of the panels include company quarters, private roads, ponds, filter plant, tank, high tension lines and private buildings. This study conducted during the above period led to the following conclusion and recommendation:

- 1) Maximum subsidence movement was 4.64 % of extraction thicknesses over the 2S panel in XV seam at Jamadoba 2 Pit.
- 2) Maximum slope, compressive and tensile strains observed over measured panels were 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively.
- 3) Subsidence, slope and strains profiles were influenced by overlying old goaves, position of goaf edges, inclination of the seam, topography of the surface profiles as well as left out stooks/ribs in the overlying seams worked by bord and pillar method of mining.
- 4) Subsidence movements did not cause any adverse impact on surface features and structures.
- 5) It is recommended to erect subsidence monitoring stations at least one month before the commencement of depillaring over new panels.
- 6) It is also recommended to extend subsidence monitoring stations equal to panel depth outside the panel boundary.
- 7) It is recommended to continue subsidence investigations for the safety evaluation of different surface features and structures lying over different on-going and future depillaring panels.

1.0 INTRODUCTION

Subsidence investigation at different collieries of Tata Steel (erstwhile TISCO) in Jharia Coalfield is being carried out since 1982, on yearly sponsorship. General Manager of Tata Steel Jharia division requested Director, Central Institute of Mining and Fuel Research (CIMFR), Dhanbad to conduct subsidence investigations over depillaring panels in the collieries of Jharia Coalfield for the period between October, 2017 and September, 2018. Subsidence investigations were conducted in five collieries, namely, Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadiah, Sijua and Bhelatand of Tata Steel in Jharia Coalfield. Mining leasehold areas of these collieries have important surface features and structures like railway lines, quarters, hospital, roads, forest land, high tension line, nallah, agricultural land, water tank, buildings, etc. The main objectives of this study are to evaluate the stability and safety of different surface features and structures lying above the depillaring panels and to generate data to develop subsidence predictive model for Jharia Coalfield.

It was proposed to conduct surface ground movement studies over 12 stowed panels between October, 2017 and September, 2018 located in the above-mentioned five collieries. This report covers outcome of subsidence investigations conducted over 12 panels at Tata Steel collieries in Jharia Coalfield during October, 2017 and September, 2018.

2.0 GEO-MINING DETAILS OF EXTRACTION

Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit and Digwadiah collieries are located in the eastern limb whereas Sijua and Bhelatand colliery is located in the western limb of Jharia Coalfield as depicted in Fig. 1. Geo-mining details of different panels are shown in Table - 1. The width-depth ratio of the panels varied between 0.24 and 0.87, i.e., all the panels were under sub-critical width. The lower width-depth ratios of the panels were maintained to minimize the magnitude of subsidence movements for the protection of important surface features and structures. All the stowed panels were under multi-seam working condition. Layouts of monitoring stations with overlying workings and surface features are shown in figures 2 through 13. Systematic erections of subsidence monitoring stations over and around the panels were not feasible at few places owing to constraints by different surface features and structures. Borehole sections of five collieries with lithology and strata thickness are shown in figures 14 to 18.

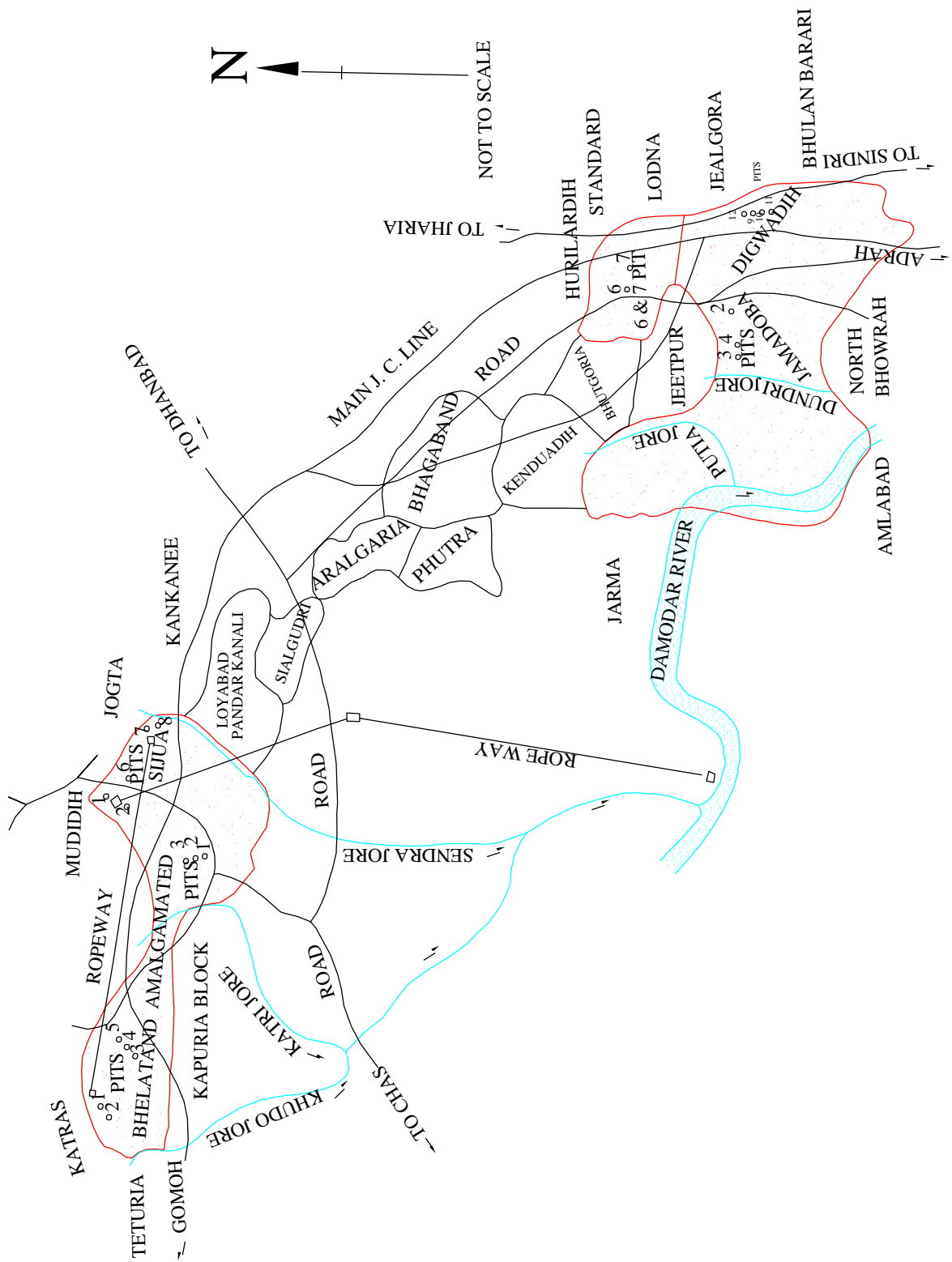


Fig. 1: Location of Tata Steel collieries in Jhaira Coalfield

Table-1: Geo-mining details of extraction in different collieries of Tata Steel in Jharia Coalfield

Sl. No.	Colliery	Seam/dip of seam/panel	Extraction thickness (m)	Average depth of extraction (m)	Panel size (m x m)	Mining method / extraction percentage (%) / Overburden sandstone (%)	Extraction period	Overlying goaf	Surface properties
1	Jamadoba 2 Pit	XV/1in 5/3S	4.50	133.00	140X116	B&P/80/60	08/2018 to cont.	Caved goaves in 16, 15A partly virgin	Private road, single storey company quarter, H.T. line, forest
2	Jamadoba 2 Pit	XI/1 in 7/3S	2.70	593.00	200X185	B&P/80/92	04/2017 to cont.	18, 14 seams caved; 17, 16, 16A and 15A seams partly caved; 13 seam fully stowed and 12 seam virgin.	Dungri jore and Private road
3	Jamadoba 2 Pit	XI/1 in 7/2S	4.50	530.00	150X250	B&P/80/92	15/01/16 to cont.	18 and 15A seams partly caved; 16A and 16 and 14 seams partly caved	Pucca road, seasonal tank, H.T. line, Aerial ropeway of SAIL central store and company quarters.
4	Jamadoba 2 Pit	XV/ 1in 5/2S	3.40	166.00	245X72	B&P/60/80	01/09/15 to cont.	XVI seam caved	Barren land
5	Bhutgoria Jamadoba 6&7 Pit	IX/ 1 in 7.2/6S	3.06	405.00	350X150	B&P/70/60	10/2016 to cont.	16A and 16 seams mostly caved; 14 and 11 seams mostly stowed	Quarters, H.T. Line, plantation & barren land
6	Bhutgoria Jamadoba 6&7 Pit	IX/1 in 7.2/1S	3.06	406.50	400X150	B&P/70/60	12/2015 to cont.	16A and 16 seams partly caved; 16, 14 and 11 seams stowed	Company quarters, road, private buildings

Sl. No.	Colliery	Seam/dip of seam/panel	Extraction thickness (m)	Average depth of extraction (m)	Panel size (m x m)	Mining method / extraction percentage (%) / Overburden sandstone (%)	Extraction period	Overlying goaf	Surface properties
7	Digwadih	IX/1 in 7/8S	2.94	410.00	240X150	B&P/70/62	12/2016 to 05/2018	15A, 16 and 16A seams caved; 15, 14 and 11 seams partly stowed	H.T. line, pucca road, private buildings and seasonal tank.
8	Digwadih	IX/1 in 6.8/6S	2.94	435.50	290X194	B&P/72/60	01/2018 to cont.	16A, 16 and 15A seams caved; 15, 14 and 11 seams stowed	Private buildings, two seasonal tanks, drain, road and H.T. line
9	Sijua	X/1 in 4.67 /10S(Ext.)	3.71	373.00	150X90	B&P/70/65	05/2017 to cont.	15, 14, 13, 12 and 11 seams stowed	Buildings, J.S.T. line, tank, village road
10	Sijua	IX/1 in 5.07 /1S	3.05 (Top)	273.90	215X200	B&P/80/65	08/2018 to cont.	13 and 16 seams stowed	Plantation, road, barren land
11	Bhelatand	XIV(E)/ 1 in 5.4/ 3S	2.70	382.19	220X130	B&P/75/63	12/2017 to cont.	16 seam partly caved and stowed; 15 seam stowed	Paddy land and H.T. line
12	Bhelatand	XIV(W)/ 1 in 6/ 1S	3.00	468.00	180X155	B&P/75/67	11/2017 to cont.	15, 16 and 17 seams caved	Barren & paddy land, PWD road

B&P = Bord & Pillar, S = Stowing; H.T. = High Tension; Ext. = extension

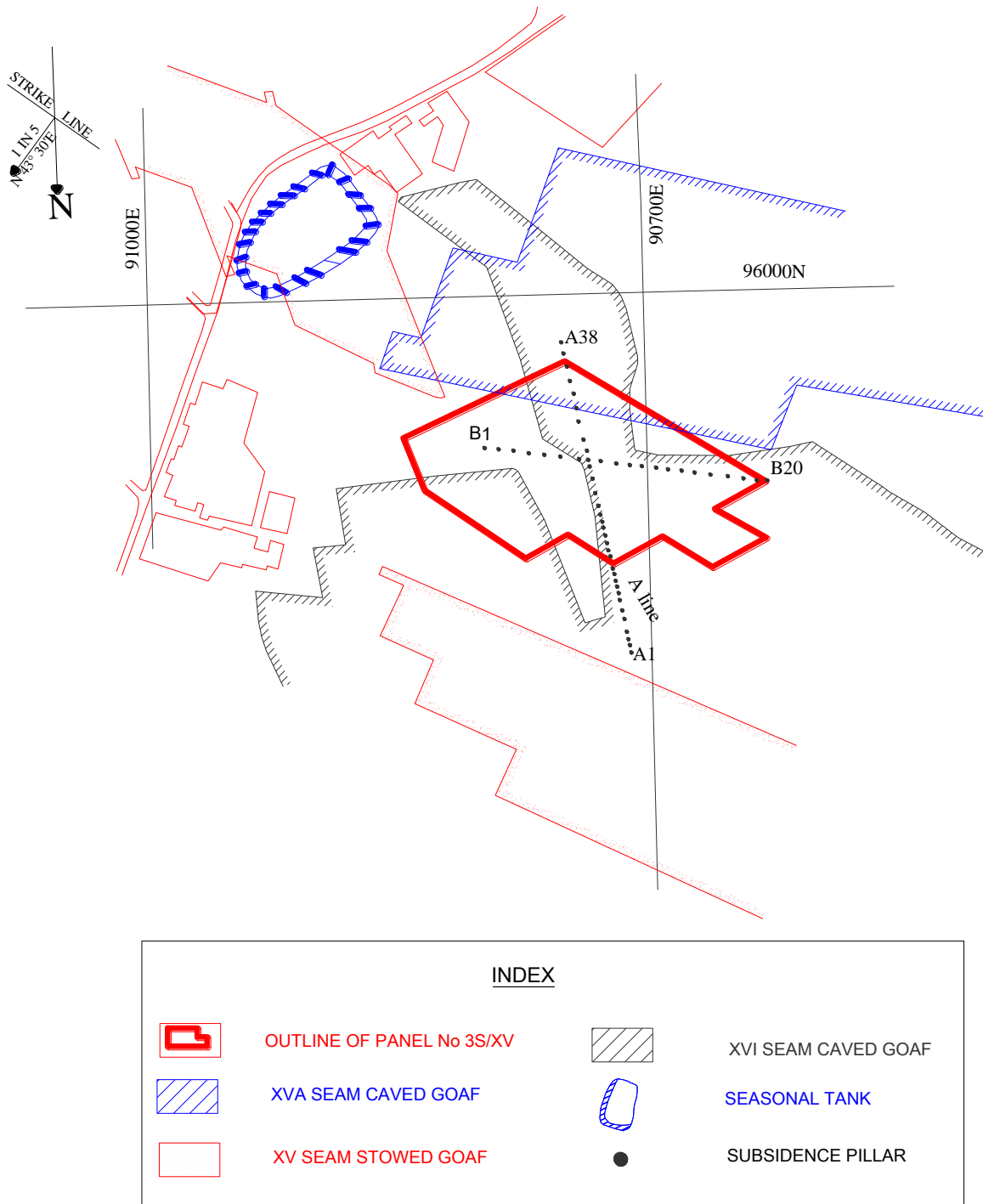
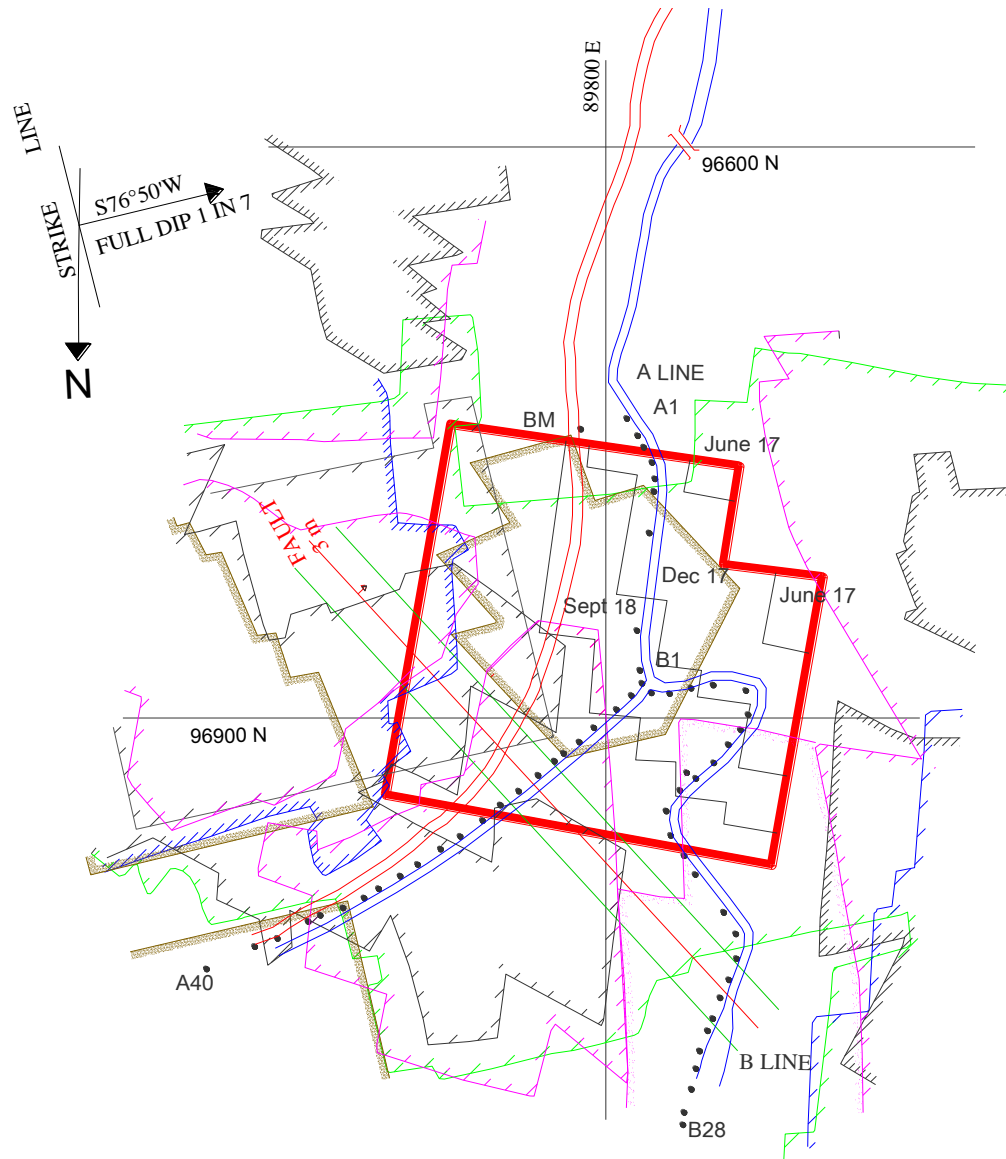


