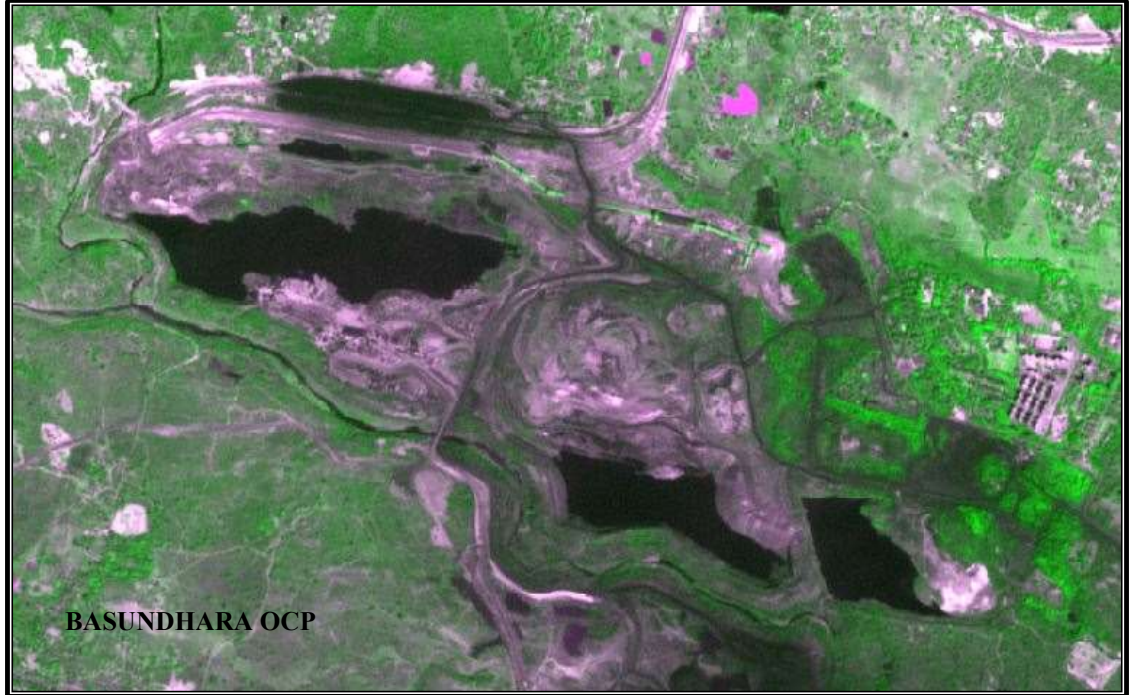


महानदी कोल्फील्ड्स लिमिटेड के ५ मिलियन घन मीटर (कोल + अधिभार) प्रतिवर्ष से कम उत्पादन क्षमतावाले १ खुली खदान का भूमि पुनरुद्धार हेतु २०२४ के उपग्रह डाटा के आधार पर निगरानी का प्रतिवेदन

Land Restoration / Reclamation Monitoring of less than 5 m.cu.m. (Coal+OB) Capacity Open Cast Coal Mines of Mahanadi Coalfields Limited Based on Satellite Data for the Year 2024



Submitted to
Mahanadi Coalfields Limited



महानदी कोल्फील्ड्स लिमिटेड के ५ मिलियन घन मीटर (कोल + अधिभार) प्रतिवर्ष से कम उत्पादन क्षमतावाले १ खुली खदान का भूमि पुनरुद्धार हेतु २०२४ के उपग्रह डाटा के आधार पर निगरानी का प्रतिवेदन

Land Restoration / Reclamation Monitoring of less than 5 m. cu. m (Coal + OB) capacity Open Cast Coal Mines of Mahanadi Coalfields Limited Based on Satellite Data for the Year 2024

March-2025



Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

CONTENTS

Executive Summary **iii-viii**

1.0	Background	01
2.0	Objective	02
3.0	Methodology	02
4.0	Land Reclamation in Mahanadi Coalfields Limited	05

List of Tables

Table-1	Project wise Land Reclamation Status	vi
Table-1.1	Status of Land Reclamation in remaining 7 projects	vii
Table-2	Area Statistics of Land Use Classes in OC Mines	07

List of Plates

Plate-1	Land Use Map of Basundhara OCP	08
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List of Figures

Figure-1	Bar-Chart of Land Reclamation Status of the Project	viii
Figure-2	Methodology of Land Reclamation Monitoring	02
Figure-3	Bar-Chart of Land Use/Cover Status of Basundhara OCP	09

List of Photographs

Photo-1	Plantation on External OB (Basundhara OCP)	10
Photo-2	Social Forestry Plantation (Basundhara OCP)	10
	शब्द-कोष	11
	ABBREVIATIONS	14
	GLOSSARY	15

कार्यकारी सारांश

१.० परियोजना

महानदी कोल्फील्ड्स लिमिटेड के ५ मिलियन घन मीटर (कोल+ अधिभार) प्रतिवर्ष से कम उत्पादन क्षमतावाले १ खुली खदान के पुनरुद्धार हेतु वर्ष २०२४ के उपग्रह डाटा पर आधारित तीन साल के अन्तराल पर सलाना नियमित निगरानी।

