सत्यमेव जयते

कोयला मंत्रालय

Ministry of Coal

Sustainability & Just Transition (S & JT) Division

Greening Initiatives in Coal & Lignite PSUs

February, 2024

Prepared by CMPDIL

प्रल्हाद जोशी
PRALHAD JOSHI
ಪ್ರಲ್ಹಾದ ಜೋಶಿ

संसदीय कार्य, कोयला एवं खान मंत्री
भारत सरकार
नई दिल्ली
MINISTER OF PARLIAMENTARY AFFAIRS,
COAL AND MINES
GOVERNMENT OF INDIA
NEW DELHI

Foreword

In the pursuit of sustainable development, the Ministry of Coal has undertaken a transformative journey to reconcile gigantic efforts being made by the coal PSUs for energy security with the pressing need for environmental management. Recognizing the critical role of the coal sector in our nation's energy landscape, it is incumbent upon us to strike a harmonious balance between industrial progress and ecological preservation. It is our firm belief that economic growth and environmental conservation are not mutually exclusive; they are two sides of the same coin.

This report, "Greening Initiatives in Coal & Lignite PSUs," is an effort to highlight the commitment towards environment sustainable practices within the coal sector. As we navigate through the challenges posed by climate change and strive to meet our energy demands responsibly, the Ministry of Coal has embarked on a journey to enhance the green cover associated with coal mining and processing activities.

The Ministry of Coal has presented a thorough review of the initiatives and accomplishments that characterize our endeavours to enhance the green cover in and around mining areas, contributing to the nation's overall environmental wellbeing. This report not only reflects our steadfast commitment to environmental accountability, and ongoing improvement but also serves as a documentation of our achievements and a roadmap for the journey ahead.

As we move forward, the Ministry remains dedicated to fostering a green and resilient future for our nation. We express our gratitude to all stakeholders, including coal companies (CIL, SCCL, NLCIL), CMPDIL, State Forest Departments as well as local communities & other organizations, who have collaborated with us in this endeavour of land reclamation. Their efforts, insights and support have been instrumental in shaping the initiatives outlined in this report.

(Pralhad Joshi)

31st January, 2024

Office : Room No. 15, Parliament House, New Delhi-110001, Tel : 011-23017780, 23017798, 23018729, Fax : 011-23792341
Office : Room No. 353, 'A' Wing, 3rd Floor, Shastri Bhawan, New Delhi, Tel : 23387277, 23383109, 23386402
Residence : 11 Akbar Road, New Delhi-110001, Tel : 011-23014097, 23094098,
H. No. 122-D, 'Kamitartha' Mayuri Estate, Keshwapur, Hubli-580023 (Karnataka)
Tel. No. : 0836-2251055, 2258955, E-mail : pralhadvjoshi@gmail.com, officeofpralhadjoshiji@gmail.com

रावसाहेब पाटिल दानवे
Raosaheb Patil Danve

राज्य मंत्री
रेल, कोयला एवं खान
भारत सरकार
MINISTER OF STATE FOR
RAILWAYS, COAL AND MINES
GOVERNMENT OF INDIA

FOREWORD

In the dynamic landscape of energy production, coal sector stands as a cornerstone of our nation's progress. However, with this prominence comes a profound responsibility – the responsibility to safeguard our environment and foster sustainable practices that ensure a harmonious coexistence between industry and nature for years to come.

This report, "Greening Initiative in Coal & Lignite PSUs" encapsulates the collective efforts of the Ministry of Coal toward realizing a vision where economic prosperity is seamlessly intertwined with ecological restoration and well-being. As we confront the challenges posed by climate change and resource utilization, it becomes imperative to redefine the narrative surrounding coal sector.

This report delves into the transformative initiatives undertaken by the Ministry to enhance green cover in and around coal mining areas. It not only documents the achievements and milestones reached but also outlines a roadmap for the furthering the transformation of the coal sector into a beacon of sustainable development.

I extend my heartfelt appreciation to all those who have contributed to this endeavour, fostering a spirit of cooperation that is essential for meaningful change. Together, let us embark on a future where the coal sector is synonymous with responsible resource management and environmental safeguarding.

Jai Hind, Jai Bharat.

(Raosaheb Patil Danve)

504 'C' Wing, Shastri Bhawan, Dr. Rajendra Prasad Road, New Delhi-110001
Tel. : 011-23070524, 23385203, 23070529, Fax : 011-23070529
E-mail : mos-mines@gov.in, mos-coal@gov.in, mosr.rb@railtel.gov.in

अमृत लाल मीणा, भा०प्र०से०
सचिव
AMRIT LAL MEENA, IAS
SECRETARY
Tel.: 23384884 Fax : 23381678
E-mail : secy.moc@nic.in

सत्यमेव जयते
आज़ादी का अमृत महोत्सव

भारत सरकार
GOVERNMENT OF INDIA
कोयला मंत्रालय
MINISTRY OF COAL
शास्त्री भवन, नई दिल्ली–110 001
SHASTRI BHAWAN, NEW DELHI-110 001
www.coal.gov.in

FOREWORD

It is with great pleasure that I introduce this report on "Greening Initiatives in Coal & Lignite CPSUs". This study was undertaken by Central Mine Planning and Design Institute Limited (CMPDIL), under the guidance of the Ministry of Coal.

Ministry of Coal, along with the coal companies under its administrative control has been making constant and sincere efforts to minimize the environmental footprint of coal mining through sustained reclamation and afforestation activities across areas in and around its mining sites. It also helps to join hands with the nation in helping to increase the green cover of India.

The initiatives detailed in this report represent a paradigm shift in the way we approach resource utilization and sustainable environmental stewardship. From the inception of innovative technologies to the execution of comprehensive environmental management plans and carrying out afforestation work on an improved scale, the coal sector is evolving into a responsible organ of the environment conservation.

On behalf of the Ministry of Coal, I would like to extend my sincere appreciation to the coal PSUs – CIL, SCCL, NLCIL and CMPDIL in particular for their efforts in bringing this study to fruition. I sincerely hope that this report will gain widespread attention and be utilized for increasing green cover through use of innovative techniques such as seed ball plantation, seed casting through drones and Miyawaki plantation in coal mines by others.

12.2.24
(Amrit Lal Meena)

Plance : New Delhi

Dated : February 12, 2024

भबानी प्रसाद पति, भा.व.से.
संयुक्त सचिव
Bhabani Prasad Pati, IFS
Joint Secretary

आज़ादी का अमृत महोत्सव

सत्यमेव जयते

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GOVERNMENT OF INDIA
कोयला मंत्रालय
MINISTRY OF COAL
शास्त्री भवन, नई दिल्ली
SHASTRI BHAWAN, NEW DELHI
Ph. : 011-23387698
E-mail : bppati@ifs.nic.in

MESSAGE

The coal sector in India not only provides energy security to the nation, but also strives to strike a balance between development and environment sustainability.

In a significant move towards environmental responsibility, the coal companies have come forward in their collaborative efforts to increase green cover in tandem with their coal production. Recognizing the dual responsibility of meeting energy demands and preserving the environment, these companies have actively engaged in initiatives aimed at enhancing ecological balance.

The report, "Greening Initiatives in Coal & Lignite PSUs" prepared by Central Mine Planning and Design Institute Limited (CMPDIL) is an attempt to outline the initiatives, which the coal sector has taken for increasing the green cover of the nation through reclamation efforts.

The greening initiatives undertaken both in closed and running coal mines have been showcased in this report along with a roadmap towards a more sustainable and green future. The data provided has also been validated through Remote Sensing Studies and ground truthing surveys at select sites.

I truly appreciate the efforts undertaken by all coal companies in supporting the nation for this green cause and also appreciate the efforts made by CMPDIL in preparation of this report.

(BHABANI PRASAD PATI)

P.M. PRASAD
Chairman-cum-Managing Director
Coal India Limited

Foreword

Coal/lignite has been mainstay of energy security of the country and constitute above 50% share of the primary energy of the country. About 70% of the electricity generation in India is attributed to coal sector. Though, thrust is now to transition away from fossil fuel for our energy needs but for a developing economy like that of India, the share of coal lignite, is likely to continue in near future. It is expected that coal lignite production will reach 1.50 billion tonnes by the year 2030.

The coal mining is associated with land degradation apart from other environmental impacts and sector operates through environmental prescriptions from Central/State Governments. Being the site specific industry, diversion of forest land has also been undertaken to carry out mining operations. The coal/lignite sector is bound to undertake technical reclamation of mined out areas and mine degraded lands to reduce the mining footprints on land and render the degraded sites into a safe and productive land usage.

India is also signatory to Paris Agreement, 2015 and bound to implement the targets set out in its Nationally Determined Contributions (NDC) submitted to UNFCCC. As per India's NDC, it has to create about additional 2.5 to 3.0 billion tonnes of carbon sink by the year 2030. In addition, India is also party to UNCCD, setting the land restoration target to 26 million ha of degraded lands by 2030. For diversion of forest land, coal/lignite companies are also required to have duly afforested land for compensatory afforestation. It is therefore essential that coal companies undertake technical reclamation in a systematic and time bound manner.

This report on "Greening Initiative of Coal & Lignite PSUs" highlights the efforts of the coal companies they have undertaken technical and biological reclamation. Such efforts not only help coal companies to undertake seamless mining but render the post-mining land into a safe and productive land usage for the community and helping India to achieve its international obligations.

(P.M. Prasad)
Chairman, CIL

Ph. 033-23246611/23246622 Fax: 033-23244154 Email: chairman.cil@coalindia.in
Web: www.coalindia

Dr. B. Veera Reddy
Director (Technical) ,
Coal lndia Limited
CMD,
Central Coalfields Limited
(Addl. charge)

FOREWORD

Importance of coal in the nation's energy matrix as well as the need for environmentally responsible mining operation goes hand in hand given the advent of significance of sustainable development. Coal lndia Limited (ClL), being the single largest coal producer in the country understands its role as a major pillar for the nation's energy security and is striving to achieve 1 billion tonnes of coal production by the year 2025-26. CIL also recognizes its responsibility to the society as well as environment and strives to undertake environmentally responsible and socially inclusive coal mining.

Under the guidance of Ministry of Coal, the coal sector is undertaking many initiatives aimed at sustainable resource consumption along with a thrust on restoration and reclamation of mined out areas. Considering the value of land resources given the critical role of eco-system services.

This report on "Greening lnitiative of Coal & Lignite PSUs" is yet another effort by the coal sector to showcase the practices being undertaken across coal mining projects to push fonruard with sustainable end uses for land resources. Coal companies are undertaking scientific reclamation of mined out lands through technical & biological reclamation schedules as per mining plans and also going fonruard to establish examples of community centric land uses like restored forests, eco-parks, eco-tourism sites, agricultural avenues, etc.