Fig. 2: Layout of monitoring stations over 3S panel in XV seam with overlying side goaf at Jamadoba 2 Pit colliery











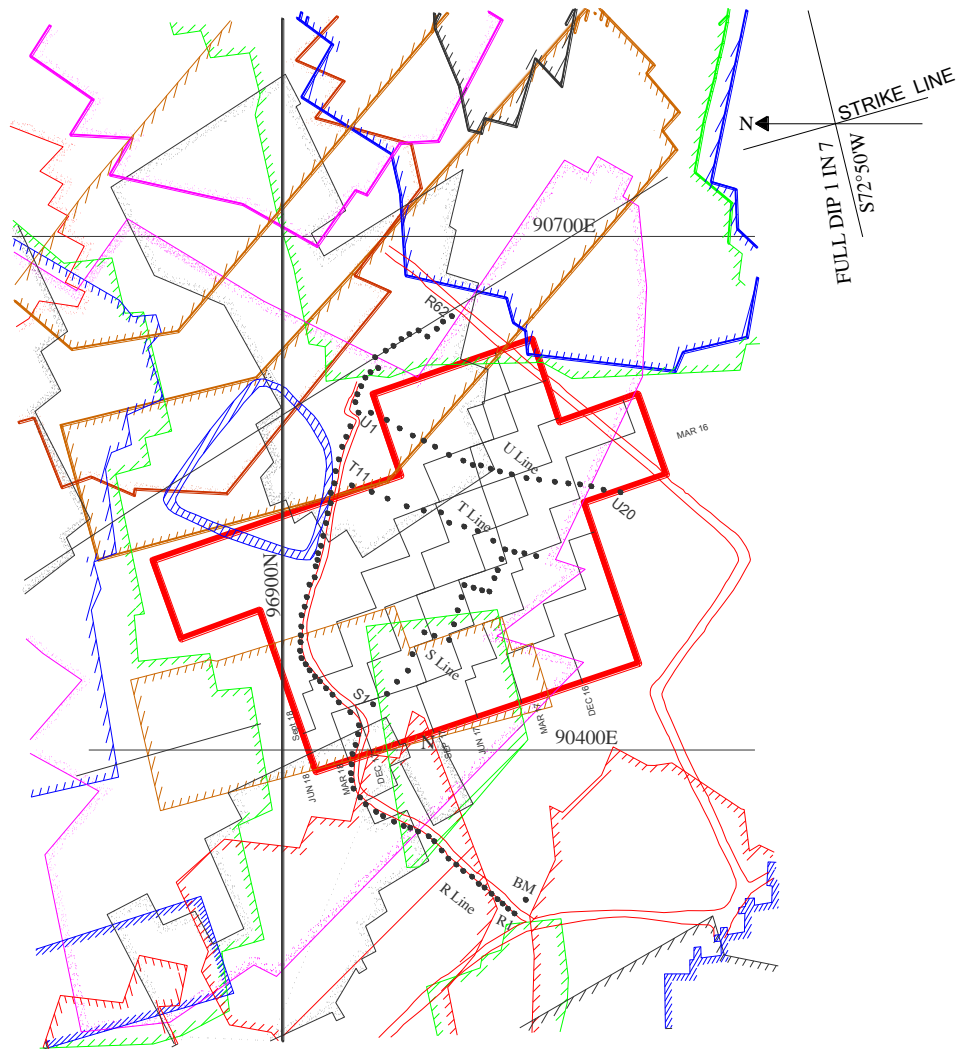
INDEX			
	OUTLINE OF PANEL No XI/3S		XVI SEAM CAVED GOAF
	XVIII SEAM CAVED GOAF		XV A SEAM CAVED GOAF
	XVII SEAM CAVED GOAF		XIV SEAM STOWED GOAF
	XVI-A SEAM CAVED & STOWED GOAF		SUBSIDENCE PILLAR

Fig. 3: Layout of monitoring stations over 3S panel in XI seam with overlying goaves at Jamadoba 2 Pit colliery











INDEX			
	Panel No XI/2-S		XVI Seam Goaf
	XVIII Seam Goaf		XV A Seam Goaf
	XVII Seam Goaf		XIV Seam Goaf
	XVI A Seam Goaf		Subsidence Pillar

Fig. 4: Layout of monitoring stations over 2S panel in XI seam with overlying goaves at Jamadoba 2 Pit colliery

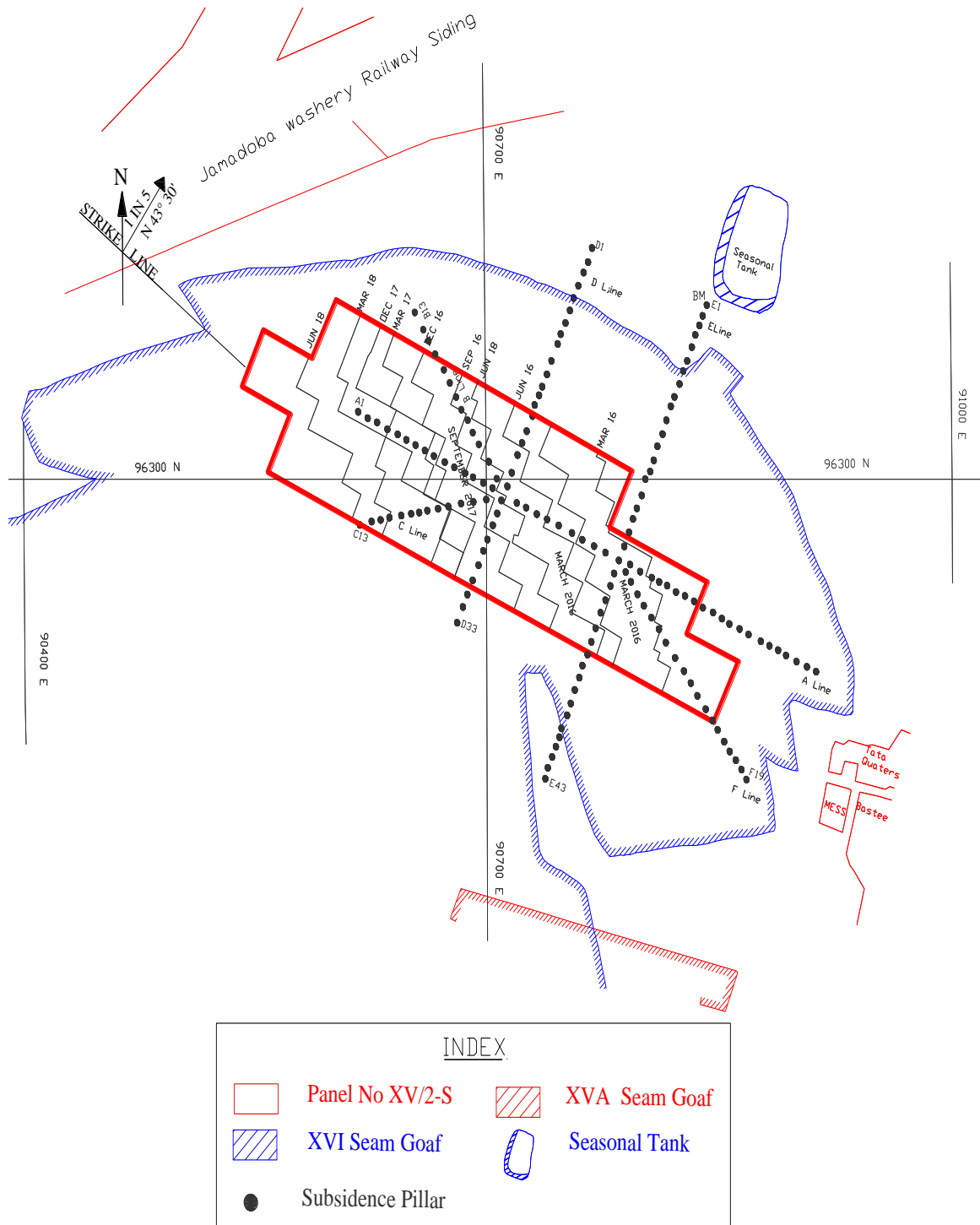


Fig. 5: Layout of monitoring stations over 2S panel in XV seam with overlying goaves at Jamadoba 2 Pit colliery

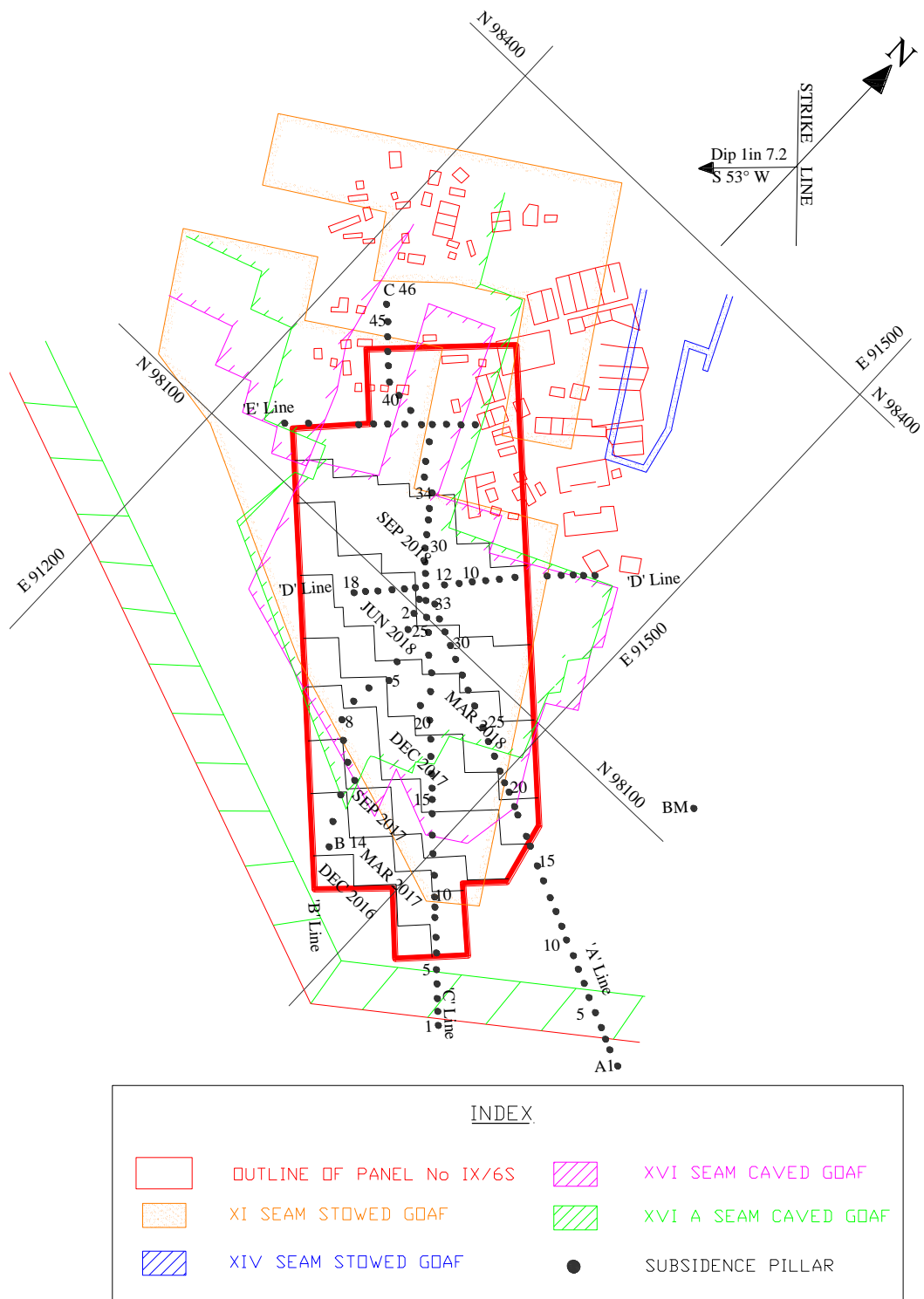


Fig. 6: Layout of monitoring stations over 6S panel in IX seam with overlying goaves at Bhutgoria Amalgamated Jamadoba 6&7 Pits colliery