२.० उद्देश्य

भूमि पुनरुद्धार (लैंड रिक्लेमेशन) का उद्देश्य कुल पट्टाक्षेत्र में बैकफील, वृक्षारोपण, सामाजिक वानिकी, सक्रिय खनन क्षेत्र, जल निकाय (वाटर ड्रेनेज), बंजर भूमि, कृषि भूमि और जंगल के विभिन्न प्रकार के वितरण प्रणाली के क्षेत्र का आकलन करने के लिए है। यह अध्ययन उपरोक्त सभी खुली खदानों के भूमि पुनरुद्धार (लैंड रिक्लेमेशन) का निगरानी के प्रगति का आकलन करने में सहायता करेगा तथा इसके अतिरिक्त पर्यावरण संरक्षण के लिए आवश्यक उपचारात्मक उपायों को क्रियान्वित करने में भी सहायता करेगा।

३.० मुख्य निष्कर्ष

- वर्ष २०२४ में २०२४-२५ के दौरान निगरानी के लिए एमसीएल की १ ओपनकास्ट परियोजना में कुल खदान पट्टा क्षेत्र ४३७.१० हेक्टेयर है, जिसमें से कुल उत्खनन क्षेत्र २०२.३४ हेक्टेयर है, जिसके १४७.३६ हेक्टेयर क्षेत्र (७२.८३ %) बैकफिलिंग (तकनीकी रूप से पुनरुद्धार के तहत), और ५४.९८ हेक्टेयर क्षेत्र (२७.१७ %) सक्रिय खनन के तहत है। विश्लेषण से यह स्पष्ट है कि उपर्युक्त १ ओपनकास्ट परियोजनाओं की कुल उत्खनन भूमि का संचयी रूप से ७२.८३ % पहले से ही पुनरुद्धार के अधीन है और कुल उत्खनन क्षेत्र का शेष २७.१७ % सक्रिय खनन के अंतर्गत है। परियोजना का विवरण तालिका-१ में दिया गया है और चित्र-१ में ग्राफिक रूप से दर्शाया गया है।
- बासुंडहारा परियोजना में वर्ष २०२१ के संबंध में वर्ष २०२४ के लिए भूमि पुनर्ग्रहण की स्थिति की तुलना करने पर, यह विश्लेषण से स्पष्ट है कि भूमि पुनर्ग्रहण के

तहत क्षेत्र १४३.१३ (२०२१) हेक्टेयर से बढ़कर १४७.३६ हेक्टेयर (२०२४) हो गया है।

- सीआईएल से प्राप्त कार्य आदेश के खंड २.(ii) अनुसार तीन-वर्षीय चक्र में निगरानी के अंतर्गत आने वाले शेष ७ परियोजना की समग्र भूमि पुनरुद्धार स्थिति तालिका १.१ में दी गई है, ताकि सभी क्लस्टरों तथा खुली खदानों से संबंधित जानकारी हर वर्ष उपलब्ध कराई जा सके।

Executive Summary

- 1.0 Project** Land restoration / reclamation monitoring of 1 opencast coal mine of Mahanadi Coalfields Ltd. (MCL) producing less than 5 million cu. m. (Coal + OB) per year based on satellite data, on triennial basis.
- 2.0 Objective** Objective of the land restoration / reclamation monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the various projects. This will help in assessing the progressive status of mined out land reclamation and to take up remedial measures, if any, required for environmental protection.
- 3.0 Salient Findings**
- Out of the total mine leasehold area of 437.10 hectares of the 1 OC project viz. Basundhara OCP considered for monitoring during year 2024; total excavated area is only 202.34 Ha., out of which 147.36 Ha. (72.83%) is under backfilling and 54.98 Ha. (27.17%) is under active mining. It is evident from the analysis that 72.83% area of the OC project has already been under reclamation and balance 27.17% area is under active mining. Project wise details are given in Table-1 & Fig -1.
 - On comparing the status of land reclamation for the year 2024 with respect to the year 2021 in Basundhara project, it is evident from the analysis that area under land reclamation has increased from 143.13 Ha. (Yr. 2021) to 147.36 Ha. (Yr. 2024).
 - A composite land reclamation status of the remaining 7 Projects that are covered under monitoring in the three-year cycle is given in Table 1.1 so that information related to all projects will be made available every year as per clause 2.(ii) of the received work order from CIL.