I am sure that this report will help to highlight the work being done by the companies at grass roots level and help set the stage for more efficient reclamation and restoration strategies across coal mines.

(Dr. B. Veera Reddy)

सेन्ट्रल माईन प्लानिंग एण्ड डिजाईन इंस्टीच्यूट लिमिटेड
(कोल इण्डिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार का एक लोक उपक्रम)
गोन्दवाना प्लेस, कांके रोड, राँची - 834031, झारखण्ड (भारत)
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Public Sector Undertaking of Govt. of India)
Gondwana Place, Kanke Road, Ranchi – 834031, Jharkhand (India)
Corporate Identity Number – U14292JH1975GOI001223

Foreword

In the intricate tapestry of industry and ecology, we find ourselves at a pivotal juncture where progress and sustainability must walk hand in hand. As the coal sector move ahead on this transformative journey, it is with great pride and a sense of responsibility that I introduce this report "Greening Initiative in Coal & Lignite PSUs" aimed at fostering a greener tomorrow.

The coal sector has the privilege of being the prime mover of the economic development. However, with this privilege comes the imperative onus to mitigate our environmental impact and ensure a harmonious coexistence with nature.

Central Mine Planning and Design Institute Limited (CMPDIL) under the guidance of Ministry of Coal (MoC) and in association with Coal India Limited (CIL)'s coal producing subsidiaries, Singareni Collieries Company Limited (SCCL) and NLC India Limited (NLCIL) has come out with this document which is not just a token gesture, but it reflects a profound understanding that the responsible extraction of natural resources must coexist with the preservation and enhancement of our natural heritage.

Ministry of Coal has come out with Mine Closure Guidelines in 2009 which was revised in due course of time and mandates post-closure safe, secured and productive land use after the cessation of mining activities. The Mine Closure Guidelines issued in 2022 has the similar mandate for mines which were closed prior to year 2009 when the first Mine Closure Guideline was issued. Coal producing companies has to take up reclamation of mining areas to render it into productive use with the intention to secure sustainable livelihood of local community.

This initiative showcases the unwavering commitment to development of green cover to fulfil India's NDC target of 2.5 to 3.0 billion tonnes of carbon sink by the year 2030. By actively contributing to the creation and preservation of green cover, we aim to offset the ecological footprint associated with our operations. I take this opportunity to congratulate the entire team for bringing out this excellent document.

(Manoj Kumar)
Chairman-cum-Managing Director

फोन नम्बर/Phone No. : 0651-2230001
फैक्स नम्बर/Fax No. : 0651-2230003
ई-मेल/E-mail: cmd.cmpdi.cil@coalindia.in
वेब साईट/Website: www.cmpdi.co.in

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Central Mine Planning and Design Institute Limited (CMPDIL) would like to express its sincere gratitude to the Ministry of Coal (MoC), Government of India, for providing this opportunity to undertake this important study on "Greening Initiatives in Coal & Lignite PSUs". Their guidance and support throughout the study have been invaluable. We would also like to express our sincere gratitude to Shri Pralhad Joshi, Union Cabinet Minister, Parliamentary Affairs, Coal and Mines; Shri Raosaheb Patil Danve, Union Minister of State, Ministry of Coal, Mines and Railways; Shri Amrit Lal Meena, Secretary, Ministry of Coal (MoC) and Shri B.P. Pati, Joint Secretary, MoC, for their valuable inputs, who have greatly contributed to the success of this report. We would like to thank the reviewers who provided their expertise, especially Shri P.M. Prasad, Chairman, Coal India Ltd. (CIL); Dr. B. Veera Reddy, Director (Technical), CIL; Shri Manoj Kumar, Chairman-cum-Managing Director, CMPDIL and Shri Shankar Nagachari, Director(Technical/CRD), CMPDIL for their constructive and valuable feedback on the report. Their comments have greatly enhanced the relevance and quality of this report.

We express our gratitude to Shri Darshan Kumar Solanki, Deputy Secretary, Shri Arvind Kumar, Under Secretary, and Shri Sunil Kumar Bhawaria, Manager (Environment) of the Sustainability & Just Transition Division, Ministry of Coal, for their unwavering support in finalizing the report. Our appreciation also extends to CIL and it's all subsidiaries, SCCL, and NLCIL for providing the data in time for the finalization of this report. We also acknowledge the efforts put in by the Geomatics Division of CMPDIL for carrying out the validation of the data through remote sensing and all Regional Institutes of CMPDIL for validation of the data through ground truth surveys. We extend our sincere thanks to all those who have provided us with valuable information, feedback, and support throughout this study.

The noteworthy contributions of Shri Rakesh Dwivedi, GM (Environment), CMPDIL, Dr. Vinita Arora, GM (Environment), CMPDIL, and Miss Dipti Pillai, Assistant Manager (Environment), are acknowledged in the report's preparation. Special appreciation is reserved for the young executives across all coal companies for diligently providing essential data, vital to completing this report.

We eagerly anticipate ongoing collaboration with all coal companies to address challenges within the coal sector and promote efforts to increase green cover in coal mining areas in India. This collective endeavour aligns with the nation's goal to achieve a forest cover exceeding 33% of the total geographical area of India.

PREFACE

Coal sector plays a crucial role in a developing country like India where energy security is a critical pillar for sustained economic growth and prosperity. Despite the increasing thrust on development of renewable energy sources, coal will continue to remain the bedrock for India's energy matrix for the time being, given its domestic availability as an efficient fuel. However, India is also mindful for the need for sustainable coal mining with increased focus on protection of environment, forests & bio-diversity and host communities.

Ministry of Coal (MoC) has also established Sustainability & Just Transition (S&JT) Division - recognising the importance of sustainability in coal mining sector with a thrust on initiatives for protection and enhancement of local environment and host communities. Land amelioration and afforestation is a major thrust area under S&JT, MoC which aims to monitor the status of land reclamation measures across coal mining areas.

Majority of the coal production in India is through Public Sector Units (PSUs) which includes Coal India Limited (CIL) (accounting for 80% of the net production), Singareni Collieries Company Limited (SCCL) (accounting for 8.4% of the net production) and lignite production through NLC India Limited (NLCIL). Coal mining has a major impact on land resources given the huge land acquisition required for these projects. Hence, major coal producers (CIL, SCCL & NLCIL) have an enhanced responsibility towards undertaking reclamation across the lands impacted by mining and establishing suitable and sustainable end uses prior to handing back these land assets to the State / local communities.

In line with the same, coal PSUs undertake technical & biological reclamation activities as a part of progressive as well as final mine closure, both within and outside coal mining areas – including project offices / colonies, local institutions, open spaces, etc. and also distribute saplings to local communities is done periodically to enhance green cover in the region.

This report has been prepared under the directives of S&JT Division, MoC in order to assess the status of reclamation and plantation undertaken by coal & lignite PSUs till FY 2021-22. The groundwork for the report involved collection of mine-wise data by the companies with regard to land use status and corresponding reclamation and plantations undertaken and planned (within and outside project sites). The collected data was further consolidated by CMPDIL and has been presented in this report to account for land use across coal mines, reclamation done so far and types of plantations undertaken. The data (w.r.t CIL's mines) has also been validated against the satellite based reclamation studies and ground truth survey has also been done at select sites. A roadmap for future plantations planned till FY 29-30, considering the strides required in terms of effective land reclamation and sustainable end use for mining degraded lands has also been proposed.

It is expected that the report will strengthen the resolve towards land reclamation and land management among coal PSUs and aid to establish a much needed thrust on creation of sustainable green cover across coal mining projects.

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ABBREVIATIONS

ACA	Accredited Compensatory Afforestation
AMD	Acid Mine Drainage
ARD	Acid Rock Drainage
BCCL	Bharat Coking Coal Limited
CBD	Convention of Biological Diversity
CCL	Central Coalfields Limited
CIL	Coal India Limited
CMPDIL	Central Mine Planning & Design Institute Limited
CTE	Consent to Establish
CTO	Consent to Operate
EC	Environmental Clearance
ECL	Eastern Coalfields Limited
FC	Forest Clearance
FCA	Forest Conservation Act
GA	Geographical Area
ISFR	India State of Forest Report
LDN	Land Degradation Neutrality
LT5	Less Than 5 mcm Coal+OB p.a.
MCL	Mahanadi Coalfields Limited
MCP	Mine Closure Plan
MoC	Ministry of Coal
MoEF&CC	Ministry of Environment, Forests & Climate Change
MT	Million Tonnes
MT5	More Than 5 mcm Coal+OB p.a.
MTPA	Million Tonnes Per Annum
MW	Mega Watt
NCL	Northern Coalfields Limited
NEC	North Eastern Coalfields
NLCIL	NLC India Limited
NPV	Net Present Value
OB	Overburden
OC	Opencast
OCP	Opencast Project
P&M	Plant & Machinery
PSU	Public Sector Unit
S&JT	Sustainability & Just Transition
SCCL	Singareni Collieries Company Limited
SECL	South Eastern Coalfields Limited
UG	Underground
UNCCD	United Nations Convention to Combat Desertification
WC	Wildlife Clearance
WCL	Western Coalfields Limited

1 Introduction

1.0 Coal Sector in India

Coal sector plays a crucial role in a developing country like India with an estimated contribution of about 55% to the energy consumption matrix in India. Despite the sustained growth of renewable power sources, coal will continue to remain a mainstay for meeting the energy needs of the country at least till 2040.

Coal India Limited (CIL), a public sector undertaking, is a major contributor towards coal production in India. In addition, the Singareni Collieries Company Limited (SCCL) and NLC India Limited (NLCIL) also contribute to production of coal and lignite in the country. Some other public sector companies like NTPC, state PSUs and private sector entities are also engaged in coal mining in India.

CIL, with an approx. coal production of 703.20 MT in 2022-23, has set an ambitious target to achieve 1 billion tonnes of coal production by the year 2025-26. SCCL has a target to produce 80 MT coal by 2024-25 and aims to reach a production of 100 MT by 2029-30[1]. As per Vision 2025 document, NLCIL has planned to produce 93.15 MTPA of coal/lignite, 13760 MW of coal/lignite based power.