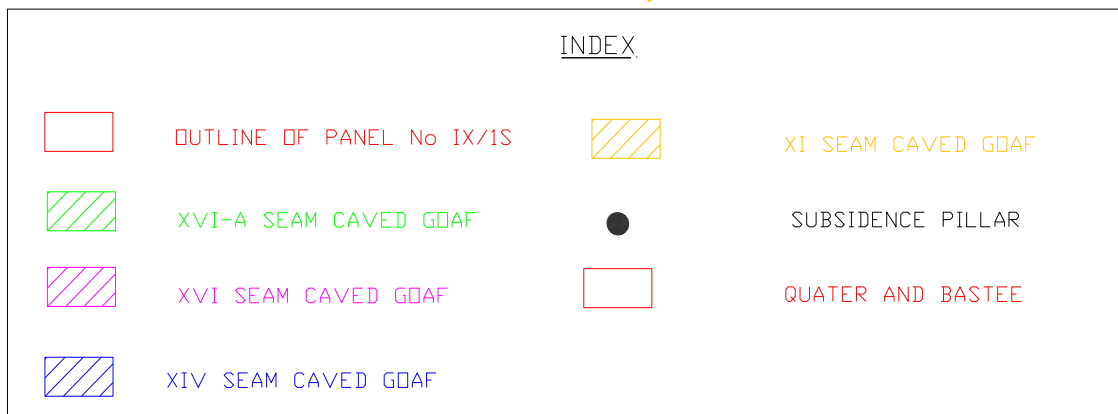
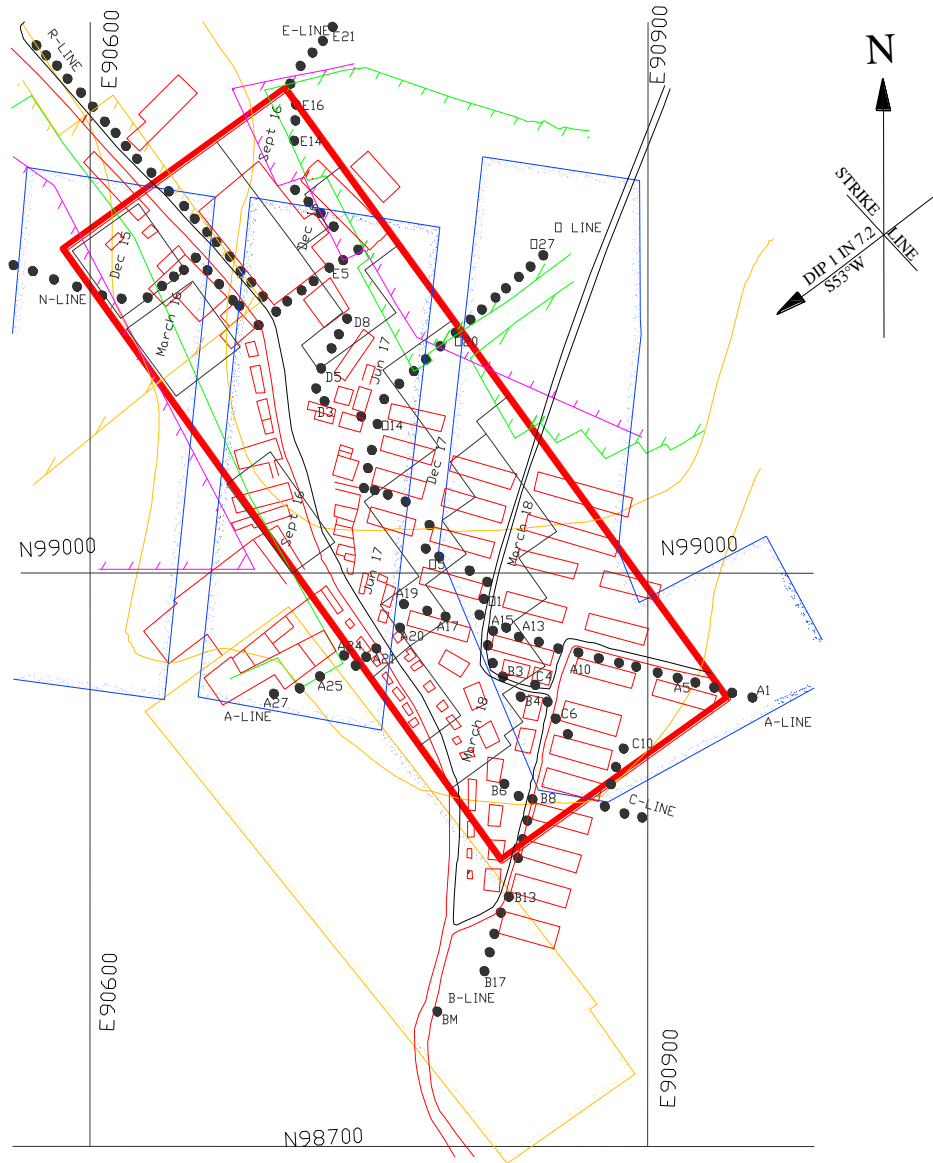


Fig. 7: Layout of monitoring stations over 1S panel in IX seam with overlying goaves at Bhutgoria Amalgamated Jamadoba 6&7 Pits colliery

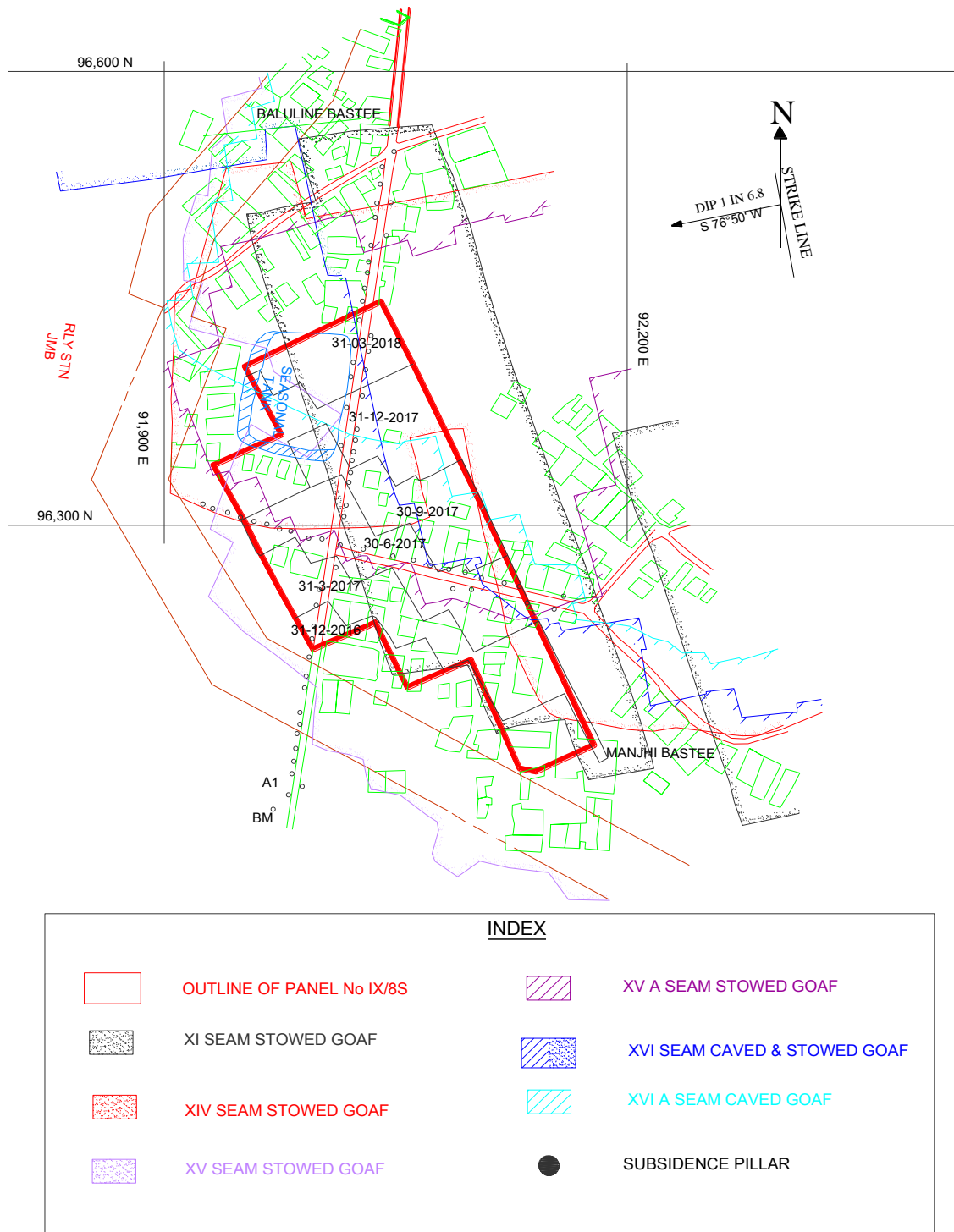


Fig. 8: Layout of monitoring stations over 8S panel in IX seam with overlying goaves at Digwadih colliery

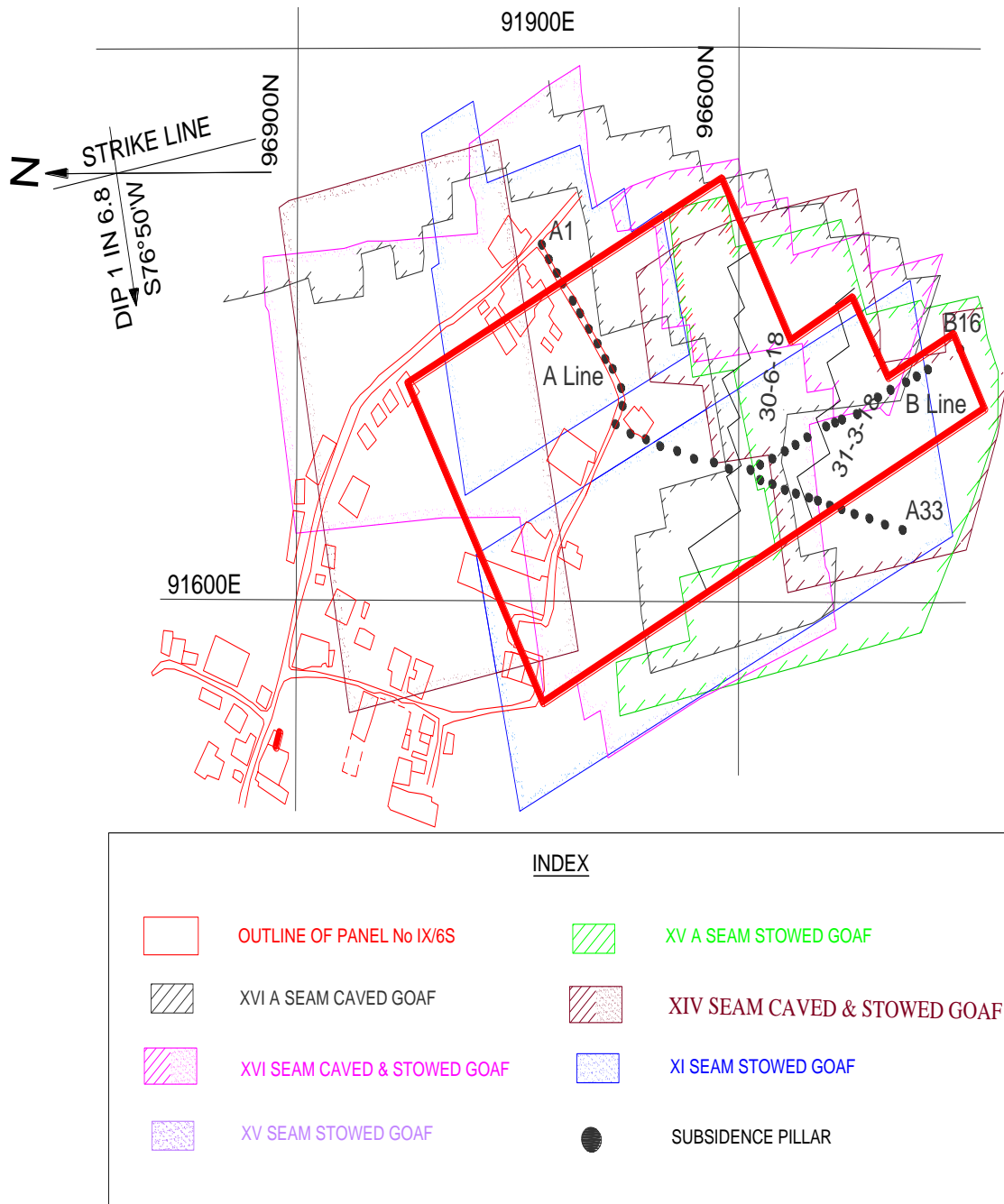


Fig. 9: Layout of monitoring stations over 6S panel in IX seam with overlying goaves at Digwadih colliery

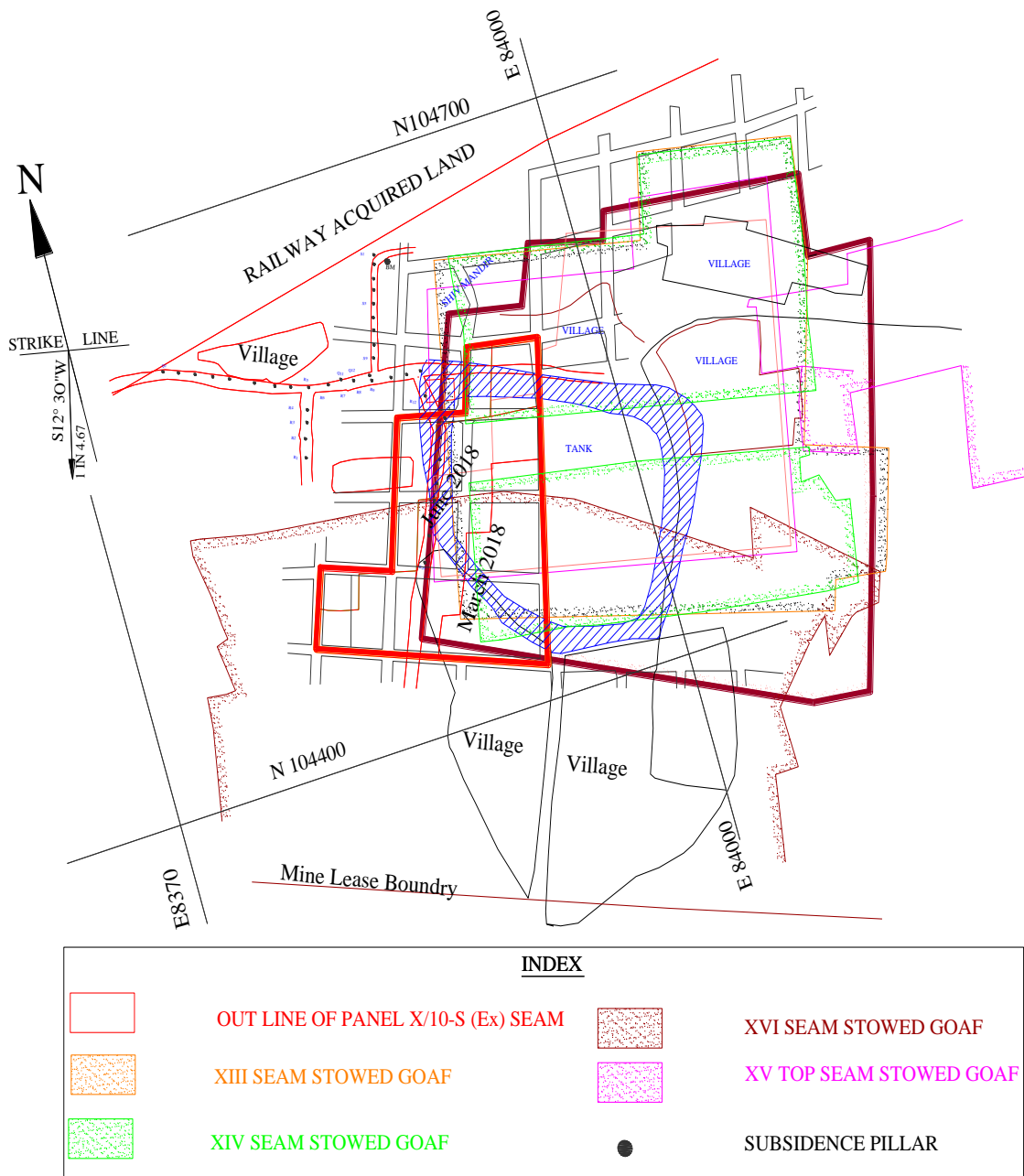


Fig. 10: Layout of monitoring stations over 10S (Ext.) panel in X seam with overlying goaves at Sijua colliery