TABLE-1

Table - 1 Land Reclamation Status in Basundhara OC mine of MCL based on Satellite Data of the Year 2021 & 2024																			
(Area in Hectare)																			
Sl. No.	Project	Total Leasehold Area		Technical Reclamation		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in Leasehold)		Total Area under Reclamation	
						Biological Reclamation		Other Plantations											
				Area under Backfilling		Plantation on Excavated / Backfilled Area		Plantation on External OB Dumps		Social Forestry, Avaneue Plantation Etc.									
1	2	3		4		5		6		7		8		9 (=4+5+8)		10 (=5+6+7)		11(=4+5)	
		2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024	2021	2024
1	Basundhara OC	437.10	437.10	143.13	147.36	0.00	0.00	8.53	6.32	10.13	10.13	58.10	54.98	201.23	202.34	18.66	16.45	143.13	147.36
				71.13%	72.83%	0.00%	0.00%					28.87%	27.17%			4.27%	3.76%	71.13%	72.83%
	TOTAL (A)	437.10	437.10	143.13	147.36	0.00	0.00	8.53	6.32	10.13	10.13	58.10	54.98	201.23	202.34	18.66	16.45	143.13	147.36
				71.13%	72.83%	0.00%	0.00%					28.87%	27.17%			4.27%	3.76%	71.13%	72.83%

(% is calculated with respect to Excavated Area as applicable)

Note: In reference of the above Table, different parameters are classified as follows:

1. Area under Biological Reclamation includes Areas under Plantation done on Backfilled Area Only.
2. Area under Technical Reclamation includes Area under Barren Backfilling only.
3. Area under Active Mining Includes Coal Quarry, Advance Quarry Site, Quarry filled with water etc., if any.
4. Social Forestry and Plantation on External OB Dumps are not included in Biological Reclamation and are put under separate categories as shown in the Table above.
5. (%) calculated in the above Table is in respect to Total Excavated Area except for "Total Area under Plantation" where % is in terms of "Leasehold Area".
6. Leasehold boundary of Basundhara OC has been updated in year 2021 as per EC.

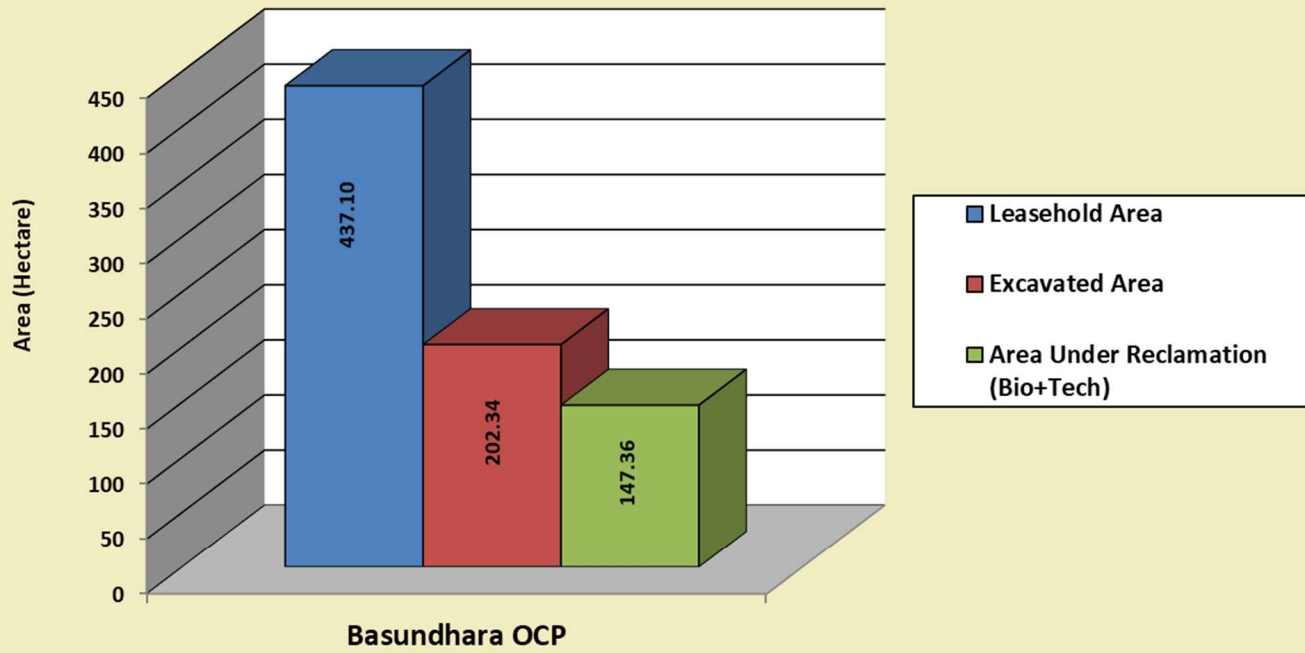
Table - 1.1 Status of Land Reclamation in remaining 7 Projects of MCL

(Area in Hectare)