1.1 Stages of coal mining

Coal mining involves four major stages –

i. **Exploration of deposits** - Information about the location and value of the mineral ore deposit is obtained during the exploration phase. The exploration phase involves surveys, field studies, drilling boreholes, other exploratory activities and finally preparation of a Geological Report for the coal Block.

ii. **Construction and development of the mine -** The Geological Report helps to ascertain the viability / feasibility of the project and the project proponent may begin to plan for the development of the mine after getting a Project Report prepared for the mine. This phase of the mining project has several distinct components like site preparation and clearing of vegetation, construction of roads, mining infrastructure, residential colonies, etc. Statutory approvals and permissions like Environment Clearance, Forest Clearance, Consent from SPCBs etc. are also planned for and secured at this stage as applicable.

[1]Estimated Projection of Coal Demand upto 2029-30 (https://coal.gov.in/sites/default/files/2021-01/coal- demand-projections20052022.pdf)

iii. **Active mining-** The active mining phase involves extraction of coal either through opencast or underground mining methods or a combination of both, depending upon the geo-mining conditions and provision in Project Report.

iv. **Mine closure activities -** The final phase involving mine closure activities are focused at remedial measures to ensure that the entire mining affected area in converted / developed back to a safe, stable and environmentally sustainable condition. In practice, the activities of mine closure are taken up concurrently with the mining activities under progressive mine closure followed by final mine closure activities after ceasing of mining activities.

1.2 Land as a resource w.r.t coal sector

Coal mining has a large land footprint owing to the need for clearance of vegetation, removal & rehandling of overburden, risk of subsidence and inundation as well as provisioning required for infrastructural amenities to facilitate storage and handling of coal.

In India, there is plan to bring more coal blocks to reduce the coal imports. This will need more land leading to increased impacts on land assets. In order to bring the coal mining areas into gainful utilisation, these land masses will require both extensive and intensive amelioration measures, especially in case of opencast mines. In order to ensure proper and liveable environment for the communities surrounding mining areas as well as the ecosystem, it is necessary to plan and implement mine closure activities.

Reclamation and rehabilitation of mined out land assumes greater significance as it involves measures to be undertaken not only to end the footprint of mining on the land but also to render it into productive land usage so that it does not become a liability but a sustainable source of income to the society. Although the primary purpose of mine reclamation plan is usually to minimize the impact to the local environment after a mine is closed, the mine reclamation plans being made these days can encompass much more than just returning a mine site to its natural state. In fact, some closed mines are now well developed forests, farmlands, open spaces or public parks.

Mine closure involves assessment of impacts of closing a mine, identification of engineering problems and determination of their solutions. Mine closure primarily includes progressive and final mine closure planning activities.

The progressive mine closure plan identifies and includes the mine closure and other allied activities required to be executed continuously and sequentially during the entire period of mining operation since the inception of the project. The primary aim of progressive mine closure plan is to limit the disturbances as early as possible after it is created by mining activities.

The final mine closure plan identifies and includes the mine closure and other allied activities required to be executed towards the end of mine life and may continue even after the final closure of mining activities till a self-sustained ecosystem is created in and around the project area. Initially, the final mine closure plan is based on available inputs at the time of preparation and the likely future development in mines. Various projects are made on a broader horizon which may undergo subtle changes in course of execution of mining activities in future.

1.3 Land amelioration and afforestation monitoring by S&JT Division, MoC

The Sustainability & Just Transition (S&JT) Division, MoC plans to adopt a systemic approach, starting from collection of data, analysis of data, presentation of information, planning based on information; by domain experts, adoption of best practices, consultations, innovative thinking, site-specific approaches, knowledge sharing and dissemination and finally end with an aim to ease the lives of people and communities in general.
Land amelioration and afforestation efforts will be carried out as per the following procedure:

- Collection of baseline data/maps related to different coal mines like block/mine areas, OB dumps areas, water filled voids, reclaimed areas, unutilized areas, plantations etc., from various coal companies.
- Help coal companies to identify areas where plantation projects could be taken up immediately, along with identification of various species of plants, suitable for specific regions to create large carbon sinks for climate change management.
- Identify the activities to be taken up for creation of additional land suitable for plantation, stabilization of slope, soil treatment, creation of levelled land, dewatering etc., as per time line under MCP.
- Check the possibility and plan for productive reuse of these lands for rehabilitation, integrated modern townships, agriculture, horticulture, FCA compensatory land, renewable energy farms etc.

1.4 Objectives of the report

The objectives of the "Greening initiatives in Coal & Lignite PSUs report" are as follows:

- ❖ To assess the greening initiatives taken by coal/lignite PSUs within and outside project area
- ❖ Identification of areas which will be amenable for planation /green cover in command areacoal lignite PSUs
- ❖ Roadmap for Planation/ Greening Initiatives to be undertaken by coal/lignite PSUs
- ❖ Validation/verification of plantation/greening initiatives undertaken by coal/lignite PSUs

1.5 Significance of the report and structure

S&JT Division, MoC had directed CMPDIL to prepare this report, "Greening initiatives in Coal & Lignite PSUs" covering all aspects of reclamation / planting / cultivation / grassing and including aspects of plantation like old and new plantations done, within and outside mining areas, along roadsides, over dump areas, etc.

A format in this regard was finalized in consultation with MoC and circulated to all coal companies (CIL subsidiaries, SCCL and NLCIL).

The structure of the report is as follows:

Chapter I	:	Introduction
Chapter II	:	Coal Mining Statistics
Chapter III	:	Environmental Consequences Of Coal Mining
Chapter IV	:	Mining Footprint On Land
Chapter V	:	Greening Statistics For Closed Mines
Chapter VI	:	Greening Statistics For Running Mines
Chapter VII	:	Overall Greening Scenario
Chapter VIII	:	Data Validation Through Comparison With Remote Sensing Studies
Chapter IX	:	Ground Truth Survey At Select Sites
Chapter X	:	Summary & Conclusion

2. Coal Mining Statistics

2.0 Coal mining statistics

Need for coal

During 2022-23, the domestic coal production across the country was 893.08 MT whereas coal imports constituted of 237.67 MT; lignite production was 44.80 MT. A significant proportion of this demand is for power generation in the thermal power sector. The balance demand is through non- regulated sectors comprising steel, cement, captive power plants etc. It is envisaged that new segments such as power demand from use of electric vehicles and demand for coal from the chemicals sector etc. would also add to the existing demand.

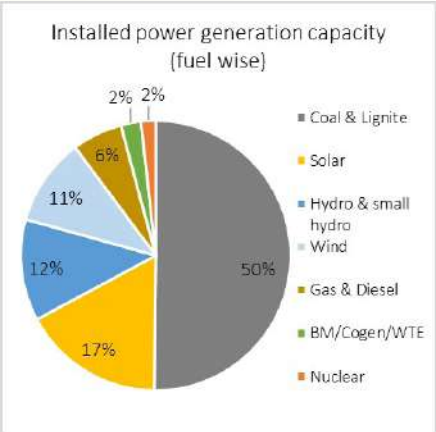


Figure 2.1: Installed power generation capacity (fuel wise) as on 30.11.20232

Coal & lignite reserves

The estimated coal reserves of the country as on 01.04.2023 are 378.21 billion tonnes, which are spread over 69 coalfields, are mainly confined to eastern and south central parts of the country[3]. Whereas, lignite reserves stand at a level around 36 billion tonnes, of which 90 % occur in the southern State of Tamil Nadu.

[2]Source - https://powermin.gov.in/sites/default/files/uploads/power_sector_at_glance_Nov_2023.pdf
[3]Source - https://www.cmpdi.co.in/en/coal-inventory

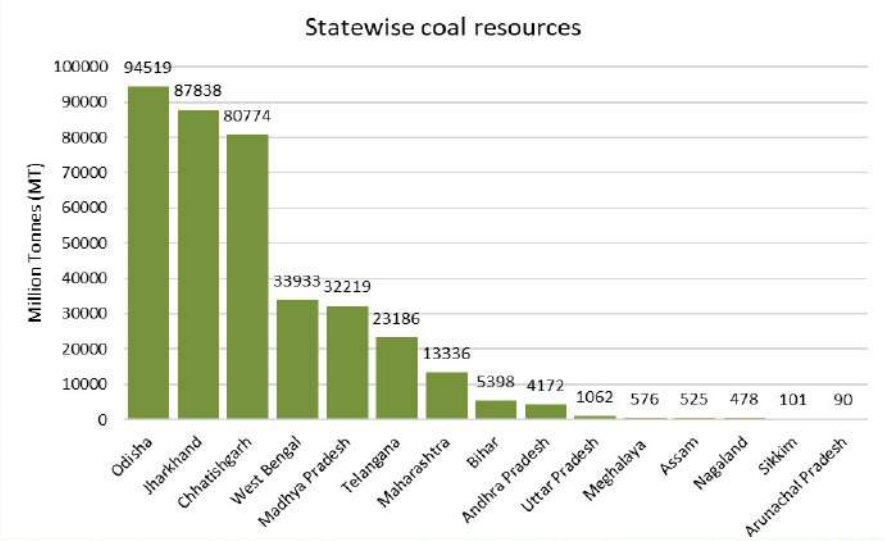


Figure 2.2: Statewise coal resources as on 01.04.2023

2.1 Statistics over the decade

Coal Production

Over the past decade, coal production has increased by approx. 60% whereas lignite production has decreased by approx. 3.5%. As per data available with MoC, during FY 22-23 coal production was approx. 893.08 MTPA and lignite production was approx. 44.80 MTPA.

Coal India Limited (CIL), Singareni Collieries Company Limited (SCCL) and NLC India Limited (NLCIL) are the major contributors to production of coal and lignite in the country. CIL, with an approx. coal production of 703.20 MT in 2022-23, has set an ambitious target to achieve 1 billion tonnes of coal production by the year 2024-25. SCCL has a target to produce 80 MT coal by 2024-25 and aims to reach the production of 100 MT by 2029-30. By 2030, NLCIL has also planned capacity addition to increase its coal production upto 24 MTPA.