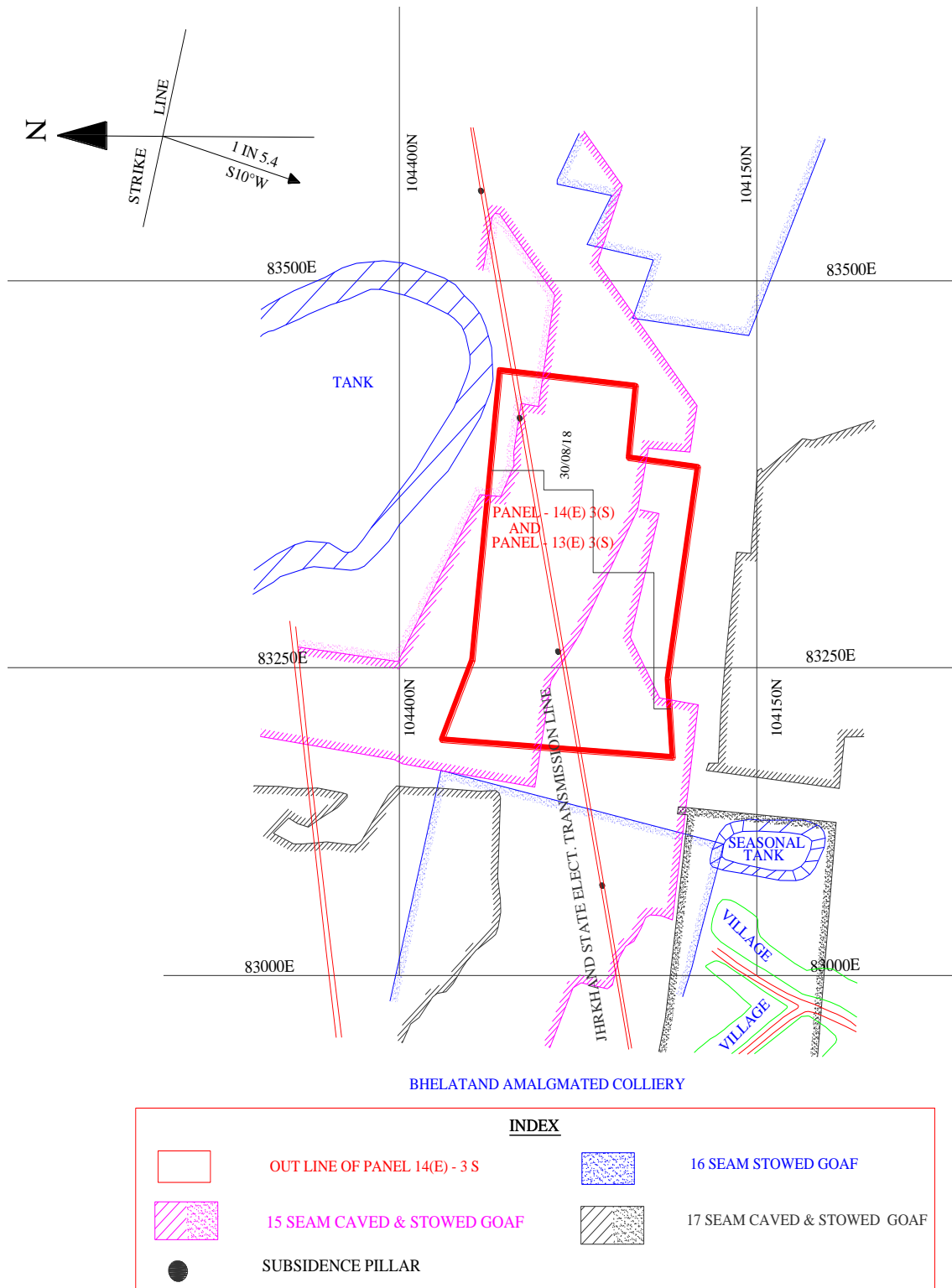


Fig. 12: Layout of monitoring stations over 3S panel in XIV (E) seam with overlying goaves at Bhelatand colliery

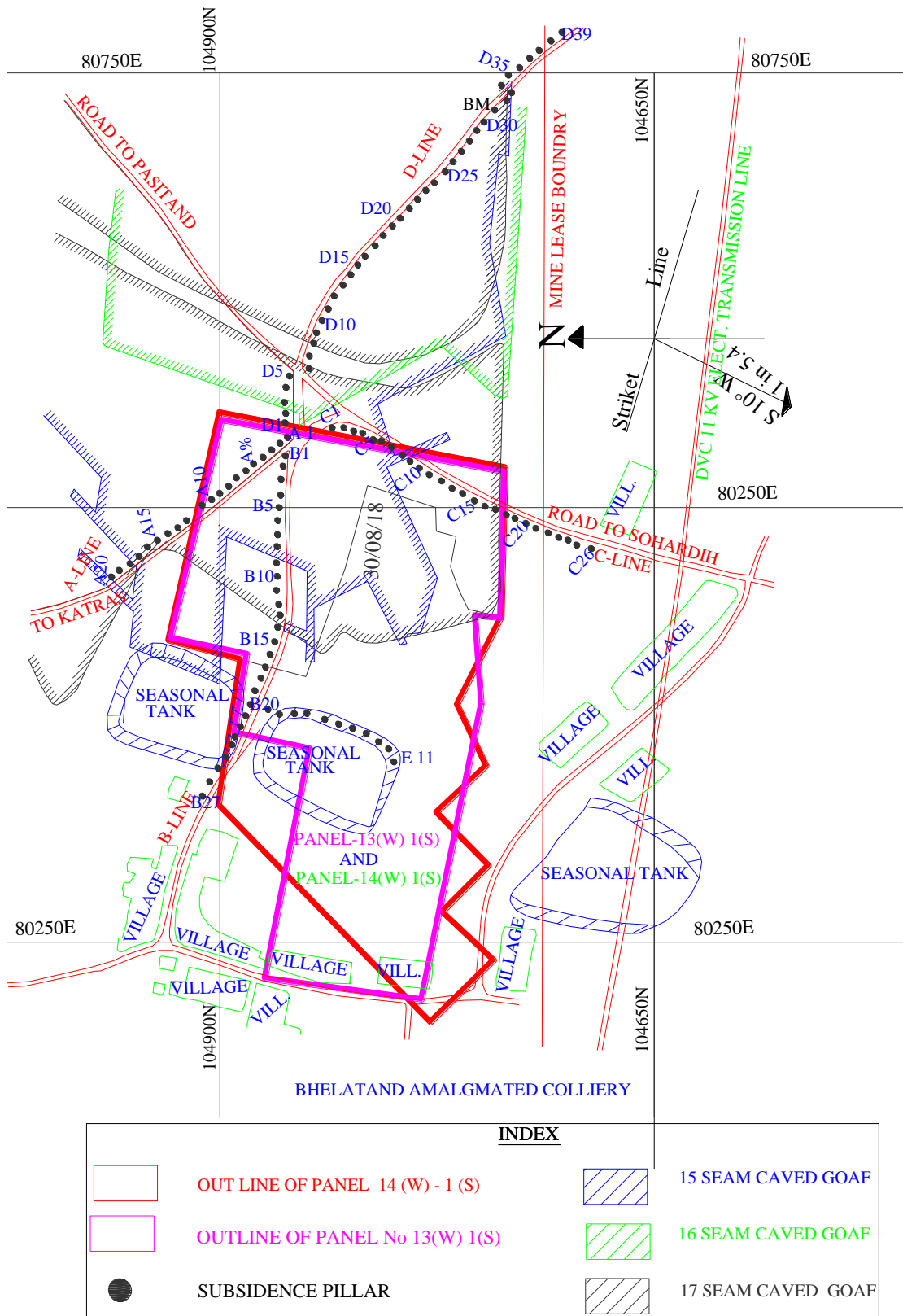


Fig. 13: Layout of monitoring stations over 1S panel in XIV(W) seam with overlying goaves at Bhelatand colliery