Sl. No.	Cluster No.	Total Leasehold Area		Technical Reclamation Area under Backfilling		Plantation						Area under Active Mining		Total Excavated Area		Total Area under Plantation (% Green Cover Generated in		Total Area under Reclamation	
						Biological		Other Plantations											
						Plantation on Excavated /		Plantation on External OB		Social Forestry, Avaneue									
1	2	3		4		5		6		7		8		9 (=4+5+8)		10 (=5+6+7)		11(=4+5)	
		2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022	2019	2022
2	Gopalji (B)	1141.43	1141.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			0.00%	0.00%	0.00%	0.00%
		2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
3	Basundhara W Extn. [C]	323.00	323.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	3.00	0.00	0.00	0.00	0.00	3.00	3.00	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			0.93%	0.93%	0.00%	0.00%
		2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023	2020	2023
4	Chhendipada	24.30	24.30	6.86	0.52	4.46	10.80	2.84	2.84	2.07	2.07	3.97	3.97	15.29	15.29	9.37	15.71	11.32	11.32
				44.87%	3.40%	29.17%	70.63%					25.96%	25.96%			38.56%	64.65%	74.04%	74.04%
5	Balanda	351.22	351.22	31.11	32.79	196.90	195.22	0.00	0.00	6.66	6.66	18.21	18.21	246.22	246.22	203.56	201.88	228.01	228.01
				12.64%	13.32%	79.97%	79.29%					7.40%	7.40%			57.96%	57.48%	92.60%	92.60%
6	Orient 1&2 UG	1144.28	1144.28	0.00	0.00	0.00	0.00	0.00	0.00	21.73	21.73	0.00	0.00	0.00	0.00	21.73	21.73	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			1.90%	1.90%	0.00%	0.00%
7	Orient 3 UG	981.84	981.84	0.00	0.00	0.00	0.00	0.00	0.00	18.31	18.31	0.00	0.00	0.00	0.00	18.31	18.31	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			1.86%	1.86%	0.00%	0.00%
8	Nandira UG	474.00	370.00	0.00	0.00	0.00	0.00	0.00	0.00	4.15	3.42	0.00	0.00	0.00	0.00	4.15	3.42	0.00	0.00
				0.00%	0.00%	0.00%	0.00%					0.00%	0.00%			0.88%	0.92%	0.00%	0.00%
	TOTAL (D)	2975.64	2871.64	37.97	33.31	201.36	206.02	2.84	2.84	52.92	52.19	22.18	22.18	261.51	261.51	257.12	261.05	239.33	239.33
				14.52%	12.74%	77.00%	78.78%					8.48%	8.48%			8.64%	9.09%	91.52%	91.52%
	*GRAND TOTAL (A+B+C+D)	4877.17	4773.17	181.10	180.67	201.36	206.02	11.37	9.16	66.05	65.32	80.28	77.16	462.74	463.85	278.78	280.50	382.46	386.69
				39.14%	38.95%	43.51%	44.42%					17.35%	16.63%			5.72%	5.88%	82.65%	83.37%

**Grand Total (A+B+C+D) is the composite value of all 8 projects of MCL covered in 3 years cycle of Land Reclamation Monitoring (% is calculated with respect to Excavated Area as applicable)*

Fig 1: Land Reclamation Status of Basundhara OC in Year 2024



1.0 Background

- 1.1** Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land which is the scarcest natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do effect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future.
- 1.2** Keeping above in view, Coal India Ltd. (**CIL**) issued a work order vide letter no. CIL/WBP/ENV/2017/DP/8477 dated 21.09.2017 to Central Mine Planning & Design Institute (**CMPDI**), Ranchi, for monitoring of clusters with coal mines (both underground and open cast projects) having less than 5 million m³ per annum capacity (Coal +OB) at an interval of three years based on remote sensing satellite data for sustainable development of mining. Earlier, CMPDI used to carry out land reclamation monitoring for individual projects of less than 5 million capacity, but from 2018, the same is being carried out cluster wise for mines of ECL. For operational reasons and convenience, underground and opencast mines (often with multiple overlapping seams), have now been clustered together. After this, the work order was renewed periodically, and the latest work order is issued vide letter no. CIL/ENV/11463 dated 03.07.2024 from Coal India Limited for the period 2024-25 to 2026-27. According to this work order, 75 OC projects having more than 5 million cu. m (coal +OB) per annum capacity shall be monitored every year and also land reclamation monitoring of 39 (mines + clusters) having less than 5 million cu. m (coal +OB) per annum capacity, totaling 114 (OC mines & clusters) will be monitored in 2024-25 covering all the subsidiaries of Coal India Ltd. The result of land reclamation status of all such mines are hosted on the website of CIL,

(www.coalindia.in), CMPDI (www.cmpdi.co.in) and the concerned coal companies in public domain. Detailed report is submitted to Coal India and respective subsidiaries.

- 1.3** Land reclamation monitoring of all open cast projects will have to comply the statutory requirements of Ministry of Environment & Forest (MoEF). Such monitoring will not only facilitate in taking remedial measures against environmental degradation, but also enable Coal companies to utilize the reclaimed land for further socio-economic benefits in a planned way.
- 1.4** Present report is embodying the finding of the study based on satellite data of the year 2024 carried out for Basundhara OC project of capacity less than 5 mcm (coal +OB) for Mahanadi Coalfields Ltd.