Table 2.1: Coal and lignite production over the past decade[4]

Year	Raw coal (MT)	Lignite (MT)
2012-13	556.40	46.45
2013-14	565.76	44.27
2014-15	609.18	48.27
2015-16	639.23	43.84
2016-17	657.87	45.23
2017-18	675.40	46.64
2018-19	728.72	44.28

[4]Source: https://coal.gov.in/sites/default/files/2021-01/Production-of-Raw-Lignite-coal.pdf

Year	Raw coal (MT)	Lignite (MT)
2019-20	730.87	42.10
2020-21	716.08	37.90
2021-22	778.19	47.37
2022-23	893.08	44.80

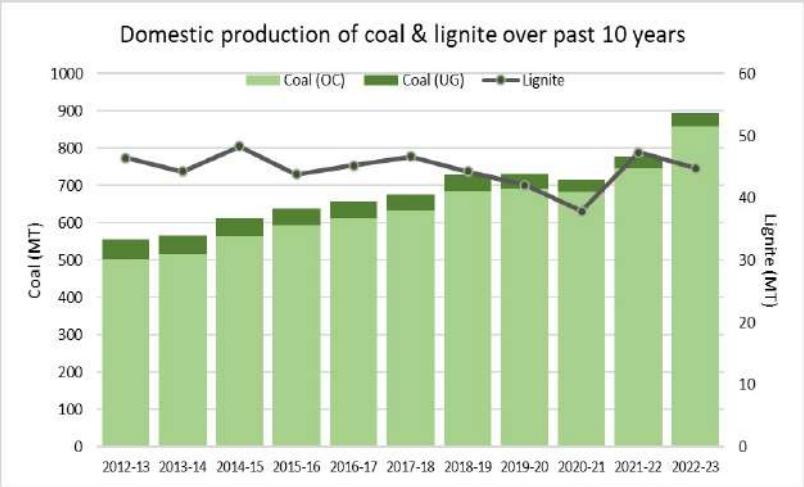


Figure 2.3: Domestic production of coal (from OC & UG mines) & lignite over the past 10 years

Import of coal

Despite the domestic production, import of coal, especially coking coal is required to mainly bridge the gap between the requirement and indigenous availability as well as improved quality. The details on import of coal over the past 10 years are presented in the table below[5]:

Table 2.2: Coal imports over the past decade

Year	Raw coal (MT)
2012-13	145.8
2013-14	166.9
2014-15	212.1
2015-16	203.9
2016-17	191.0
2017-18	208.2
2018-19	235.3
2019-20	248.5
2020-21	215.3
2021-22	208.9
2022-23	237.7

[5]Source - https://coal.gov.in/sites/default/files/2021-01/Import-of-Coal-and-Coke-last-ten-years.pdf

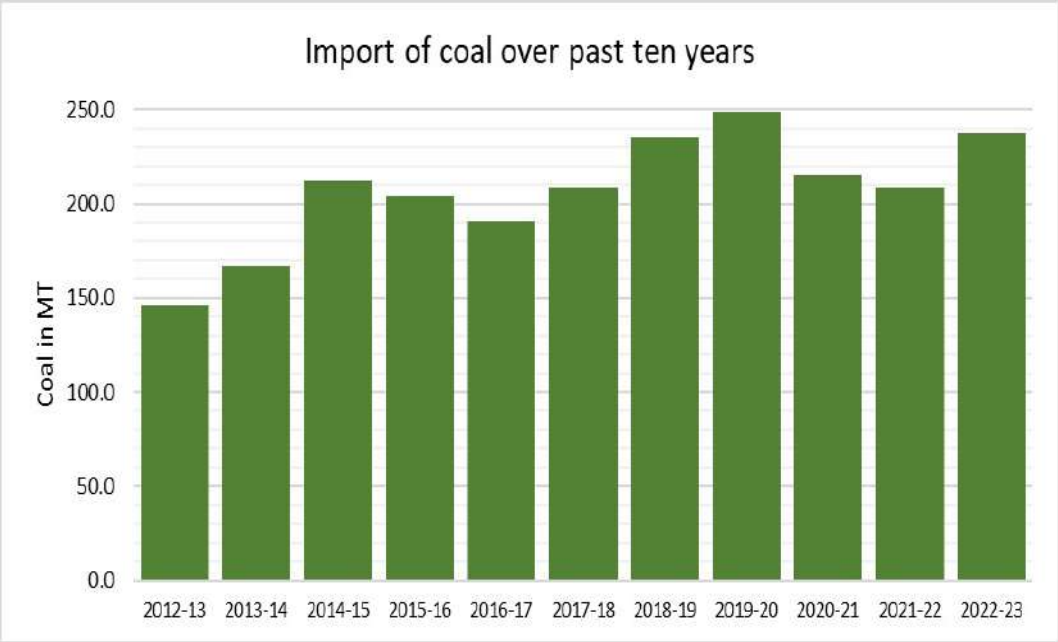


Figure 2.4: Import of coal over the past 10 years

2.2 Future Coal Production Projections

India's demand for power will continue to increase with the rising economy, population growth and rapid urbanization. India has substantial coal resources, so although the amount of renewable energy is increasing rapidly, power generation from coal continues to grow. India also aims to limit import of coal through development and expansion of indigenous coal sources.

Based on the estimated projection of coal demand upto 2029-30[6], the domestic coal supply is envisaged to increase upto 1511 MT by 2029-30. Hence, coal sector has been gearing up for enhancing coal production to fulfil the coal demand, set to rise in years ahead.

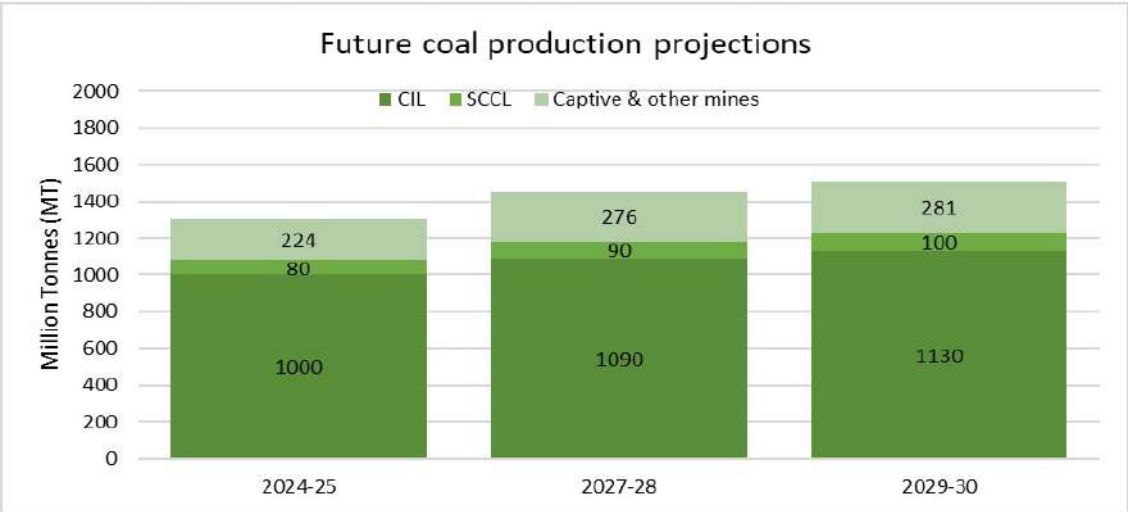


Figure 2.5: Future coal production projections by CIL, SCCL, captive & other mines

[6]Source – Ministry of Coal (coal-demand-projections20052022.pdf)

2.3 Impact of type of coal mining on land

Coal mines in India comprise of opencast (OC) and underground (UG) mines and at times, mixed mines are also being operated depending upon geo-mining conditions. The choice of opencast or underground coal mines or mixed mines depends upon extent of deposit, geological conditions, available mining technology and project economics. At present, the opencast mines have been planned for a depth of around 300 m. In future, based on the availability of mining equipment and favourable geo-mining conditions, there is possibility of opencast mines going beyond 300 m depth.

Of the net coal production, majority is through opencast mining (average 93%) and a minor percentage (average 7%) is through underground mining. The coal production from opencast and underground mining for the past decade[7] is given in the table below & also presented under Figure 2.3.

Table 2.3: Coal production from opencast and underground mining methods over the past decade

(Production unit is Million tonnes)

Year	Coal production from OC	Coal production from UG
2012-13	504.19	52.21
2013-14	516.12	49.65
2014-15	563.97	48.46
2015-16	592.82	46.41
2016-17	613.52	44.35
2017-18	633.57	41.83
2018-19	686.21	42.50
2019-20	690.39	40.48
2020-21	683.87	32.21
2021-22	745.03	33.18
2022-23	858.34	34.85
Average	609.09	45.11
Average % break-up	93.11	6.89

The company wise coal production over three years[8] from 2020-21 till 2022-23 with corresponding OB removal is presented in the table below.

Table 2.4: Coal & lignite production from opencast mining and corresponding OB removal (2020-21 till 2022-23)

Year	CIL		SCCL		NLCIL		TOTAL	
	Production (MT)	OB removal (M.cu.m)	Production (MT)	OB removal (M.cu.m)	Production (MT)	OB removal (M.cu.m)	Production (MT)	OB removal (M.cu.m)
20-21	569.77	1244.73	46.06	322.55	1.01	4.9	616.84	1572.18
21-22	597.01	1365.55	58.76	383.39	6.34	2.33	662.11	1751.27
22-23	677.72	1646.58	59.94	417.53	10.03	8.00	747.69	2072.11

[7]Source-https://coal.gov.in/sites/default/files/2021-01/Production-Opencast-and-Under-ground-minesdurin-last-ten-years.pdf
[8]Company Wise Over Burden Removal(OBR) and Stripping Ratio in Revenue Mines in last Three Years https://coal.gov.in/sites/default/files/2021-01/Company-wiseOBR.pdf

Based on company wise coal production & OB removal statistics, the average stripping ratio across the major coal companies (CIL subsidiaries, SCCL & NLCIL) are presented in the graph below[9]:

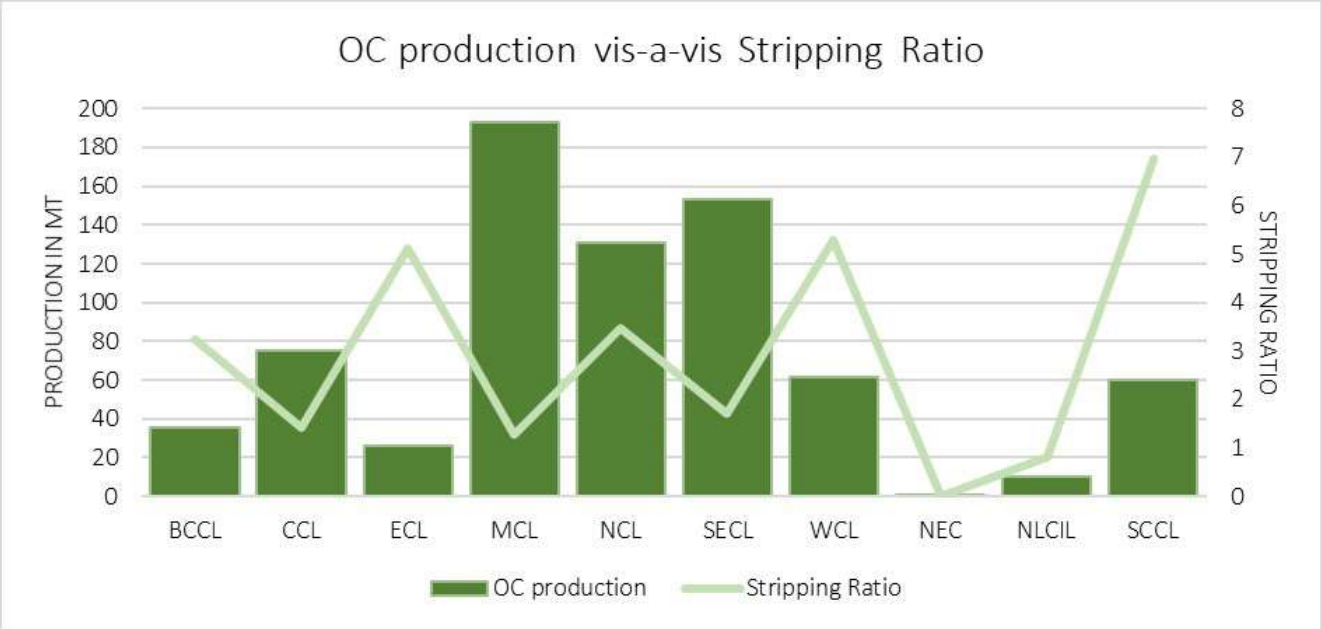


Figure 2.6: Production from opencast mines vis-à-vis stripping ratio during 2022-23

In case of opencast mines, overburden (OB) removal is a major aspect, which has major land requirement for OB disposal. The higher the stripping ratio, the higher the land requirement of handling / re-handling of OB and subsequent reclamation at the end of mine life. In case of underground mines, subsidence of land and extent of surface rights are crucial aspects. Thus, land reclamation and plantation over such areas is an active thrust area.

As per the data available from coal PSUs for the purpose of this report, CIL has 456 mines, of which almost 40.4% are opencast (184 mines), 41.7% underground (190 mines) and balance 17.9% are of mixed type (82 mines). SCCL has 50 mines, of which 42% are opencast (21 mines), 56% are underground (28 mines) and balance 2% are mixed type (1 mine). As for NLCIL, it operates only opencast mines (5 mines). The summary is presented under table 2.5 below. The detailed company wise break-up is presented under table 2.6.

[9]Company Wise Over Burden Removal(OBR) and Stripping Ratio in Revenue Mines in last Three Years -https://coal.gov.in/sites/default/files/2021-01/Company-wiseOBR.pdf

Table 2.5: Summary w.r.t number of mines vis-à-vis project area for CIL, SCCL & NLCIL

Sr. No.:	Company	Number of mines	Mining type break-up			Project area	Area break-up (in ha)		
			OC	UG	Mix	(in ha)	OC	UG	Mix
1	CIL	456	184	190	82	2,76,554.26	1,33,445.12	1,09,181.08	35,611.56
2	SCCL	50	21	28	1	34,998.65	20,399.96	13,262.05	1,336.64
3	NLCIL	5	5	0	0	15,720.24	15,720.24	-	-
	TOTAL	511	210	218	83	3,27,273.15	1,69,565.32	1,22,443.13	36,948.20

Table 2.6: Company wise break-up w.r.t project area and numbers in running & closed mines

Coal company	Type of mine	Closed mines		Running mines		Total	
		Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)
BCCL	OC	0	0.00	22	7,633.53	22	7,633.53
BCCL	UG	0	0.00	36	11,535.32	36	11,535.32
BCCL	Mixed	0	0.00	33	8,118.40	33	8,118.40
BCCL[10]	**Total**	**0**	**0.00**	**91**	**27,287.25**	**91**	**27,287.25**
CCL	OC	2	1,371.97	36	17,840.59	38	19,212.56
CCL	UG	8	3,301.81	4	1,571.78	12	4,873.59
CCL	Mixed	2	973.30	1	910.16	3	1,883.46
CCL	**Total**	**12**	**5,647.08**	**41**	**20,322.53**	**53**	**25,969.61**
ECL	OC	0	0.00	13	11,318.38	13	11,318.38
ECL	UG	0	0.00	32	18,266.27	32	18,266.27
ECL	Mixed	0	0.00	46	25,609.70	46	25,609.70
ECL[11]	**Total**	**0**	**0.00**	**91**	**55,194.35**	**91**	**55,194.35**

[10]No mine is exhausted; some are temporarily closed due to technical and financial reasons. Hence, the mines have not been reported under closed mines. Detailed status for 35 mines not operational is presented under Annexure III for reference. Project area reported excludes proposed Kapuria UG (Cluster XII) (809.6 ha)

[11]No mine is exhausted; some are temporarily closed due to technical and financial reasons. Hence, the mines have not been reported under closed mines. Proposed projects - Bhanora UG & OC and Mithapur OC in Sripur Area have not been considered

Coal company	Type of mine	Closed mines		Running mines		Total	
		Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)
MCL	OC	3	1,368.72	15	19,546.88	18	20,915.60
MCL	UG	6	5,462.76	3	2,683.50	9	8,146.26
MCL	Mixed	0	0.00	0	0.00	0	0.00
MCL[12]	**Total**	**9**	**6,831.48**	**18**	**20,546.88**	**27**	**27,378.36**
NCL	OC	1	459.00	10	18,418.07	11	18,877.07
NCL	UG	0	0.00	0	0.00	0	0.00
NCL	Mixed	0	0.00	0	0.00	0	0.00
NCL	**Total**	**1**	**459.00**	**10**	**18,418.07**	**11**	**18,877.07**
SECL	OC	5	3,339.45	22	19,777.08	27	23,116.53
SECL	UG	12	5,954.68	44	34,887.74	56	40,842.42
SECL	Mixed	0	0.00	0	0.00	0	0.00
SECL	**Total**	**17**	**9,294.13**	**66**	**54,664.82**	**83**	**63,958.95**
WCL	OC	17	4,136.70	35	27,463.31	52	31,600.01
WCL	UG	22	10,344.10	22	15,036.60	44	25,380.70
WCL	Mixed	0	0.00	0	0.00	0	0.00
WCL[13]	**Total**	**39**	**14,480.80**	**57**	**42,499.91**	**96**	**56,980.71**
NEC	OC	0	0.00	3	771.44	3	771.44
NEC	UG	0	0.00	1	136.52	1	136.52
NEC	Mixed	0	0.00	0	0.00	0	0.00
NEC[14]	**Total**	**0**	**0.00**	**4**	**907.96**	**4**	**907.96**
CIL	OC	28	10,675.84	156	1,22,769.28	184	1,33,445.12
CIL	UG	48	25,063.35	142	84,117.73	190	1,09,181.08
CIL	Mixed	2	973.30	80	34,638.26	82	35,611.56
CIL	**Total**	**78**	**36,712.49**	**378**	**2,39,841.77**	**456**	**2,76,554.26**

[12]Project area reported under running OC mines is 19546.88 ha, which includes leasehold area (17863.38 ha) as well as external area (1683.50 ha) earmarked for colonies & project office, etc.

[13]14 closed mines (10 from Kanhan area and 4 from Pench area) have not been considered since these were closed prior to 2005 and relevant data is not available in official records.

[14]Ledo OC and Toping Colliery have been considered under running mines, however closure notice for these 2 mines was submitted in 2022 and closure activities are under progress.

Coal company	Type of mine	Closed mines		Running mines		Total	
		Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)	Number of mines	Project Area (in ha)
NLCIL	OC	0	0.00	5	15,720.24	5	15,720.24
NLCIL	UG	0	0.00	0	0.00	0	0.00
NLCIL	Mixed	0	0.00	0	0.00	0	0.00
NLCIL[15]	Total	0	0.00	5	15,720.24	5	15,720.24
SCCL	OC	2	806.56	19	19,593.40	21	20,399.96
SCCL	UG	7	3,920.21	21	9,341.84	28	13,262.05
SCCL	Mixed	0	0.00	1	1,336.64	1	1,336.64
SCCL	**Total**	**9**	**4,726.77**	**41**	**30,271.88**	**50**	**34,998.65**
TOTAL	OC	30	11,482.40	180	1,58,082.92	210	1,69,565.32
TOTAL	UG	55	28,983.56	163	93,459.57	218	1,22,443.13
TOTAL	Mixed	2	973.30	81	35,974.90	83	36,948.20
TOTAL	**Total**	**87**	**41,439.26**	**424**	**2,85,833.89**	**511**	**3,27,273.15**

[15]South Pachwara OC has not been included as it is a new project.

Correlating with data on percentage break-up of approved production capacity from the running mines vis-à-vis number of mines and total area, it is observed that almost 90.7% of approved production for CIL is attributed to 156 running opencast mines (41.27% of the total running mines of CIL) accounting for 51.19% of the project area available with CIL. Balance 9.23% approved production is from 222 running underground and mixed mines (58.73% of the total running mines of CIL) accounting for 49.51% of the project area.

In case of SCCL, it is observed that almost 77% of approved production is attributed to 19 running opencast mines (46.34% of the total running mines of SCCL) accounting for 64.72% of the area available with SCCL. Balance 22.86% approved production is from 22 running underground and mixed mines (53.66% of the total running mines of SCCL) accounting for 35.28% of the total area.

It may thus be inferred that although majority of the production is from opencast mines which have large land requirements, even underground and mixed mines have a considerable land footprint despite their low contribution to net production.