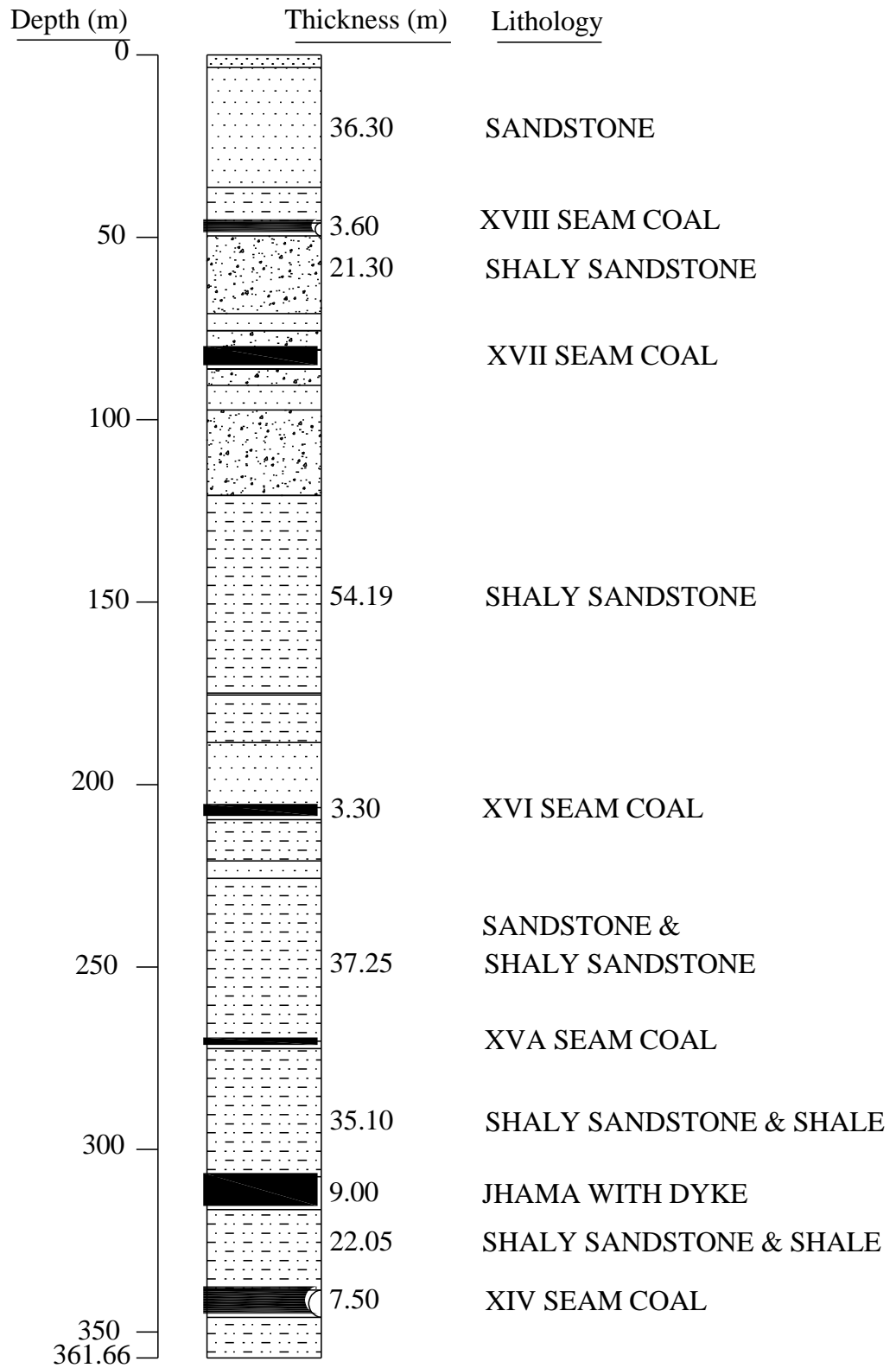


Fig. 14: Section of borehole no. J3 of Jamadoba 2 Pit

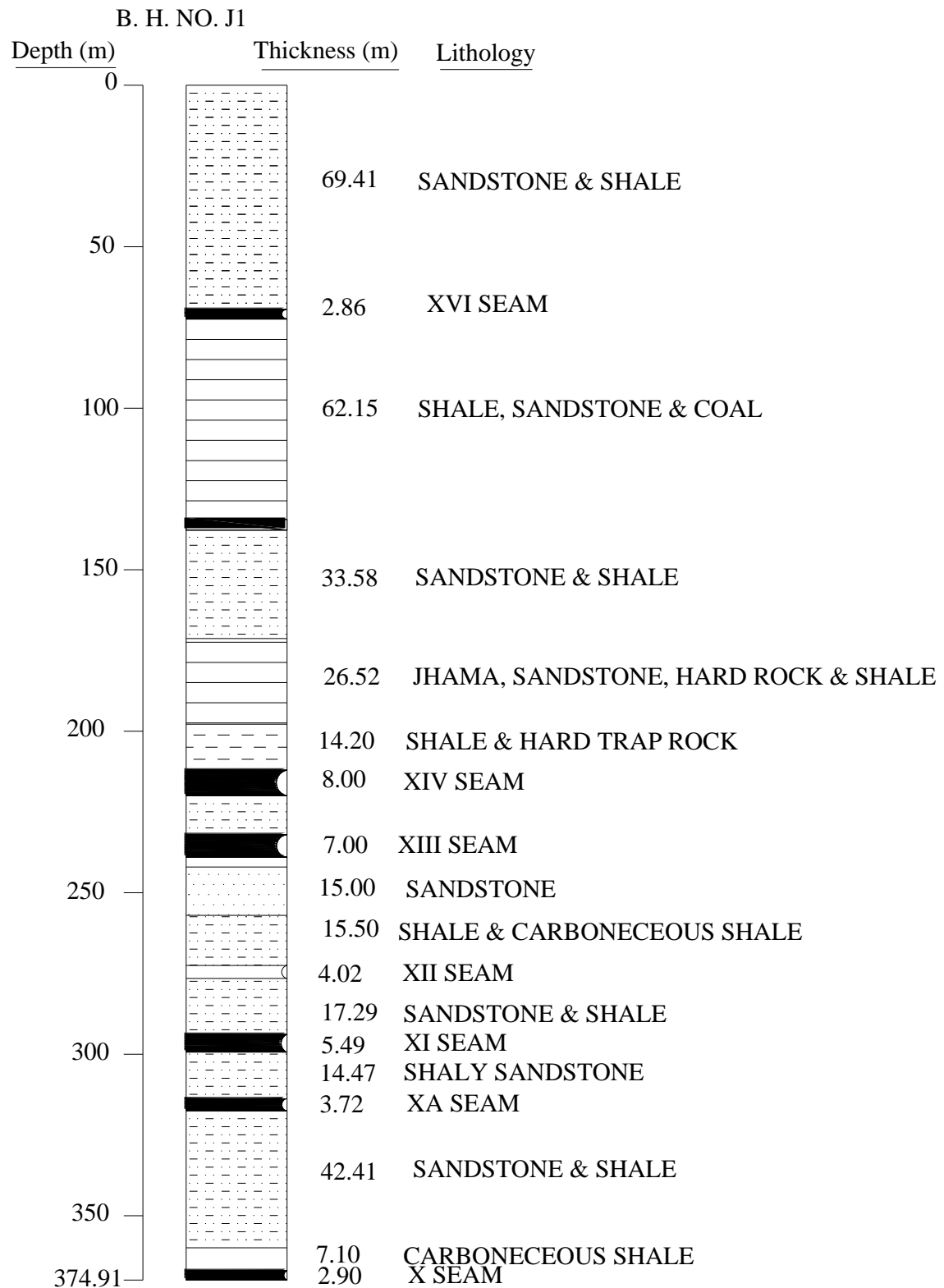


Fig. 15: Section of borehole no. J1 at Bhutgoria Amalgamated Jamadoba 6&7 Pit

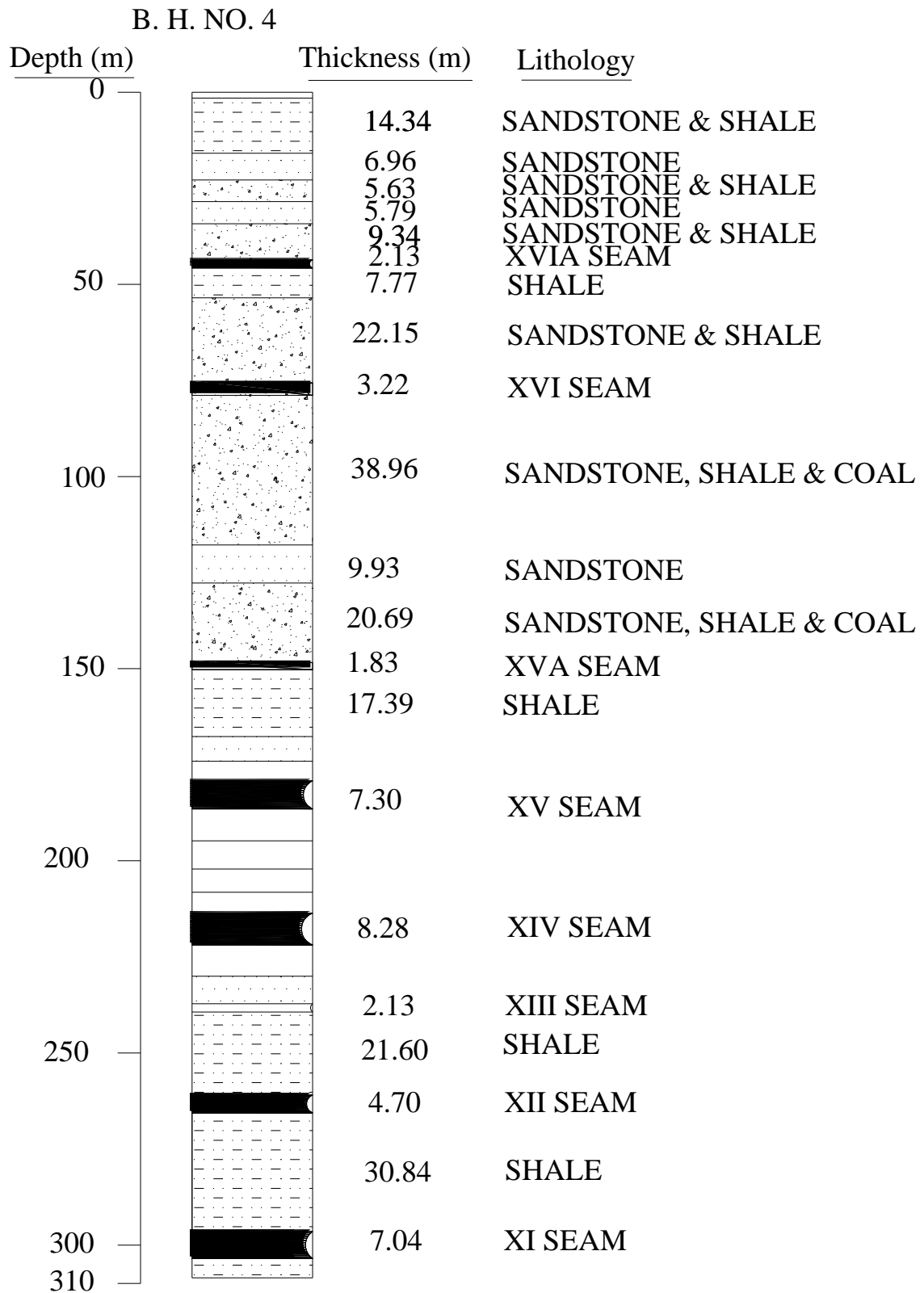


Fig.16: Section of borehole no. 4 at Digwadiah colliery

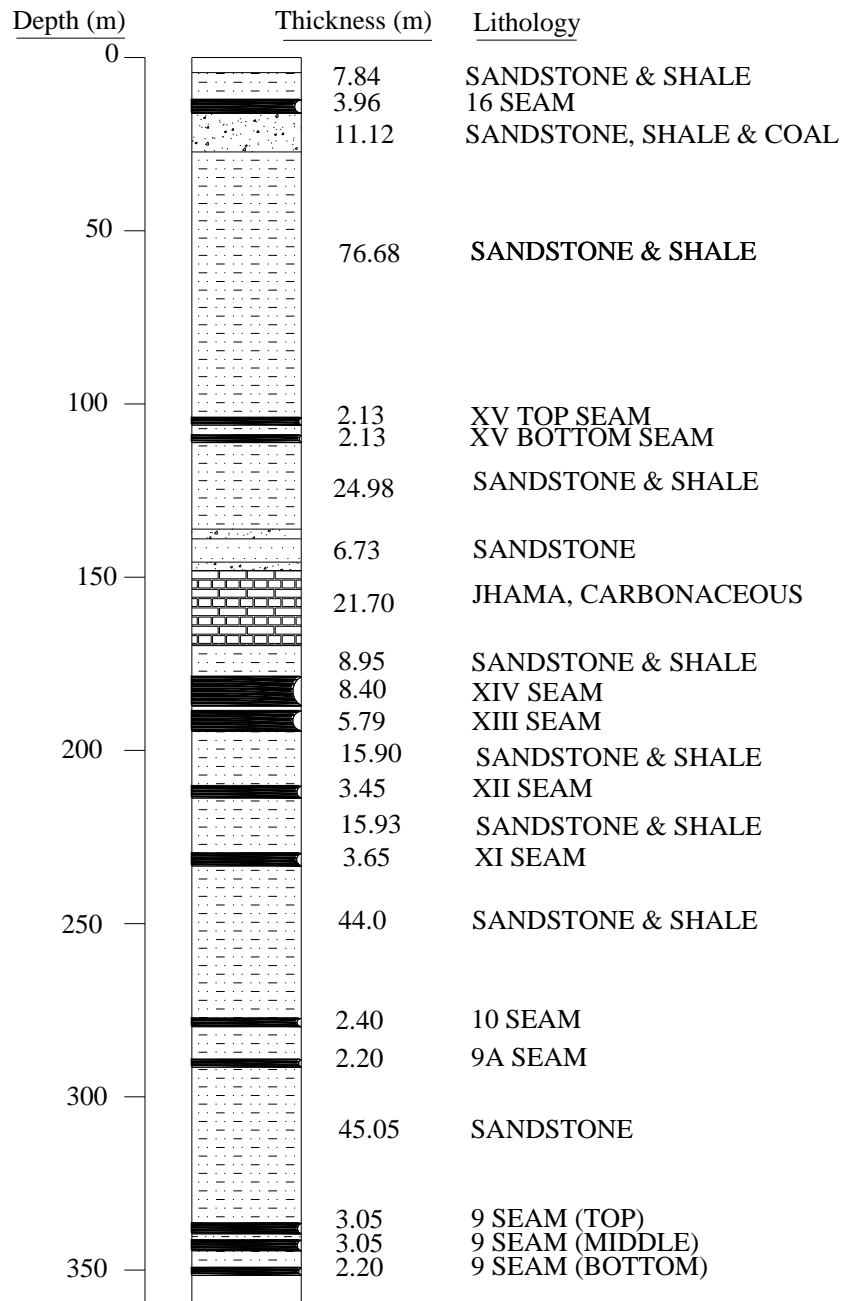


Fig. 17: Section of 2 Pit of Sijua colliery

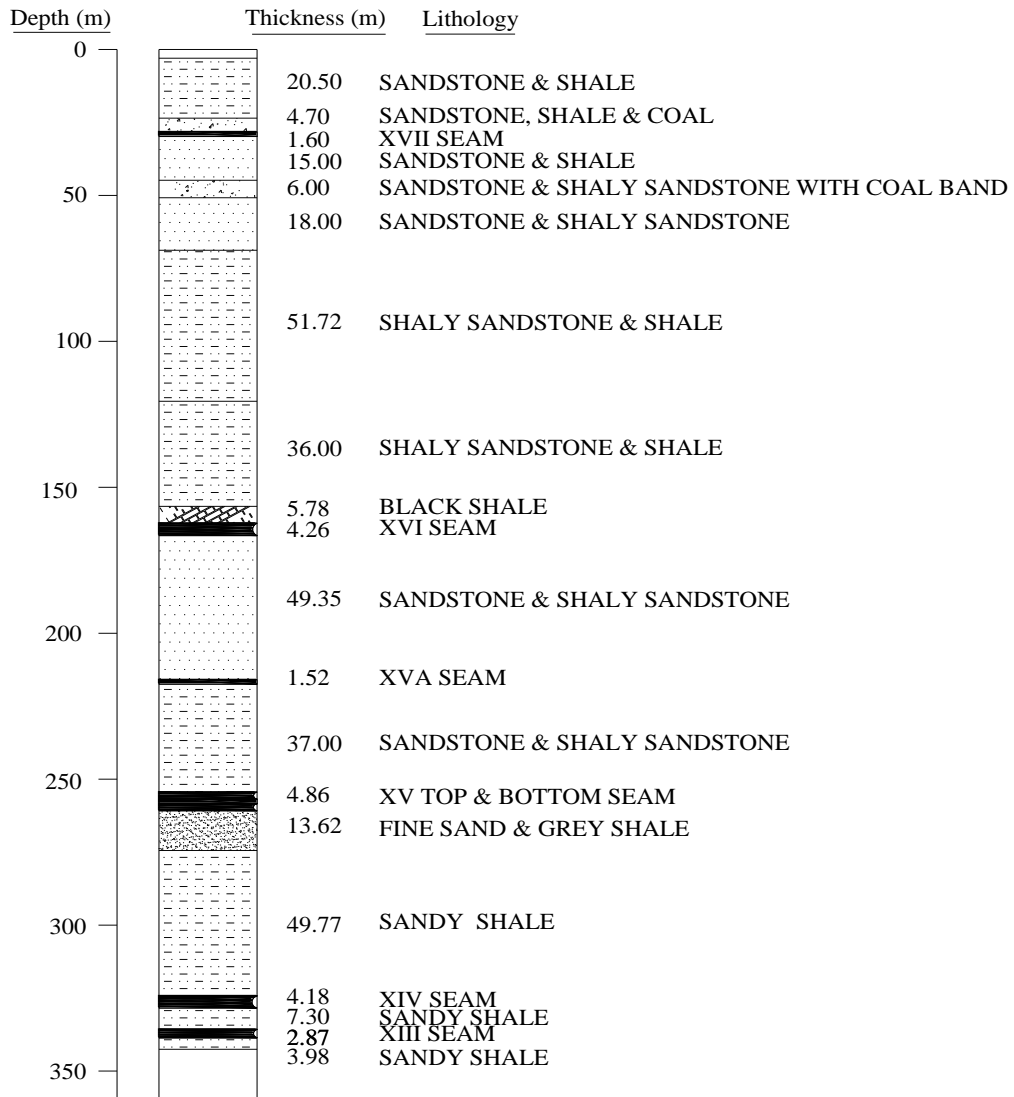


Fig. 18: Section of borehole no. B in Bhelatand colliery

The general lithologies of the overburden in all the five collieries comprise of sandstone, shale, shaly sandstone, sandy sandstone, carbonaceous shale and coal seams. Sandstone and shale are the dominant rock types in the overburden. Percentage of sandstone lying over the working panels varied from 60 to 92%. The gradient of seam varied from 1 in 4.67 to 1 in 7.2. All the coal seams lie in Barakar formation of Lower Gondwana. Depillaring was completed in IX/8S of Digwadih colliery. Depillaring was in progress in the remaining eleven panels. Most of the panels lie below company quarters, private buildings, high tension lines, water tank, filter plant and roads (Table-1).

3.0 Methodology

Monitoring stations are fixed on the ground as per the designed layout at regular interval covering the entire area of interest. Subsidence measurement is carried out from a reference station/Bench Mark (B.M.) fixed beyond the influence of ground movement. Total Station was used to conduct subsidence investigations in all the panels.

a) *Total Station*: Total Station, an outgrowth of theodolite, is used for measuring Reduced Level of subsidence monitoring stations and horizontal distance between the adjacent monitoring stations in the field (Fig. 19). This aids in computing subsidence (vertical displacement), strain (horizontal displacement) and slope of the subsidence. The key specification of Total Station is given in Table 2. Therefore, Missing Line Measurement (MLM) mode was adopted for subsidence investigation, as it calculates the horizontal distance, slope distance and difference in elevation between two target prisms as illustrated in Fig. 20.