2.0 Objective

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

3.0 Methodology

There are number of steps involved between raw satellite data procurement and preparation of final map. National Remote Sensing Centre (NRSC) Hyderabad, being the nodal agency for satellite data supply in India, provides only raw digital satellite data, which needs further digital image processing for extracting the information and map preparation before uploading the same in the website. Methodology for land reclamation monitoring is given in fig 2. Following steps are involved in land reclamation /restoration monitoring:

brightness value of neighbouring pixels using ERDAS IMAGINE 2022 s/w. and enhance the image quality for interpretation.

- **Training set selection**

Training set requires to be selected, so that software can classify the image data accurately. The image data are analysed based on the interpretation keys. These keys are evolved from certain fundamental image-elements such as tone/colour, size, shape, texture, pattern, location, association and shadow. Based on the image-elements and other geo-technical elements like land form, drainage pattern and physiography; training sets were selected/identified for each land use/cover class. Field survey was carried out by taking selective traverses in order to collect the ground information (or reference data) so that training sets are selected accurately in the image. This was intended to serve as an aid for classification.

- **Classification and Accuracy assessment**

Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between the classes that resulted from computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

The area of each land use class in the leasehold is determined using ERDAS IMAGINE v. 2022 software and given in table 2.

- **Overlay of Vector data base**

Vector data base created based on secondary data. Vector layer like drainage, railway line, leasehold boundary, forest boundary etc. are superimposed on the image as vector layer in the Arc GIS database.

- **Pre-field map preparation**

Pre-field map is prepared for validation of the classification result

3.3 Ground Truthing:

Selective ground verification of the land use classes are carried out in the field and necessary corrections if required, are incorporated before map finalization.

3.4 Land reclamation database on GIS:

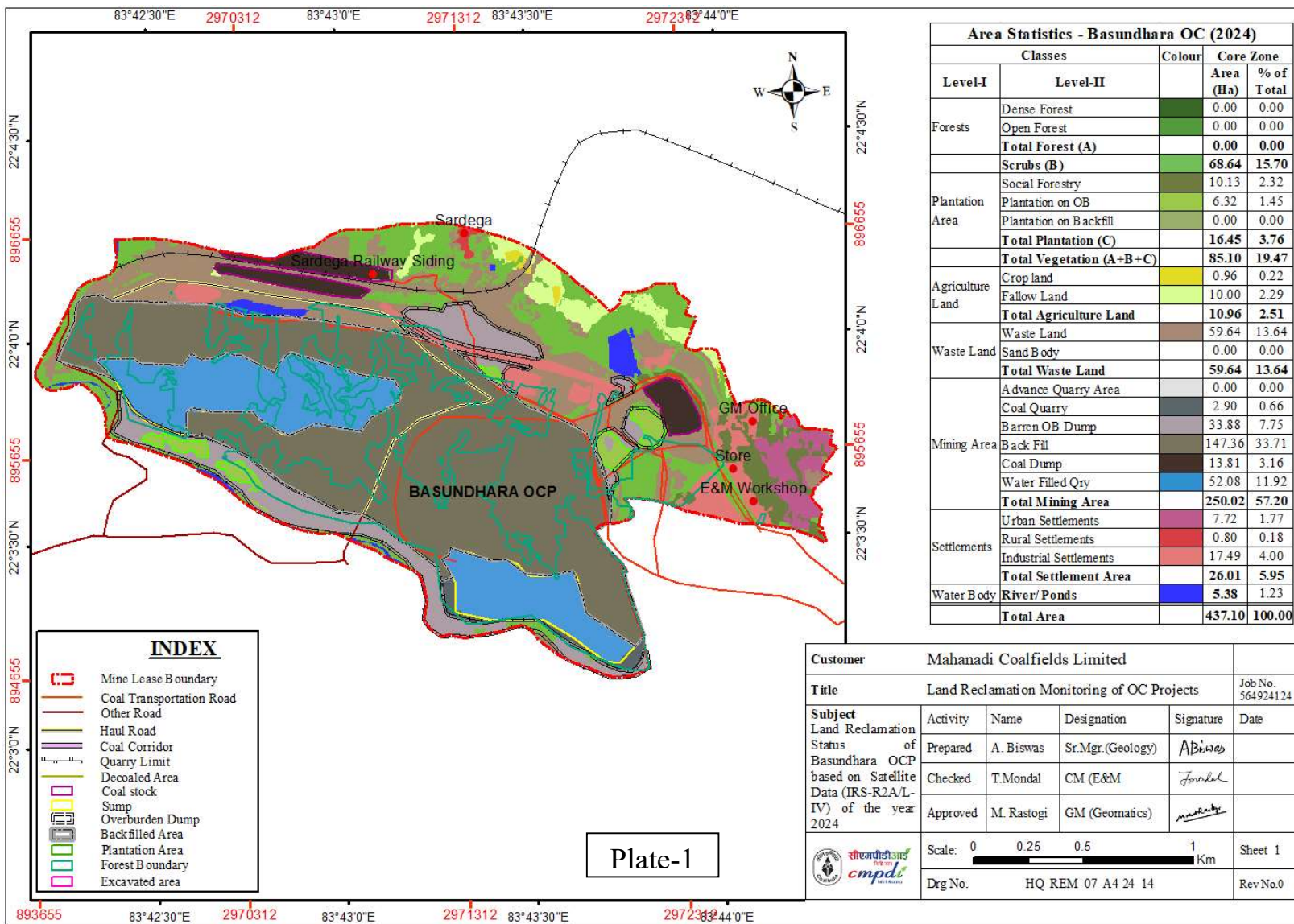
Land reclamation database is created on GIS platform to identify the temporal changes identified from satellite data of different cut-off dates.