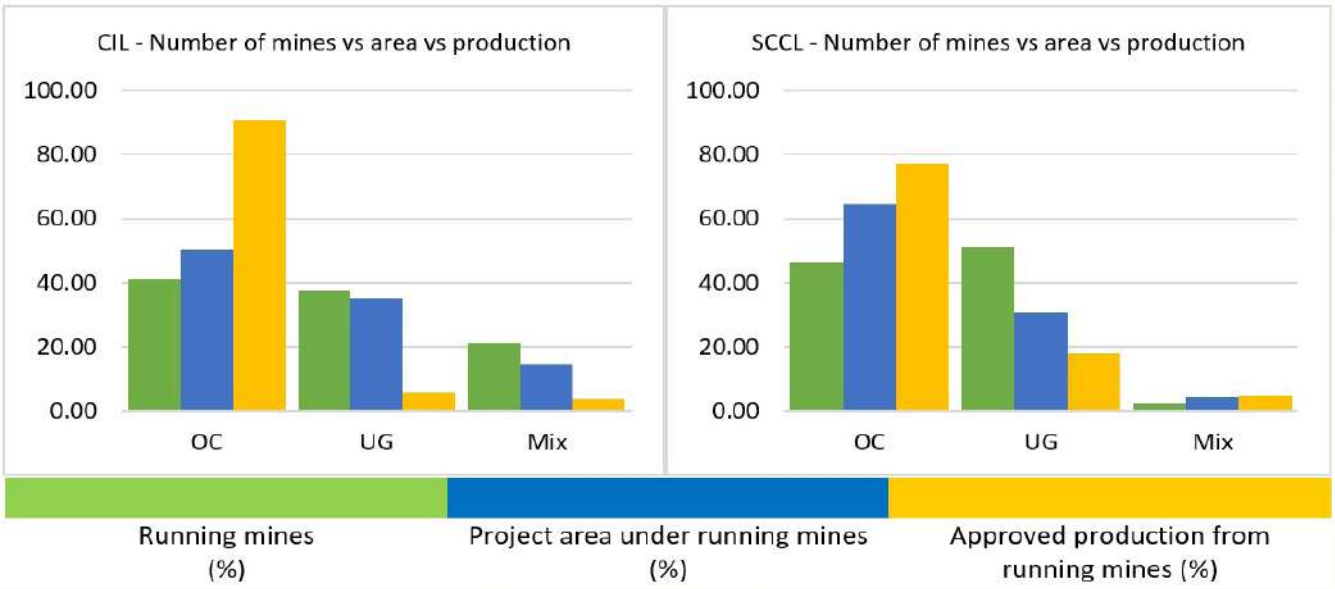


Figure 2.7: Comparison of percentage break-up w.r.t type of mine, approved production and area for CIL & SCCL

2.4 Efforts towards Mine Closure

Mining activities leave long lasting impacts on landscape, ecology, and on the mind-set of local population. The coal mining sector more often receives criticism for large-scale environmental degradation primarily owing to its footprints on the land. The adverse impacts, if not managed, can have detrimental effect on general well-being of society.

"Closure" is a term used to describe a number of facets associated with the cessation of mining activities and the "shutting down" of a mine. It refers to actions that must be taken with regard to the physical infrastructure of a mine, actions around the natural environment and the socio-economic situation, measures that must be taken regarding the employees (labour issues) and the financial implications. It covers progressive and final mine closure activities with thrust on biological reclamation of mined out and dump area as the mine progresses and on closure of the mines.

As for the legal framework, the requirement of mine closure was introduced in 2009 by the Ministry of Coal, Government of India and were further revised in 2013, 2019 and 2020.

Additionally, MoC has also issued guidelines[16] for management of mines discontinued/abandoned / closed before 2009 which were not explicitly covered in the initial mine closure guidelines. This notification aims to achieve scientific closure in order to provide benefit to the community.

Coal companies are required to prepare approved mine closure plans for all operating mines in accordance with the Mine Closure guidelines issued by MoC along with opening a fixed deposit Escrow Account with scheduled Bank for depositing annual mine closure cost as per approved Mine Closure Plan. Bio-reclamation and plantation activities account for a major chunk of the mine closure cost framework and lay the foundation towards long term restoration of the mining sites.

[16]Source: Guidelines for the Management of Mines discontinued / abandoned / closed before the year 2009 issued by MoC vide order dated 28.10.2022

3

Environmental Consequences of Coal Mining

3.0 Stages of Mining

Coal mining involves the following stages: Exploration of deposits, construction and development of the mine, active mining and mine closure activities.

Figure 3.1: Stages in coal mining

3.1 Exploration

A mining project can only commence with knowledge of the extent and value of the mineral ore deposit. Information about the location and value of the mineral ore deposit is obtained during the exploration phase. This phase includes surveys, field studies, drilling boreholes, other exploratory activities and finally preparation of a Geological Report for the coal block.

3.2 Construction and Development

If the mineral ore exploration phase proves that there is a large enough mineral ore deposit, of sufficient grade, then the project proponent may begin to plan for the development of the mine after getting a Project Report prepared for the mine. This phase of the mining project has several distinct components like site preparation and clearing of vegetation, construction of roads, mining infrastructure, residential colonies etc. Requisite clearances (like EC, FC, WC, CTE & CTO, as applicable) are also secured during this phase prior to construction and development of the project.

3.3 Active Mining

3.3.1 Opencast Mining

There are a number of advantages of open pit mining when compared to Underground Mining:

- Open pits can sometimes be brought into production quickly. Underground mining requires development (shaft sinking, adits, inclines etc.) which might take years before production can start.

However, design & construction of the processing plant also takes a long time during which U/G development might be completed in parallel;
- Open pits are generally safer than U/G mining;
- Operations are highly visible to management & easy to control;
- Low operating costs:
  - the expenditure is mainly on direct production activities–drilling, blasting & moving rock– compared with U/G which has high costs of ancillary activities: support, ventilation
  - open pit mining allows the use of very large machines which have a lower cost per tonne of mineral mined than small machines
- Geological information may be improved & grade control is normally easier;
- It is relatively easy to increase or reduce the rate of production (tonnes per month);
- Provides more operational flexibility
- Low labour intensity (small workforce required): less housing, direct & social costs associated with employees;
- The choice of an open pit mining method may not preclude later mining at depth by U/G methods.

3.3.1.1 Environmental Impact of Opencast Mining

The following are the environmental impacts of opencast mining:

- Very large amounts of waste rock (overburden) are mined. This creates costs as well as environmental issues with waste rock disposal;
- Major disruption of surface: pit footprint, waste dumps. High visual impact, especially strip mining. After closure, rehabilitation may be difficult, slow & costly;
- Open pits catch rain, making them vulnerable to flooding, which may severely disrupt production;
- Air pollution due to coal handling, coal transportation and from coal stock piles,
- Water pollution, Ground water depletion
- Change in land profile, impact on flora & fauna
- Socio-cultural impact, Economic disparity, Socio-economic conflict/Cost of living
- Displacement of people, Loss of livelihood

3.3.2 Underground Mining

Shallow mineral or coal deposits can be economically mined by open-pit or strip mines. However, with deeper mineral or coal deposits it becomes very costly to remove a great deal of overburden in these kinds of settings. So, in these cases underground mining is more cost effective. The downside is that human health and safety are at greater risk from mine cave- ins, flooding from groundwater or sea water, methane explosions in coal mines, or failure of air ventilation equipment.

Since it is a process wherein ore and minerals are extracted from deep underground, it does not incur large damages to the surface environment of the mine area. It doesn't lead to land degradation as typically present in open-pit/surface mining. It doesn't need breaking up and blasting the ground with explosives.

The surface facilities unique to underground mining are mine main entries (shafts, inclines and adits) head frame(s), heap; storage bins, hoist houses, etc. the additional underground facilities may consist of secondary and tertiary openings for providing access haulage and ventilation and various other facilities such as transportation, crusher stations, power distribution.

3.3.2.1 Environmental Impact of Underground Mining

Underground mining is a less environmentally-destructive means of gaining access to an ore deposit, however it often entails greater safety risks than strip mining, including open-pit mining. The following are the environmental impacts of underground mining:

i. Air pollution due to coal handling, coal transportation and from coal stock piles, release of obnoxious gas e.g. methane.
ii. Water pollution, Acid rock drainage (ARD) or Acid mine drainage (AMD)
iii. Land Degradation due to subsidence on account of underground depillaring leading to change in land profile, destruction of flora & fauna, caving in and rock fall
iv. Safety issues in Underground workings
v. Socio-cultural impact, Economic disparity, Socio-economic conflict/Cost of living
vi. Displacement of the people, Loss of livelihood

3.4 Mine Closure Activities

3.4.1 Components of Mine Closure

Mine closure involves assessment of impacts of closing a mine, identification of engineering problems and determination of their solutions. Mine closure primarily includes progressive and final mine closure planning activities.

The **progressive mine closure plan** identifies and includes mine closure and other allied activities required to be executed continuously and sequentially during the entire period of mining operation since the inception of the project. The primary aim of progressive mine closure plan is to limit the disturbances as early as possible after it is created by mining activities.

The **final mine closure plan** identifies and includes the mine closure and other allied activities required to be executed towards the end of mine life and may continue even after the final closure of mining activities till a self-sustained ecosystem is created in and around the project area. Initially, the final mine closure plan is based on available inputs at the time of preparation and the likely future development in mines. Various projects are made on a broader horizon which may undergo subtle changes in course of execution of mining activities in future. The main components of mine closure are as under:

Environmental	Site Characterization	Closure Planning	P&M decommissioning	Post closure care & monitoring
Assessment of damage Rehabilitation strategy Compliance of laws Approval	Geotechnical features Infrastructural facilities Nature of surrounding development	Level of mechanization Asset deployment strategy Manpower deployment Resource characterization	Asset inventory Remaining life assessment Obsolesce factor Decommissioning / reuse plan	Post closure land use Transfer of custody Post closure sustainability Post closure liabilities

3.4.2 Requirements of Mine Closure

The mine closure plan provides that mining is to be carried out in a phased manner initiating afforestation/ reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mines. It may thus be seen that it incorporates the provision of both progressive and final mine closure plan to leave the entire mining area in a safe and sustainable manner so that it does not become a liability but a resource for the local community. The following issues as per guidelines issued by Ministry of Coal, Government of India, are required to be addressed in the mine closure plans:

1. Reclamation and rehabilitation of mined out land
2. Water quality management
3. Air quality management
4. Waste management
5. Management of coal rejects from washery
6. Infrastructure
7. Disposal of mining machinery
8. Safety and security

Figure 3.3: Issues to be addressed as a part of mine closure plans as per MoC guidelines

Out of the above, the first issue i.e. reclamation and rehabilitation of mined out land assumes greater significance as it involves measures to be undertaken not only to end the footprint of mining on the land but also to render it into productive land usage so that it does not become a liability but a sustainable source of income to the society. Since the mining activities involve excavation of minerals and dumping of overburden material (both external and internal dumping), it is highly challenging to bring back the original surface profile after the cessation of mining activities. **This has also become important as Ministry of Coal, Government of India is planning to introduce provisions under Coal Bearing Area (Acquisition & Development) Act, 1957 for return of the land to the State Government (as land is a state subject).**

However, practices related to reclamation have improved significantly in recent years. Today, there are fine examples showcasing mine reclamation plans which encompass much more than just returning a mine site to its natural state. **In fact, some closed mines are now forests, farmlands, open spaces or public parks.**

The mine closure guidelines were issued by the Ministry of Coal in 2009 and which were subsequently revised in 2013, 2019 and the latest guidelines were issued in May 2020. **The guidelines issued in 2020 go so far to state that mine closure plan is integral part of the mining plan.** Additionally, MoC has also issued guidelines[17] in 2022 for management of mines discontinued / abandoned / closed before 2009 which were not explicitly covered in the initial mine closure guidelines. These guidelines are aimed at undertaking progressive and final mine closure activities during the operation of the mine and also upon its closure. The provision of escrow account has been made in these guidelines, which act as a financial assurance for mine closure activities.