Fig. 19: Total Station

Table 2: Specification of Total Station

Parameter	Specification
Make	Topcon
Model	GPT-7003
Measurement Range (1 prism)	3000 m
Linear accuracy	$\pm (2\text{mm} + 2 \text{ ppm} \times D)$
Linear Least count	1 mm
Angular accuracy	3"
Angular Least count	1"

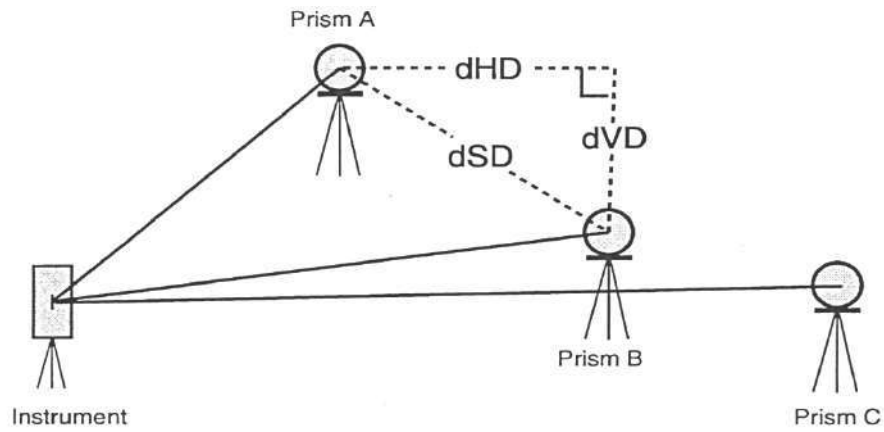


Fig. 20: Concept of Missing Line Measurement

4.0 RESULT OF SUBSIDENCE INVESTIGATIONS

Surface subsidence investigations were conducted over 12 stowed panels (4 panels at Jamadoba 2 Pit, 2 panels at Bhutgoria Amalgamated Jamadoba 6&7 Pit, 2 panels at Digwadih colliery, 2 panels at Sijua colliery and 2 panels at Belatand colliery) of Tata Steel collieries in Jharia Coalfield. Depillaring in 8S panel at Digwadih colliery was completed in May, 2018. Reduced levels of monitoring stations were measured for the computation of subsidence with the help of auto levels with 0.1 mm least count whereas inclined distance between two monitoring stations was measured by steel tape with 1 mm least count to compute compressive & tensile strains and slope. Total Station was also used in congested and highly undulating surface topographical areas for subsidence monitoring. It was not feasible to lay the monitoring stations over the depillaring panels as per the requirement owing to paddy field, built-up areas, local constraints etc. Table-3 shows the outcome of subsidence investigations conducted over 12 panels whereas figures 21 to 29 depict respective surface, strain, slope and subsidence profiles along different lines of monitoring stations erected over the studied panels. No ground movement was observed over XV/3S panel of Jamadoba 2 Pit as the depillaring operation was started in September, 2018 and the initial reading was taken in August, 2018. IX/6S and IX/8S panels of Digwadih colliery showed negligible ground movements till September, 2018. A brief description of the outcome of this study is discussed below:

4.1 Non-Effective Width

It was not possible to compute non-effective width of extraction which is expressed in terms of average depth of extraction. This is mainly due to presence of old goaves over

and around the panels in overlying seams as well as delay in erection of monitoring stations over the new panels.

4.2 Maximum Subsidence

The factors influencing the magnitude of subsidence movements include thickness of extraction, status of working over and around the panel, inclination of seam, type of goaf support, percentage of extraction, panel dimension etc. Maximum subsidence movements over different stowed panels varied between 16 and 158 mm. The maximum subsidence over completed panel was 1.66 % of extraction height.

4.3 Maximum Slope and Strains

Maximum slope, compressive and tensile strains measured over stowed panels were 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively as depicted in Table – 4.

4.4 Subsidence Movement Profiles

Subsidence movement profiles over the investigated panels spreading over Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadih, Sijua and Bhelatand collieries of Tata Steel are shown in figures 21 through 29. The characteristics of subsidence movement profiles observed along different rows of monitoring stations are as follows:

1. The strata above the working panels were disturbed due to extraction of coal from the overlying seams. The resettlement of the fragmented strata contributes in augmenting subsidence value.
2. The shapes of the subsidence profiles were asymmetric in nature. This characteristic was primarily attributed due to the combined influence of irregular overlapping of overlying caved and stowed goaves, left out coal rib pillars in the seams of overlying panels, goaf edge effects and inclination of seams as well as varied panel geometry (Figs. 21 through 29). In a few cases maximum subsidence was found to be higher on the dip side of the panels.
3. Slope and strain profiles were also not regular. These were influenced by overlying goaves, seam inclination, topography of ground surface and left out stooks/ribs in bord and pillar mining (Figs. 21 through 29).
4. Overall ground slope and surface profiles (Figs. 21 to 29) were not changed remarkably due to underground mining with stowing as the magnitude of subsidence was low due to small width-depth ratios of the panels.

5. Goaf treatment by method of stowing was adopted for all the panels with an objective to have minimum ground deformation at the surface.

4.5 Angle of Draw

The angle of draw (AoD) was determined by projecting horizontal distance perpendicular to the panel edge. A subsidence of 5 mm was considered as reference point of no subsidence on the surface for calculation of AoD. The dynamic AoD was measured along the subsidence monitoring lines of XV/2S seam of Jamadoba 2 Pit. Irregular shape of the panel led to variation in angle of draw under multi-seam working condition. Measurement was possible both along dip and strike direction (Table-3). It was not possible to measure angle of draw for other panels due to insufficient extension of monitoring stations outside the panels and improper layout of monitoring stations.

Table-3: Angle of draw measured over active panel

Panel XV/2S Jamadoba 2 pit Dimension			Date of start	Total Face Advance (m)	Working days	Face Advance (m/days)	Angle of Draw (Dynamic)	Orientation of AOD	Remark
L	W	Depth (m)							
245	72	166	Sep15	241	841	0.29	2.86	Strike	Reduced panel width due to irregular shape
							22.9	Dip	Influence of irregular panel shape and reduced panel width
							2.4	RISE	
							10.2	Dip	Full panel width

Table-4: Result of subsidence investigations at different collieries of Tata Steel in Jharia Coalfield

Sl. No.	Colliery/Panel	Width/depth ratio	Maximum subsidence (S)		Maximum slope (mm/m)	Maximum compressive strain (mm/m)	Maximum tensile strain (mm/m)	Remarks
			(mm)	(%)				
1	Jamadoba 2 Pit XV/3S	0.87	-	-	-	-	-	Extraction in progress
2	Jamadoba 2 Pit XI/3S	0.31	30	1.11	2.0	1.16	1.07	Extraction in progress
3	Jamadoba 2 Pit XI/2S	0.28	131	2.91	3.7	0.75	0.82	Extraction in progress
4	Jamadoba 2 Pit XV/2S	0.43	158	4.64	5.8	2.05	1.43	Extraction in progress
5	Bhutgoria Jamadoba6&7 Pit IX/6S	0.37	65	2.12	5.7	0.97	0.99	Extraction in progress
6	Bhutgoria Jamadoba6&7 Pit IX/1S	0.37	57	1.86	4.6	0.95	0.91	Extraction in progress
7	Digwadih IX/8S	0.37	49	1.66	3.2	0.84	0.96	Extraction completed
8	Digwadih IX/6S	0.45	16	0.54	0.98	0.39	0.38	Extraction in progress
9	Sijua X/10 S(Ext.)	0.24	101	2.7	3.0	0.70	0.50	Extraction in progress
10	Sijua IX/1S (Top)	0.73	-	-	-	-	-	Extraction in progress
11	Bhelatand XIV(E)/3S	0.34	-	-	-	-	-	Extraction in progress
12	Bhelatand XIV(W)/IS	0.33	78	2.6	3.0	0.99	0.99	Extraction in progress

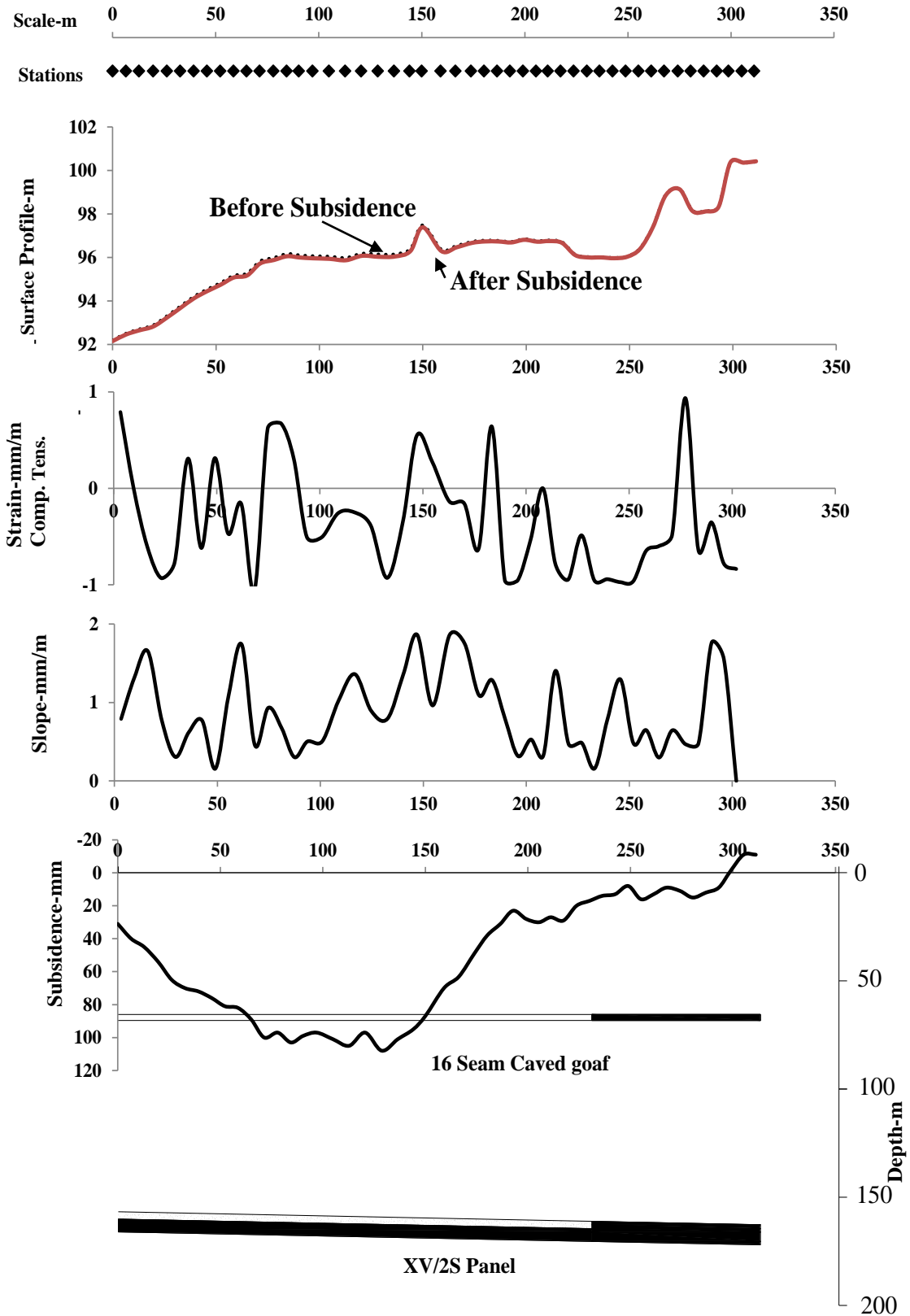


Fig. 21: Surface, strain, slope and subsidence profiles along A-line of monitoring stations over 2S panel in XV seam at 2 Pit Jamadoba colliery

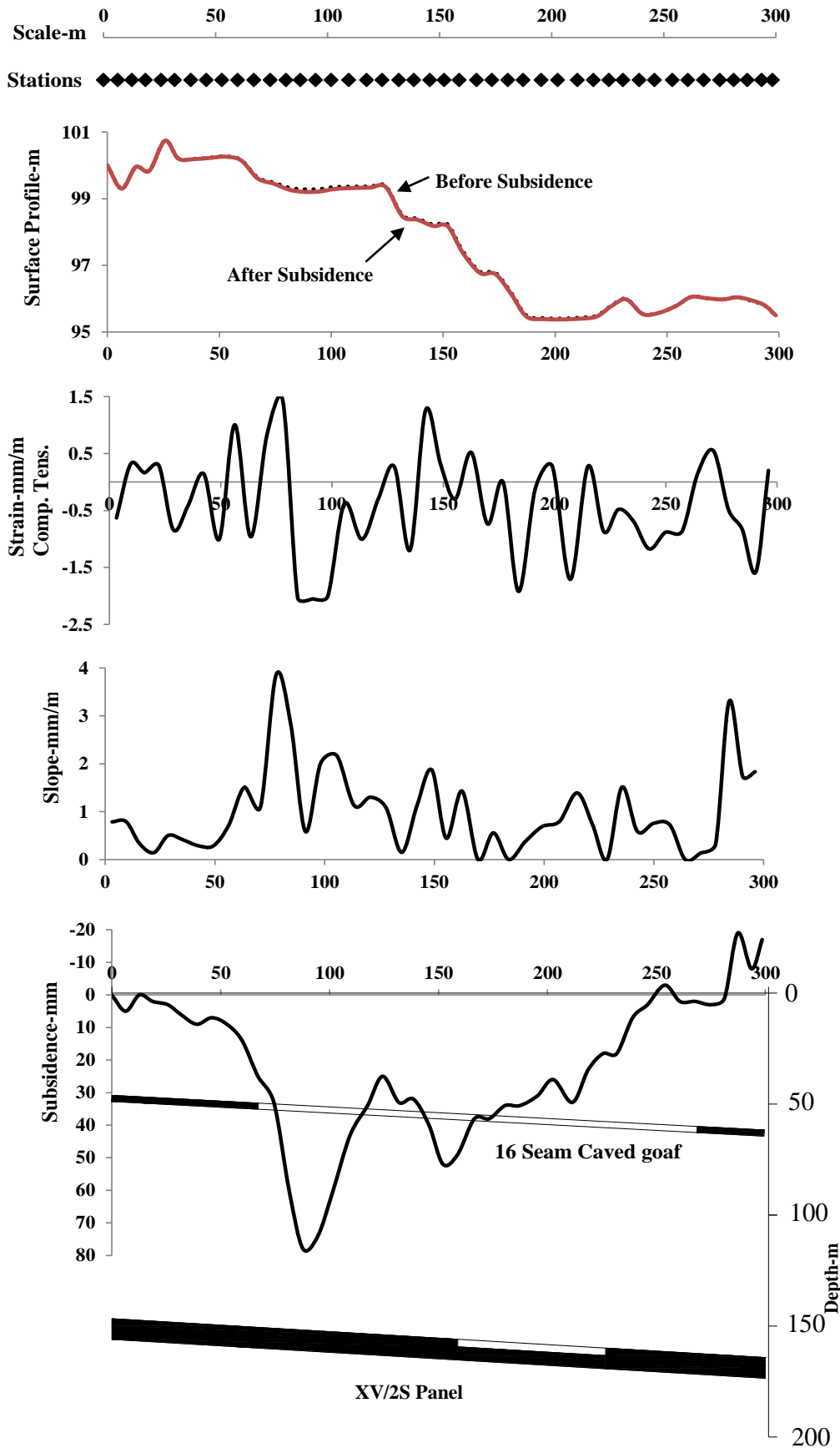


Fig. 22: Surface, strain, slope and subsidence profiles along E-line of monitoring stations over 2S panel in XV seam at Jamadoba 2 Pit colliery