4.0 Land Reclamation Status in Mahanadi Coalfields Ltd.

- 4.1** Following 1 OC project producing less than 5 million m³. (Coal + OB together) of Mahanadi Coalfields Ltd. has been taken up during the year 2024 for land reclamation monitoring:
- Basundhara
- 4.2** Area statistics of different land use classes present in the OC project in the year 2024 is given in Table 2. Land use map derived from the satellite data is given in Plate no.1. Land use status is shown in Fig. 3 and field photographs showing plantation sites in Basundhara project are shown in photo 1 - 2.
- 4.3** Study reveals that out of the total mine leasehold area of 437.10 Ha. of the 1 OC project of MCL mentioned above taken for this study in 2024-25; total excavated area is 202.34 Ha. out of which 147.36 Ha. (72.83%) is under backfilling (*Technically Reclaimed*) and balance 54.98 Ha. (27.17%) is under active mining.
- 4.4** After analyzing the satellite data of the year 2021 and 2024, it is evident that total area of plantation (Green cover) which includes plantation on backfill, OB dump as well as under social forestry has decreased from 18.66 Ha. in the year 2021 to 16.45 Ha. in the year 2024. This decrease of 2.21 Ha. in the area of total green cover during three-year cycle is due to construction activities within leasehold area.
- 4.5** A composite land reclamation status of the remaining 7 Projects that are covered under monitoring in the three-year cycle is given in Table 1.1 so that information related to all projects will be made available every year as per clause 2.(ii) of the received work order from CIL.

Table 2: STATUS OF LAND RECLAMATION IN MCL BASED ON SATELLITE DATA OF THE YEAR 2024
(Area in Hectare)

		Area	%	Area	%
FOREST	Dense Forest	0.00	0.00	0.00	0.00
	Open Forest	0.00	0.00	0.00	0.00
	Total Forest	0.00	0.00	0.00	0.00
SCRUBS	Scrubs	68.64	15.70	68.64	15.70
PLANTATION	Social Forestry/Avenue Plantation	10.13	2.32	10.13	2.32
	Plantation on OB Dump	6.32	1.45	6.32	1.45
	Plantation on Backfill (Biological Reclamation)	0.00	0.00	0.00	0.00
	Total Plantation	16.45	3.76	16.45	3.76
	Total Vegetation	85.10	19.47	85.10	19.47
	Coal Dump	13.81	3.16	13.81	3.16
ACTIVE MINING	Coal Quarry	2.90	0.66	2.90	0.66
	Advance Quarry Site	0.00	0.00	0.00	0.00
	Quarry Filled With Water	52.08	11.92	52.08	11.92
	Total Area under Active Mining	54.98	12.58	54.98	12.58
		Barren OB Dump	33.88	7.75	33.88
RECLAIMED	Area Under Backfilling (Technical Reclamation)	147.36	33.71	147.36	33.71
	Total Area under Technical Reclamation	147.36	33.71	147.36	33.71
	Total Area under Mine Operation	250.02	57.20	250.02	57.20
WASTELAND	Waste Land	59.64	13.64	59.64	13.64
	Fly Ash Pond / Sand Body	0.00	0.00	0.00	0.00
	Total Wasteland	59.64	13.64	59.64	13.64
WATERBODIES	Reservoir, Nallah, Ponds	5.38	1.23	5.38	1.23
	Total Waterbodies	5.38	1.23	5.38	1.23
AGRICULTURE	Crop Land	0.96	0.22	0.96	0.22
	Fallow Land	10.00	2.29	10.00	2.29
	Total Agriculture	10.96	2.51	10.96	2.51
SETTLEMENTS	Urban Settlement	7.72	1.77	7.72	1.77
	Rural Settlement	0.80	0.18	0.80	0.18
	Industrial Settlement	17.49	4.00	17.49	4.00
	Total Settlements	26.01	5.95	26.01	5.95
	Grand Total	437.10	100.00	437.10	100.00