3.5 Mine Site Rehabilitation–reclaiming degraded mining areas and contributing towards achieving LDN commitments

Coal sector ensures through its mine closure framework that each parcel of mining affected land is appropriately remediated and brought under green cover. All mines operate with a detailed mine closure plan with elaborate provision for progressive and final closure of the affected sites to leave a productive and sustainable land use site post closure.

Rehabilitation comprises the design and construction of landforms as well as the establishment of sustainable ecosystems or alternative vegetation, depending upon desired post-operational land use. Rehabilitation aims at to reinstate ecosystem functionality and land productivity, although it will probably assume a different land use and species composition from the original eco-system.

Mine site rehabilitation should be designed to meet three key objectives:

1. The long-term stability and sustainability of the landforms, soils and hydrology of the site
2. The partial or full repair of ecosystem capacity to provide habitats for biota and services for people
3. The prevention of pollution of the surrounding environment.

In contrast, **restoration has the more ambitious aim of re-establishing eco-system structure and function to an image of its state before disturbance, or of replicating a desired reference eco-system.** Restoration aims to re-establish an ecosystem that develops along a successional pathway so that it assumes a similar, but not necessarily identical, structure, function and composition to the original ecosystem.

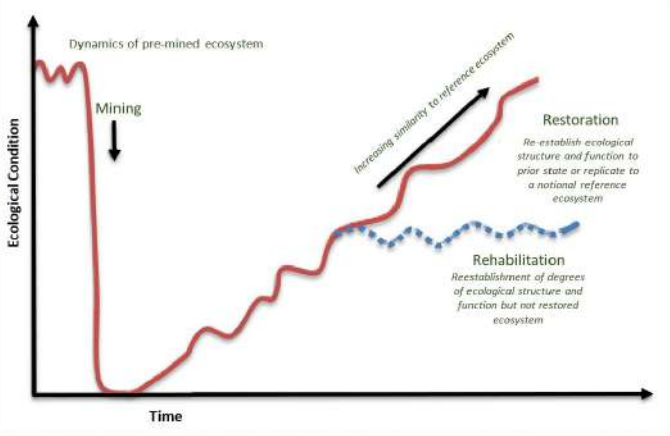


Figure 3.4: Hypothetical Ecosystem Development (Bradshaw, 1987)

[17]Source: Guidelines for the Management of Mines discontinued / abandoned / closed before the year 2009 issued by MoC vide order dated 28.10.2022

Importantly, as an ecosystem develops, definitions might also morph or develop over time. For example, a rehabilitated eco-system or landscape may progress into a near natural, restored eco-system. Conversely, ecosystems that are ostensibly being restored may be neglected because of a lack of management interventions and may be more representative of rehabilitation.

3.5.1 Role of plantation in rehabilitation of mined out areas

Plantation is the oldest technology for the restoration of lands damaged by human activity. A primary objective for achieving satisfactory rehabilitation of a mined landscape is to establish a permanent vegetation cover. There is an increasing evidence that forest plantations can play a key role in harmonizing long-term forest ecosystem rehabilitation or restoration goals with near-term socio-economic development objectives. Plantations can play a critical role in restoring productivity, ecosystem stability and biological diversity to degraded areas. Relative to unplanted sites, plantations have a marked catalytic effect on native forest development (succession) on severely degraded sites.

Numerous studies have demonstrated that land rehabilitation benefits from plantations because it allows to jump-start succession. The catalytic effects of plantations are due to changes in understorey microclimatic conditions (increased soil moisture, reduced temperature, etc.), increased vegetational–structural complexity, and development of litter and humus layers that occur during the early years of plantation growth. The development of a plantation canopy can alter the understorey microclimate and the soil physical and chemical environment to facilitate recruitment, survival and growth of native forest species. Otherwise, native species would only very slowly, if ever, regenerate on degraded sites. Thus, plantations may act as 'foster ecosystems', accelerating development of genetic and biochemical diversity on degraded sites.

Plantations have an important role in protecting the soil surface from erosion and allowing the accumulation of fine particles. They can reverse degradation process by stabilizing soils through development of extensive root systems. Once they are established, plants increase soil organic matter, lower soil bulk density, moderate soil pH, and bring mineral nutrients to the surface and accumulate them in available form. Their root systems allow them to act as scavengers of nutrients not readily available. The plants accumulate these nutrients and re-deposit them on the soil surface in organic matter, from which nutrients are much more readily available by microbial breakdown. This is exhibited in the levels of available phosphorus and potassium in afforested colliery spots.

Most importantly, some species can fix and accumulate nitrogen rapidly in sufficient quantities to provide a nitrogen capital, where none previously existed, more than adequate for normal ecosystem functioning. Once the soil characteristics have been restored, it is not difficult to restore a full suite of plant species to form the required vegetation. The other advantages are that establishment of desirable tree species capable of maintaining the site will slow or prohibit invasion of less desirable weedy species, will provide economic returns in the long term, will aid in developing wildlife habitat and will promote hydrologic balance in the watershed.

As per the India State of Forest Report (2021), most of the coal bearing districts have a significant percentage of forest area. Forest cover in terms of percentage of geographical area from the coal bearing districts ranges between 4.85% to 62.16%, with an average of 29.58%. Thus plantation and rehabilitation may have a positive impact on maintaining and improving forest / green cover in these districts. The summary of the state of forest cover in major coal mining states as per State of Forest Report (2021) is shown hereunder.

Table 3.1: State of forest cover in major coal bearing districts as per FSI's India State of Forest Report (2021)

Sl.	State	District	Geographical Area (GA) (sq. km)	Forest Cover as per ISFR 2021 (sq.km)	Forest Cover as % of GA	Change in Forest Cover w.r.t. ISFR 2019 (sq.km)	Change in % w.r.t. ISFR 2019
1	Assam	Tinsukia	3790	1583.38	41.78	0.81	0.05
2	Chattisgarh	Korba	6598	3400.93	51.54	7.23	0.21
3		Korea	6604	4105.37	62.16	8.76	0.21
4		Raigarh	7086	2623.45	37.02	3.12	0.12
5		Sarguja	15732	7109.76	45.19	27.15	0.38
6	Jharkhand	Bokaro	2883	576	19.98	2.45	0.43
7		Chatra	3718	1782.09	47.93	4.74	0.27
8		Deoghar	2477	205.8	8.31	2.09	1.03
9		Dhanbad	2040	218.18	10.7	4.67	2.19
10		Giridih	4962	905.91	18.26	4.67	0.52
11		Godda	2266	423.35	18.68	0	0
12		Hazaribagh	3555	1363.19	38.35	10.42	0.77
13		Palamu	4393	1215.73	27.67	14.95	1.25
14		Ramgarh	1341	331.26	24.7	2.26	0.69
15		Ranchi	5097	1168.78	22.93	4.29	0.37
16	Madhya Pradesh	Anuppur	3747	857.47	22.88	-11.21	-1.29
17		Betul	10043	3662.79	34.47	-0.91	-0.02
18		Chindwara	11815	4608.13	39	20.12	0.44
19		Shahdol	6205	1954.7	31.5	-16.01	-0.81
20		Singrauli	5675	2162.86	38.11	-17.27	-0.79
21		Umaria	4076	2001.24	49.1	-21.34	-1.06
22	Maharashtra	Chandrapur	11443	4050.27	35.4	-4.19	-0.1
23		Nagpur	9892	1998.79	20.21	-1.59	-0.08
24		Yavatmal	13582	2610.18	19.22	2.86	0.11
25	Odisha	Angul	6375	2783.38	43.66	0.75	0.03
26		Jharsuguda	2114	335.37	15.86	2.73	0.82
27		Sundergarh	9712	4268.17	43.95	-5.2	-0.12
28	Tamil Nadu	Cuddalore	3703	390.24	10.54	-0.72	-0.18
29	Telangana	Adilabad	16105	5743.42	35.66	22.1	0.39
30		Karimnagar	11823	2206.02	18.66	217.81	10.96
31		Khammam	13266	4508.71	33.99	29.57	0.66
32		Warangal	12846	3099.07	24.12	145.62	4.93
33	Uttar Pradesh	Sonebhadra	6905	2436.75	35.29	-103.54	-4.08
34	West Bengal	Bankura	6882	1279.37	18.59	-6.21	-0.48
35		Barddhaman	7024	340.68	4.85	1.37	0.4
36		Purulia	6259	919.24	14.69	3.36	0.37
Total			**252034**	**79230.03**	**1064.95**	**355.71**	**0.45**

4

Mining Footprint on Land

4.0 Data collection and consolidation

This report was conceptualized by S&JT Division of MoC and prepared by CMPDIL through assistance from coal companies. Based on the format finalized by MoC, data was sought from coal and lignite companies with regard to break-up of land in their mining projects as on 31.03.2022. The data received from the companies was then consolidated and the statistics in respect running and closed/abandoned mines have been presented in this chapter. The consolidated data from the coal companies with detailed heads has been included under **Annexure I** (for closed mines) & **Annexure II** (for running mines).

The exercise required collection of mine wise data from all coal/lignite PSUs and consolidated at CMPDIL end. The data sets were bifurcated w.r.t running & closed mines. For certain mines, detailed break-up has not been available for due to lack of official records, such mines have been omitted and mentioned. Considering the volume of data, certain assumptions and back- calculations have also been made at CMPDIL end to ensure arithmetic validity of the data and prevent double counting.

4.1 Land use across coal mines

In case of closed mines, since mining activity has ceased, the land area can be broadly categorized as

- Areas under subsidence
- Overburden dumps
- Surface area under other uses
- Balance area consisting areas not having surface rights, areas occupied by road/ infrastructure/ water bodies, undisturbed areas, areas earmarked for future expansion, etc.