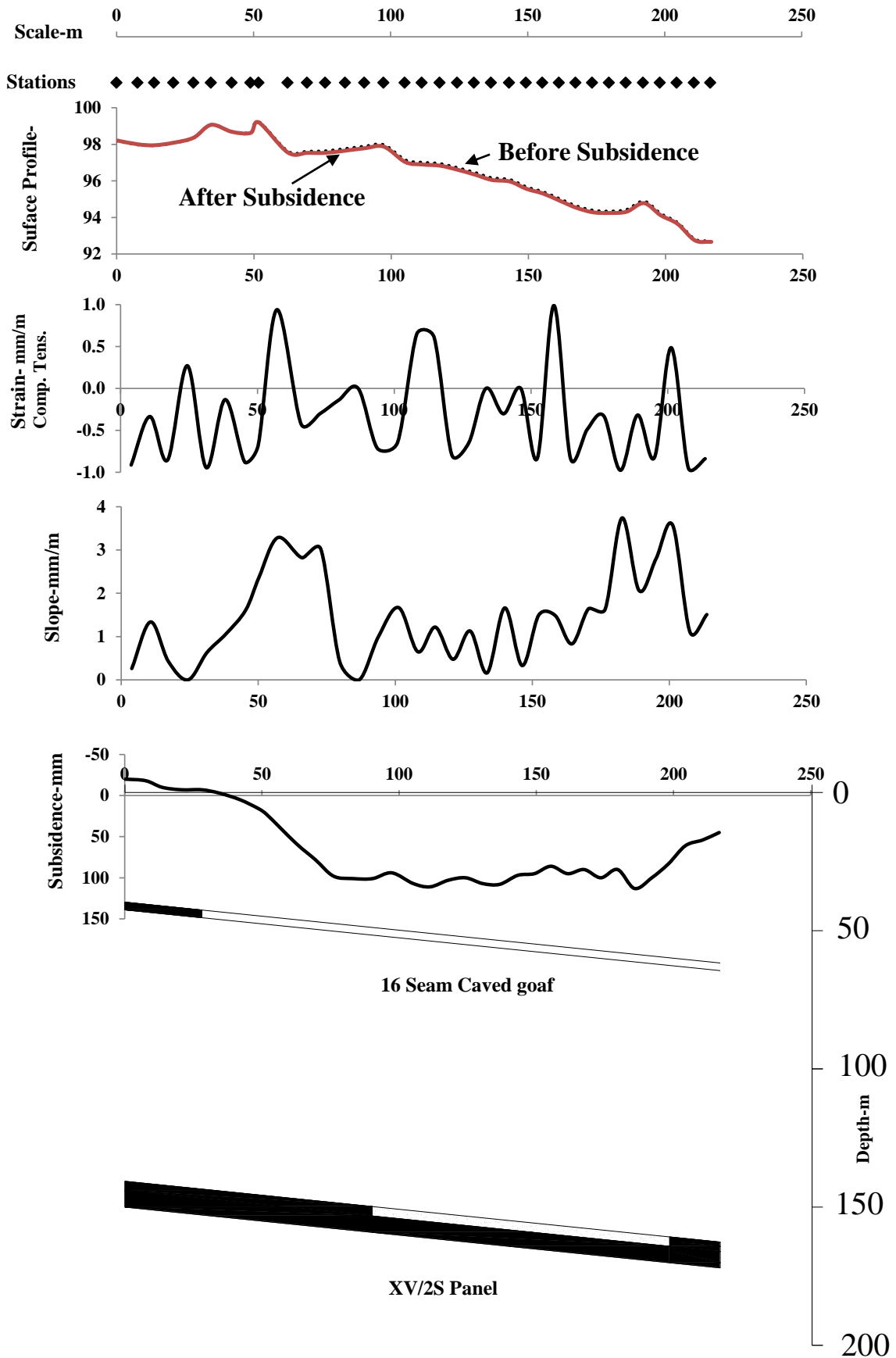


Fig. 23: Surface, strain, slope and subsidence profiles along D-line of monitoring stations over 2S panel in XV seam at Jamadoba 2 Pit colliery

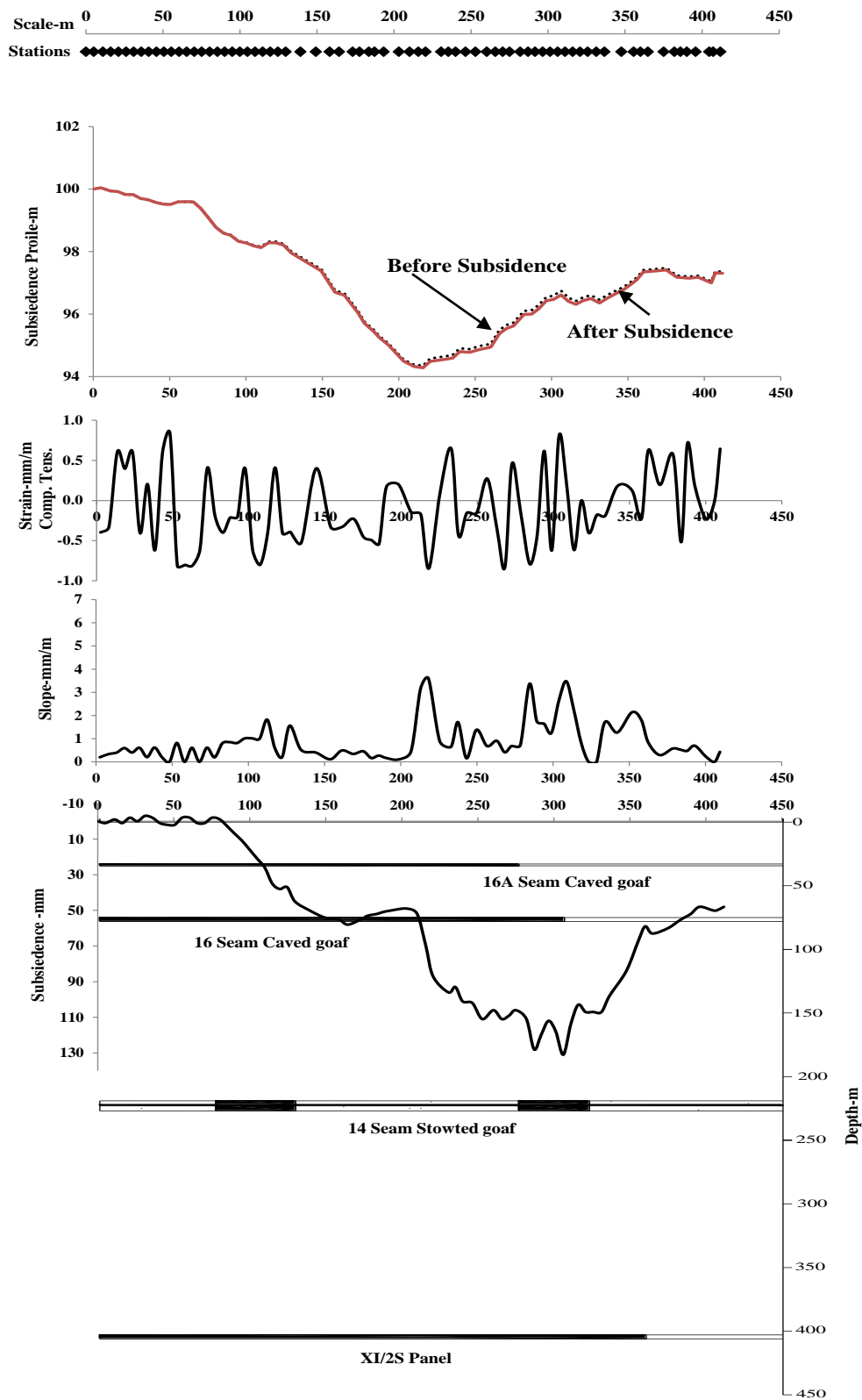


Fig. 24: Surface, strain, slope and subsidence profiles along R-line of monitoring stations over 2S panel in XI seam at Jamadoba 2 Pit colliery

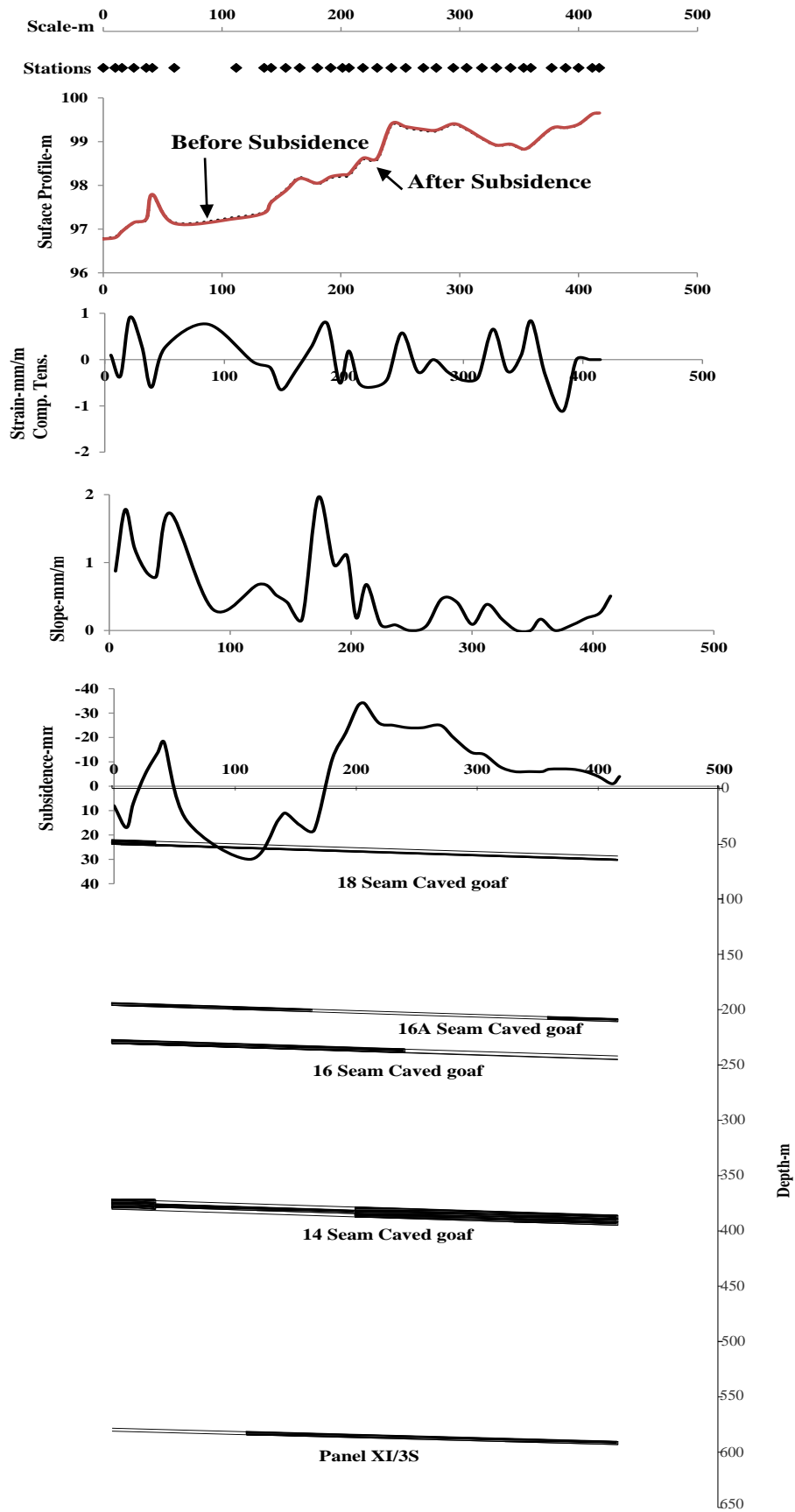


Fig. 25: Surface, strain, slope and subsidence profiles along A-line of monitoring stations over 3S panel in XI seam at Jamadoba 2 Pit colliery

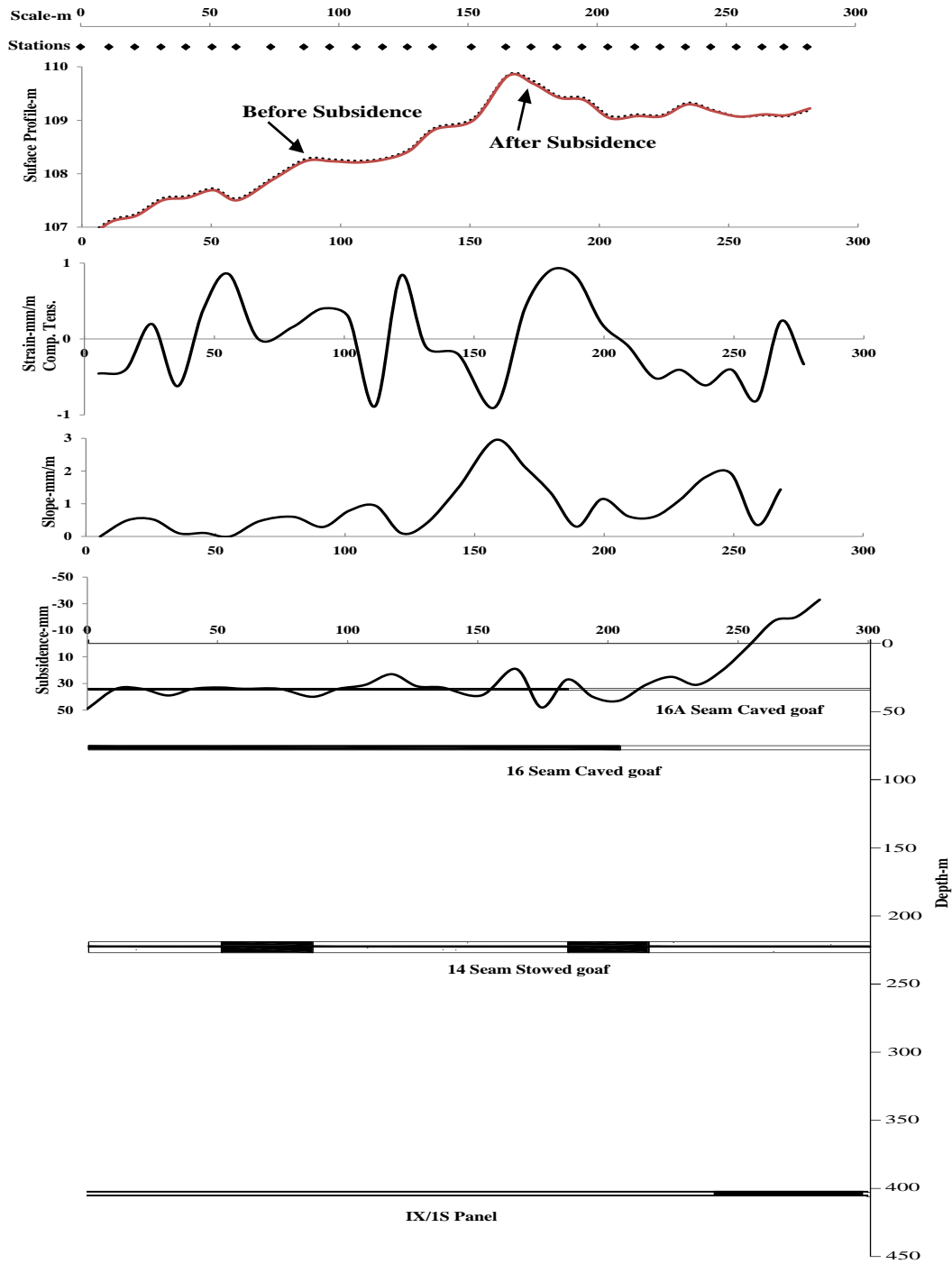


Fig. 26: Surface, strain, slope and subsidence profiles along O-line of monitoring stations over 1S panel in IX seam at Bhutgoria Amalgamated Jamadoba 6 & 7 Pit colliery