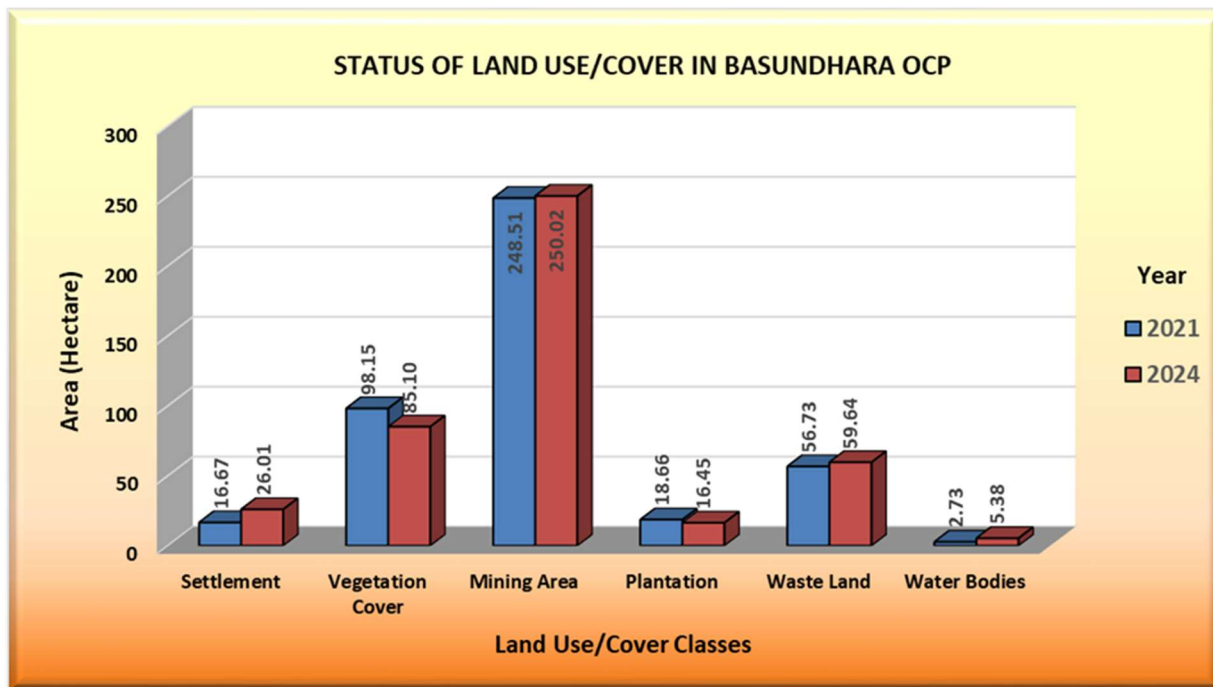


FIGURE - 3



Photo 1: Plantation on External OB Dump (Basundhara OCP)



Photo 2: Social forestry Plantation (Basundhara OCP)

शब्द-कोष

1	Land Reclamation	भूमि पुनरुद्धार
2	Over Burden	अधिभार
3	Monitoring	निगरानी
4	Report	प्रतिवेदन
5	Executive Summary	कार्यकारी सारांश
6	Opencast Mine	खुली खदान
7	Objective	उद्देश्य
8	Methodology	कार्य प्रणाली अथवा प्रक्रिया
9	Table	तालिका
10	List of Tables	तालिकाओं की सूची
11	Map	मानचित्र
12	Social Forestry	सामाजिक वानिकी
13	Plantation	पौधारोपण
14	Million	घनमीटर
15	Background	पृष्ठभूमि
16	Planning	योजनाबद्ध
17	Asses	आकलन
18	Status	स्थिति
19	Regularly	निरंतर
20	Satellite	उपग्रह
21	Subsidiary	अनुषांगिक
22	Production	उत्पादन
23	Biological Reclamation	जैविक पुनरुद्धार
24	Technical Reclamation	तकनिकी पुनरुद्धार

25	Leasehold Area	पट्टा क्षेत्र
26	Excavated Area	उत्खनन क्षेत्र
27	Active mining	सक्रिय खनन
28	Environmental Protection	पर्यावरण संरक्षण
29	Remedial Measure	उपचारात्मक उपाय
30	Interval	अंतराल
31	Systematic Error	व्यवस्थित त्रुटियाँ।
32	Error	अशुद्धियाँ
33	Curvature	वक्रता
34	Geometric	ज्यामितिक
35	Distortion	विरूपण
36	Plantation	पौधारोपण
37	Capacity	क्षमता
38	Software	सॉफ्टवेयर
39	Class	वर्ग
40	Accuracy	सटीकता
41	Statistical Separation	सांख्यिकीय पृथक्करण
42	Cubic meter	घनमीटर
43	Depicted	दर्शाया गया
44	Percentage	प्रतिशत
45	Salient Findings	मुख्य निष्कर्ष
46	Methodology	पद्धति
47	Data Procurement	डाटा क्रय
48	Satellite data Processing	उपग्रह डेटा प्रसंस्करण
49	Rectification and geo-referencing	सुधार और भूसन्दर्भ-

50	Image enhancement	छविगुण - बृद्धि
51	Training set selection	प्रशिक्षण सेट का चयन
52	Classification and Accuracy assessment	वर्गीकरण और मूल्यांकन की सटीकता
53	Area calculation	क्षेत्र गणना
54	Temporal	लौकिक
55	Processing	प्रसंस्करण
56	Overlay of Vector data base	वेक्टर डेटा बेस का अरोपन
57	Area calculation	क्षेत्रगणना-
58	Pre-field map preparation	क्षेत्र जाने के पहले नक्शे की तैयारी
59	Ground Truthing	भू-सत्यापन
60	Ground Information	भू-सूचना
61	Interpretation	व्याख्या
62	Eco-system	पारिस्थितिकी तंत्र
63	Minor	मामुली
64	Water Drainage	जल निकाय
65	Interval	अंतराल
66	Maximum	अधिकतम
67	Coal field	कोयला क्षेत्र
68	Design	परिकल्पना
69	Superimpose	आरोपित
70	Update	अद्यतनीकरण/नवीनीकरण
71	Cumulative	संचयित
72	Embankment	तटबंध
73	Cluster	खुली तथा भूमिगत खदानों के समूह

ABBREVIATIONS

Sol	Survey of India
MoEF&CC	Ministry of Environment, Forest & Climate Change
CIL	Coal India Limited
ECL	Eastern Coalfields Limited
BCCL	Bharat Coking Coal Limited
CCL	Central Coalfields Limited
WCL	Western Coalfields Limited
SECL	South Eastern Coalfields Limited
NCL	Northern Coalfields Limited
MCL	Mahanadi Coalfields Limited
NEC	North Eastern Coalfields
CMPDIL	Central Mine Planning & Design Institute Ltd
NRSC	National Remote Sensing Centre
R2/ R2A	Resource-Sat Satellites
LISS - 4	Linear Imaging and Self Scanning Sensor
FCC	False Colour Composite
OCP	Opencast Project
UGP	Underground Project
OB	Over Burden
GCP	Ground Control points
GIS	Geographic Information System
WGS-84	World Geodetic System
UTM	Universal Transverse Mercator

GLOSSARY

Sl.	Term	Definition
1.	Land Reclamation	To manage, reclaim and restore mined out/ degraded land as close as possible to its original stage
2.	Over Burden	The material that lies above the coal seam/ deposit
3.	Monitoring	A process of evaluation to check or keep record for a period of time.
4.	Opencast Coal Mine	Open-pit mining, also known as opencast mining, is a surface mining technique that extracts minerals from an open pit in the ground.
5.	Social Forestry	Social forestry is the management and protection of forests and afforestation of barren and deforested lands with the purpose of helping environmental, social and rural development. Plantation (Social/ Avenue or other) carried out outside mining area.
6.	Biological Reclamation	Plantation on Backfilled areas (Stabilized Internal Dumps)
7.	Technical Reclamation	Area under backfilling (Over burden dumped inside the mine voids) in mining area.
8.	Green Cover Generation	Total Plantation carried out in the lease area of Project. This include Plantation on Backfill, Plantation on OB and Social Forestry
9.	Leasehold Area	The area, for which lease is granted for the purpose of undertaking mining and allied operations
10.	Excavated area	Mined out area which includes active mining, area under backfilling and plantation on backfilled areas
11.	Active Mining	Mining areas which include Coal Quarry, Advance Quarry, Quarry Filled with Water etc.
12.	Environmental Protection	It is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and, where possible, to mitigate damage and reverse trends.
13.	Remedial Measure	Any measure or action required or undertaken to investigate, monitor, clean up, remove, treat, prevent, contain or otherwise remediate the presence or release of any hazardous substance or activity.

14.	Systematic Error	Every measurement differing from the true measurement in the same direction, and even by the same amount in some cases
15.	Geometric Distortion	It refers to the improper positioning of any image with respect to their true geographic position when viewed in a properly scaled common image display plane.
16.	Land Use/Cover Class	Land cover is what covers the surface of the earth and land use describes how the land is used.
17.	Accuracy	The closeness of agreement between a measured quantity value and a true quantity value.
18.	Environmental Clearance	Environmental Clearance (EC) for any developmental projects like coal mining projects etc. has been made mandatory by the Ministry of Environment, Forests and Climate Change (MoEF&CC) through its Notification issued on 27.01.1994 under the provisions of Environment (Protection) Act, 1986.
19.	Rectification and Geo-referencing	Geo-referencing is the assigning of absolute location of a data point or data points. Geo-rectification refers to the removal of geometric distortions between sets of data points, most often the removal of terrain, platform, and sensor induced distortions from remote sensing imagery
20.	Image Enhancement	It is the process of modifying digital images so that the results are more suitable for processing or further image analysis.
21.	Training set selection	It is a portion of a data set used to fit or train a model for prediction or classification of values that are known in the training set, but unknown in other (future) data
22.	Image Classification	It refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps.
23.	Temporal Changes	The 'temporal change' means the change in any entity with a period of time.
24.	Ground Truthing	Collection of primary/ basic information from ground realities for satellite image interpretation and thematic mapping.
25.	Cluster	Group of opencast and/ or underground minesclubbed together for administrative purposes.
26.	Arc GIS	GIS Software used for Map preparation
27.	ERDAS IMAGINE	Satellite Image Data Classification Software



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