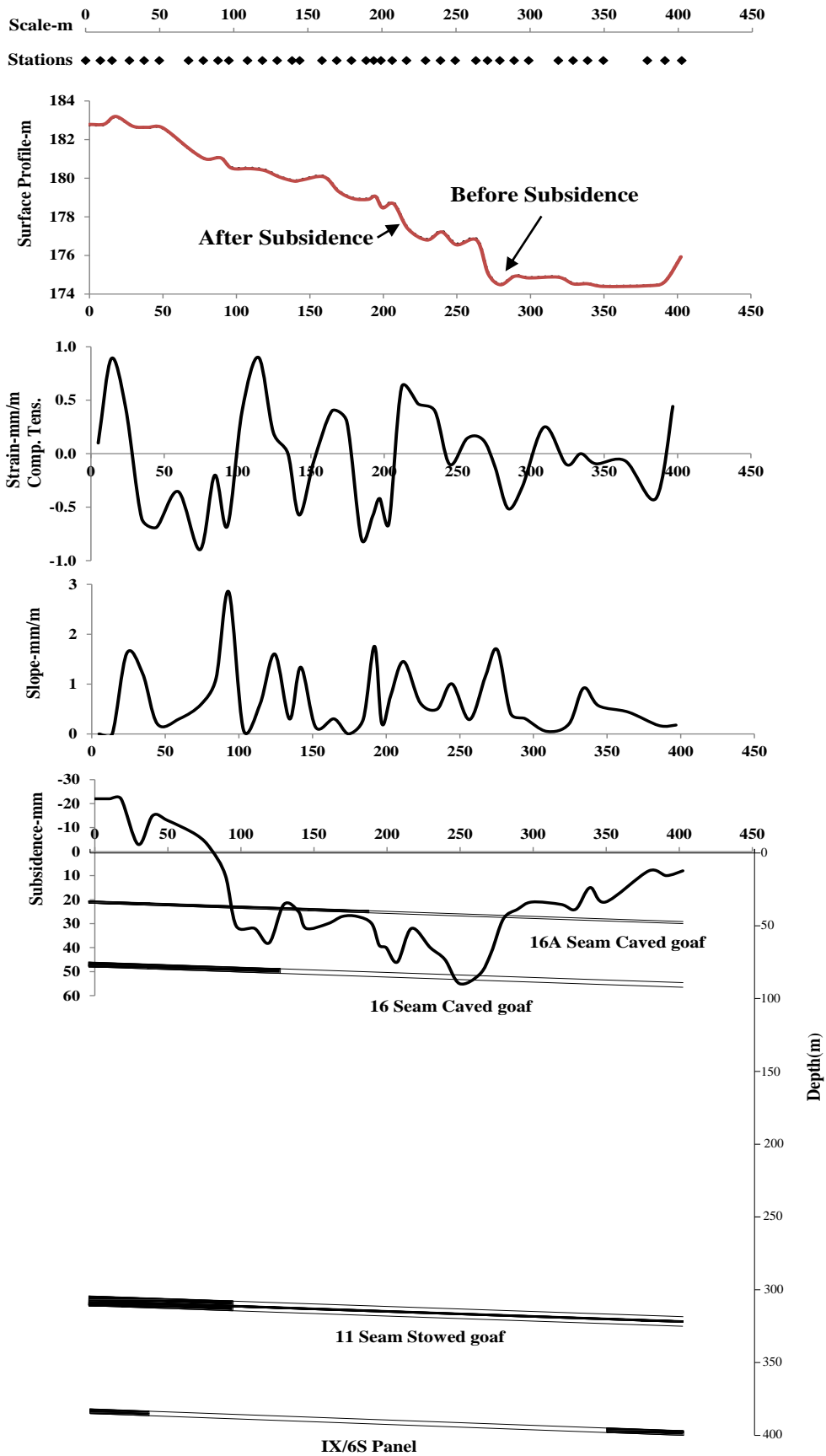


Fig. 27: Surface, strain, slope and subsidence profiles along C-line of monitoring stations over 6S panel in IX seam at Bhutgoria Amalgamated Jamadoba 6 & 7 Pit colliery

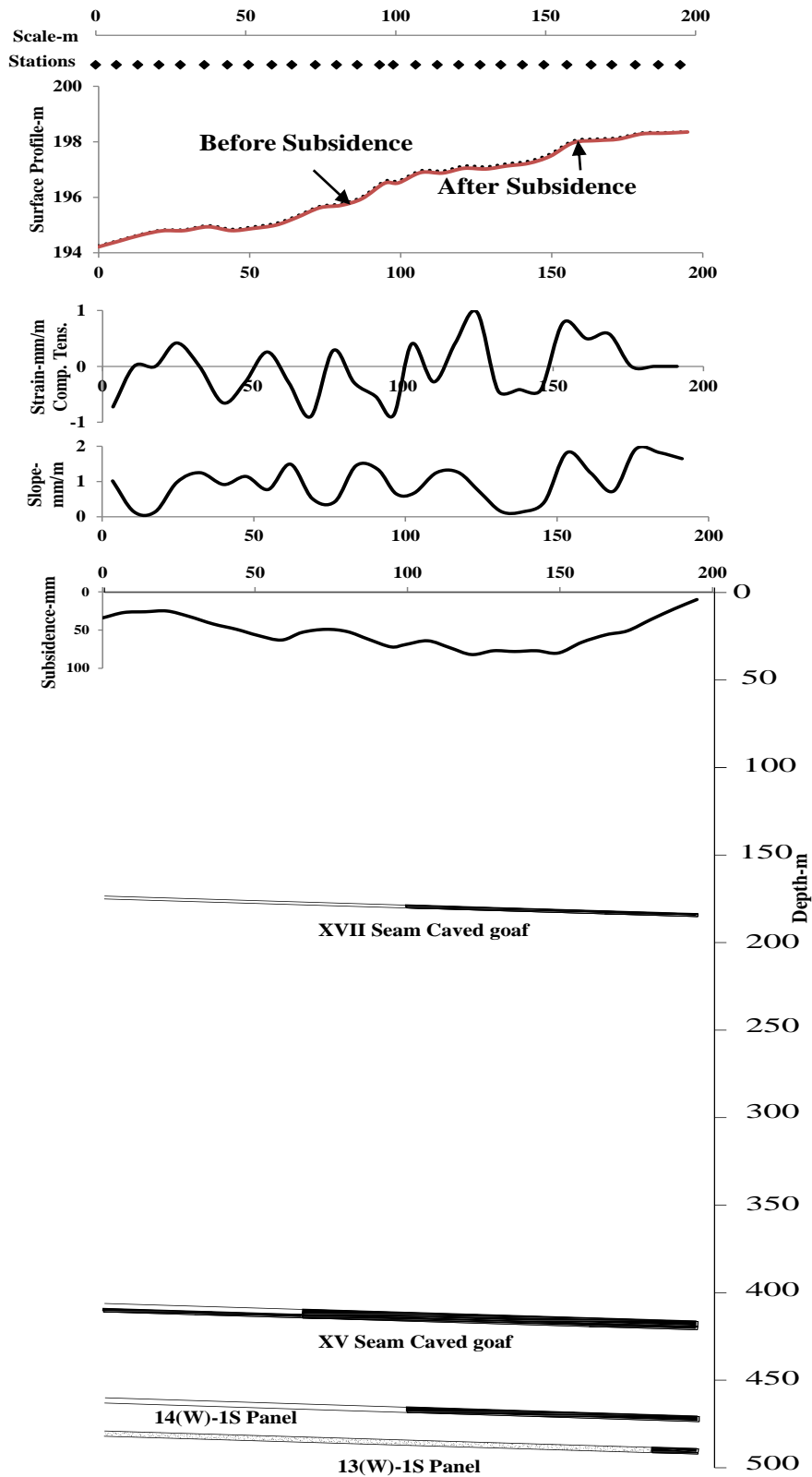


Fig. 28: Surface, strain, slope and subsidence profiles along B-line of monitoring stations over 1S panel in XIV (W)-1S seam at Bhelatand colliery

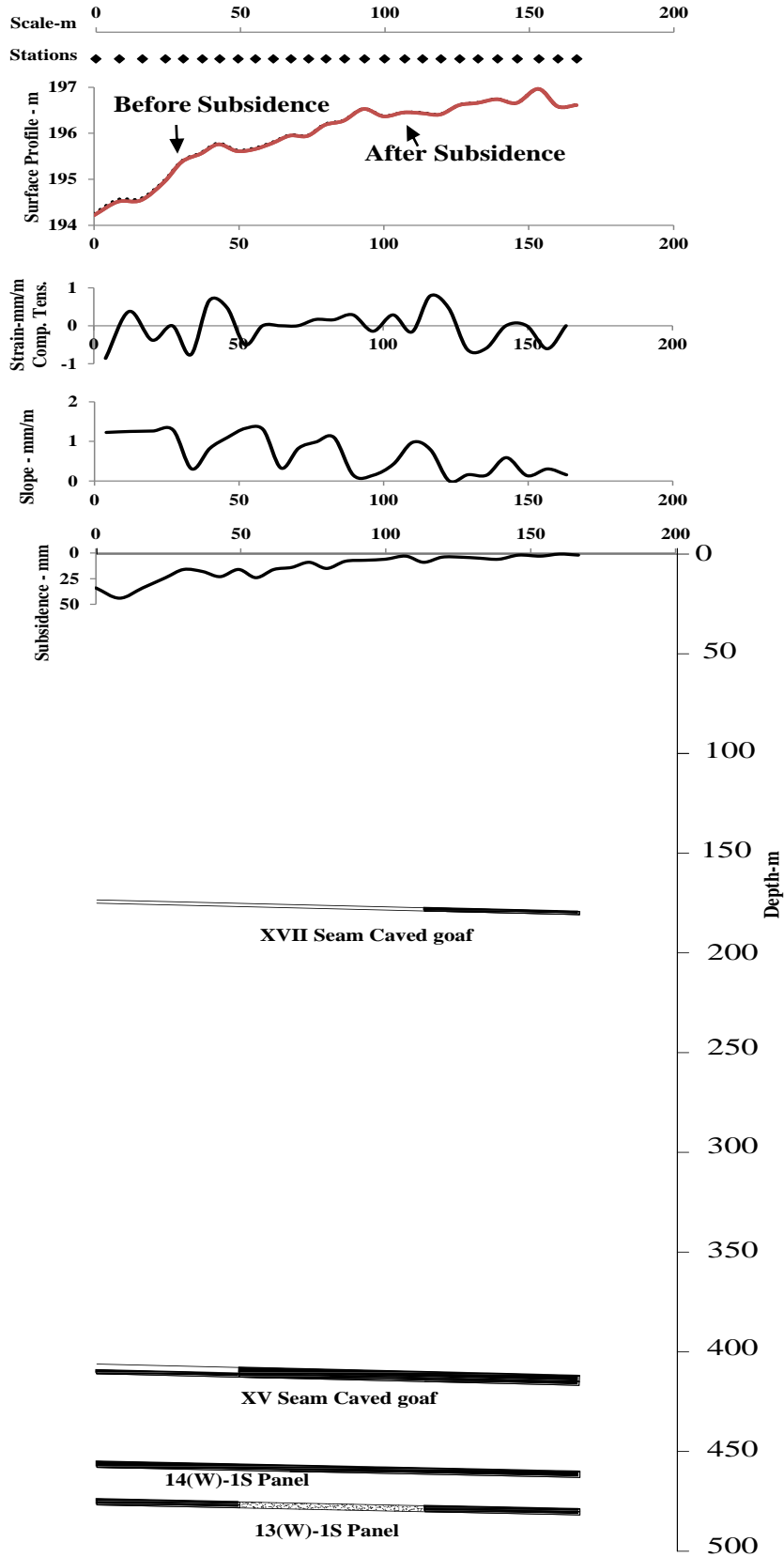


Fig. 29: Surface, strain, slope and subsidence profiles along C-line of monitoring stations over 1S panel in XIV(W)-1S seam at Bhelatand colliery

5.0 IMPACT OF SUBSIDENCE MOVEMENTS

Surface subsidence movements did not cause any adverse impact on surface features and structures as the magnitude of strains were within safe limit (Table - 4). No surface cracks were noticed during the course of measurement. Ground movements caused localized alteration in surface drainage pattern but the over all surface topography was intact. There was no adverse impact on the surface terrain due to mining induced subsidence.

6.0 CONCLUSIONS

Subsidence investigations conducted over 12 stowed panels during October, 2017 to September, 2018 at Jamadoba 2 Pit, 6 & 7 Pit Bhutgoria Amalgamated Jamadoba, Digwadih, Sijua and Bhelatand collieries of the Tata Steel in Jharia Coalfield led to the following conclusions:

1. Maximum subsidence movement was 4.64% of extraction thicknesses over the 2S panel in XV seam at Jamadoba 2 Pit.
2. Maximum slope, compressive and tensile strains observed over measured panels was 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively.
3. Subsidence, slope and strains profiles were influenced by overlying old goaves, position of goaf edges, inclination of the seam, topography of the surface profiles as well as left out stooks/ribs in the overlying seams worked by bord and pillar method of mining.
4. Subsidence movements did not cause any adverse impact on surface features and structures.

7.0 RECOMMENDATIONS

The following recommendations are proposed for effective subsidence investigations over the Tata Steel collieries of Jharia Coalfield:

1. It is recommended to erect subsidence monitoring stations at least one month before the commencement of depillaring over new panels.
2. It is also recommended to extend subsidence monitoring stations equal to panel depth outside the panel boundary.
3. It is recommended to continue subsidence investigations for the safety evaluation of different surface features and structures lying over different on-going and future depillaring panels.

Upload of compliance report on company's website