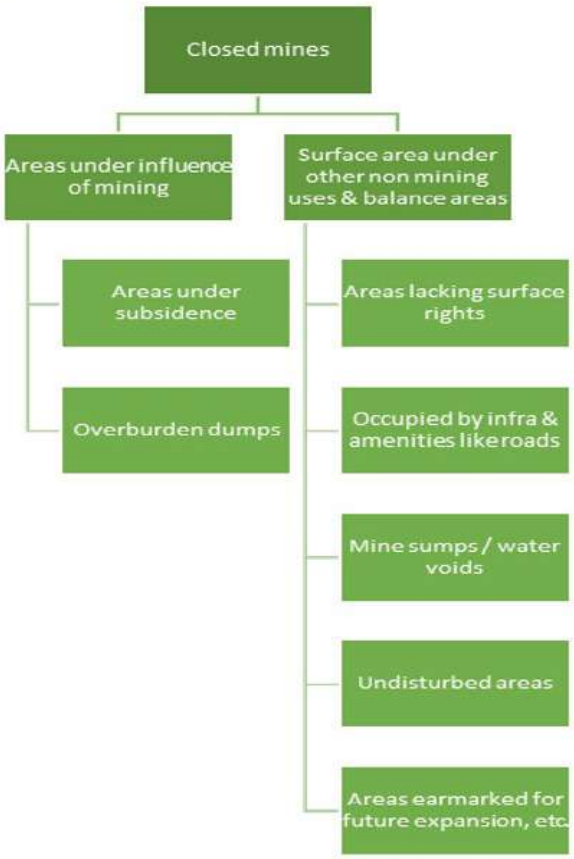


Figure 4.1: Land use across closed mines

In case of operating mines, since the mining activities are ongoing under various stages, the area under active mining or areas retained for meaningful uses are extensive. The land patches in running mines may broadly be categorized as

- Active mining areas, which include
  - Areas under subsidence in case of UG mines
  - Areas under excavation and not backfilled for ensuring clear space for safe operation of mines
  - Active dumping sites
- Overburden dumps (internal & external)
- Infrastructure areas (buildings, roads, stockyard, siding, etc.)
- Undisturbed areas – retained for future expansion / acquired but pending clearances, etc.
- Any other areas, not falling under any of the above heads – includes areas not having surface rights, areas not surveyed as on date, areas having water bodies, etc.

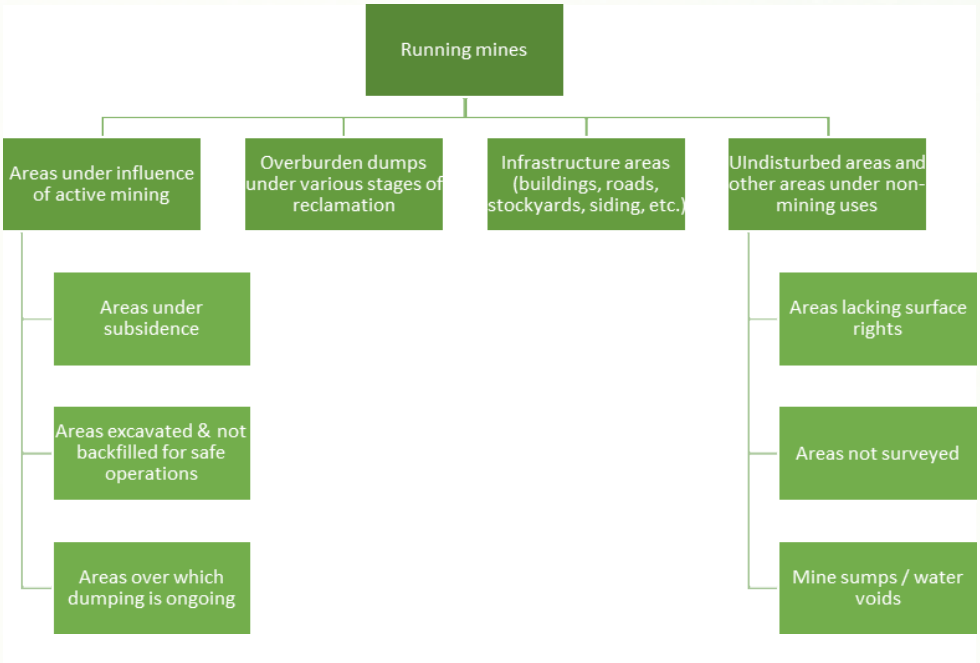


Figure 4.2: Land use across running mines

Biological reclamation is carried out over subsided areas where feasible, over reclaimed quarry areas and over internal and external overburden dumps. Additionally, companies also take up plantation at other feasible sites within the project area, eg. near infrastructure areas and other viable patches. Certain patches are not amenable for plantation on account of presence of mine voids, occupied by infrastructure, plans for future expansion in case of underlying reserves, need for retaining clear access, lack of survey, etc. Also, in case of certain UG mines, surface rights are not available for the reported project areas and hence, plantation is limited to areas under mining rights for such mines.

4.2 Status of land area in closed mines

Of the 87 closed / abandoned / discontinued mines, 30 are opencast, 55 are underground and 2 are mixed mines spread over total project area of 41,439.26 ha. Opencast mines account for 11,482.40 ha which

is 34.48% the total project area, underground mines account for 28,983.56 ha, which is 63.22% of the total closed mines' area and mixed mines which account for 973.30 ha which is 2.30% of the total closed mines' area.

The company wise break-up w.r.t mines based on mining type and corresponding project area are presented in the graphs below.

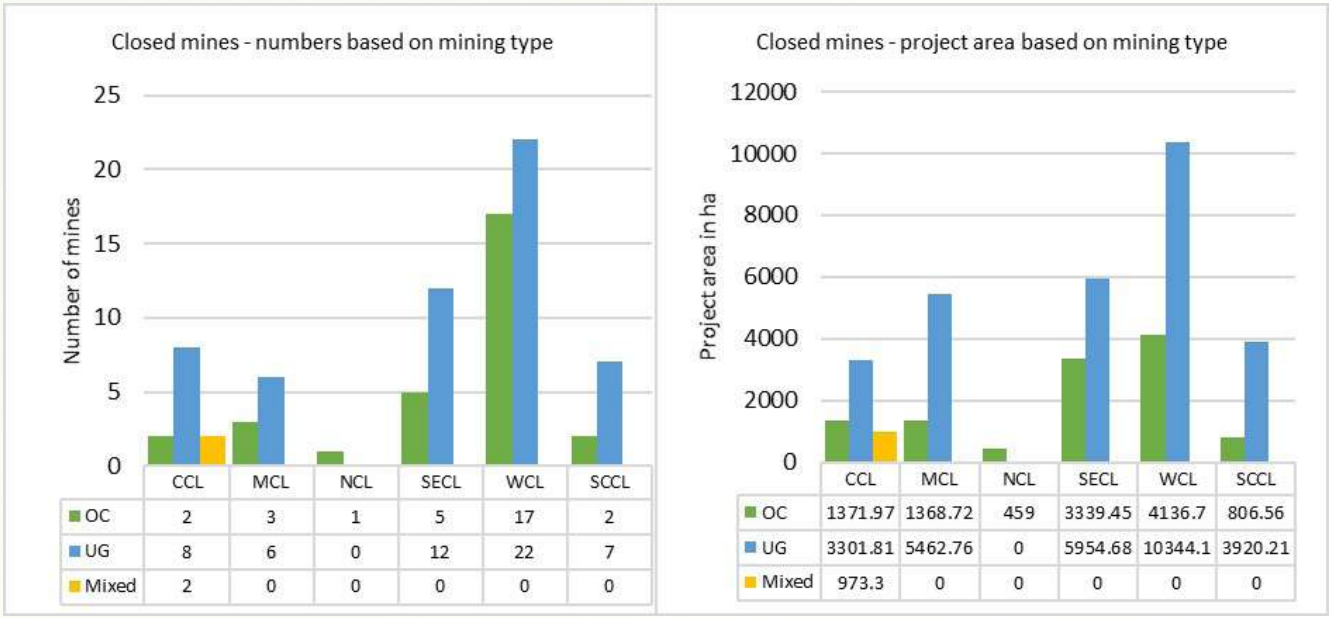


Figure 4.3: Number of closed mines and corresponding project area based on type of mining

Areas directly influenced by mining including patches under subsidence, quarry areas and overburden dump areas account for 16.3% of the project area (5.8% under subsidence and 10.5% under overburden dumps), surface areas under other uses (last cut, submerged patches, areas without surface rights, etc.) account for 26.9% and balance areas (infra, roads, mine voids, undisturbed patches, etc.) account for 56.8% of the project area.

The detailed table showing company wise[18] area break-up under these heads is presented in the table below.

[18]In case of BCCL & ECL, no mine is exhausted; some are temporarily closed due to technical and financial reasons. Hence, not reported under closed mines by the company. For BCCL, detailed status for 35 mines not operational is presented under Annexure III for reference. For WCL, 14 closed mines (10 from Kanhan area and 4 from Pench area) have not been considered since these were closed prior to 2005 and relevant data is not available in official records.

Table 4.1 : Land area break-up in closed mines

Coal PSU	No. of mines	Project Area	Break-up of project area			
			Quarry area / area under subsidence	Surface areas under other uses[19]	Over-burden dump area	Balance project area[20]
BCCL	0	-	-	-	-	-
CCL	12	5647.08	432.7	1264.26	849.34	3100.86
ECL	0	-	-	-	-	-
MCL	9	6831.48	0	4571.1	349	1911.39
NCL	1	459	0	0	126	333
SECL	17	9294.13	868.03	2751.26	1323.49	4351.34
WCL	39	14480.8	181	2543.59	1351.52	10404.58
NEC	0	-	-	-	-	-
CIL	78	36712.49	1481.73	11130.21	3999.35	20101.17
NLCIL	0	-	-	-	-	-
SCCL	9	4726.77	908.86	0	371.41	3446.5
TOTAL	**87**	**41439.26**	**2390.59**	**11130.21**	**4370.76**	**23547.67**
Percentage break-up			%	%	%	%
BCCL			-	-	-	-
CCL			7.7	22.4	15	54.9
ECL			-	-	-	-
MCL			0	66.9	5.1	28
NCL			0	0	27.5	72.5
SECL			9.3	29.6	14.2	46.8
WCL			1.2	17.6	9.3	71.9
NEC			-	-	-	-
CIL			4	30.3	10.9	54.8
NLCIL			-	-	-	-
SCCL			19.2	0	7.9	72.9
TOTAL			5.8	26.9	10.5	56.8

WCL has the highest number of closed mines as well as the largest project area under closed mines. This is followed by SECL & MCL. Areas impacted by mining (subsidence areas, overburden dumps and other surface areas) account between 27.1% (lowest in SCCL) to 72% (highest in MCL), averaging at 42.3% overall.

[19] Areas under last cut, submerged patches, areas lacking surface rights, other areas under non-mining uses, etc.
[20] Includes patches under infra, roads, mine voids, undisturbed patches, etc.

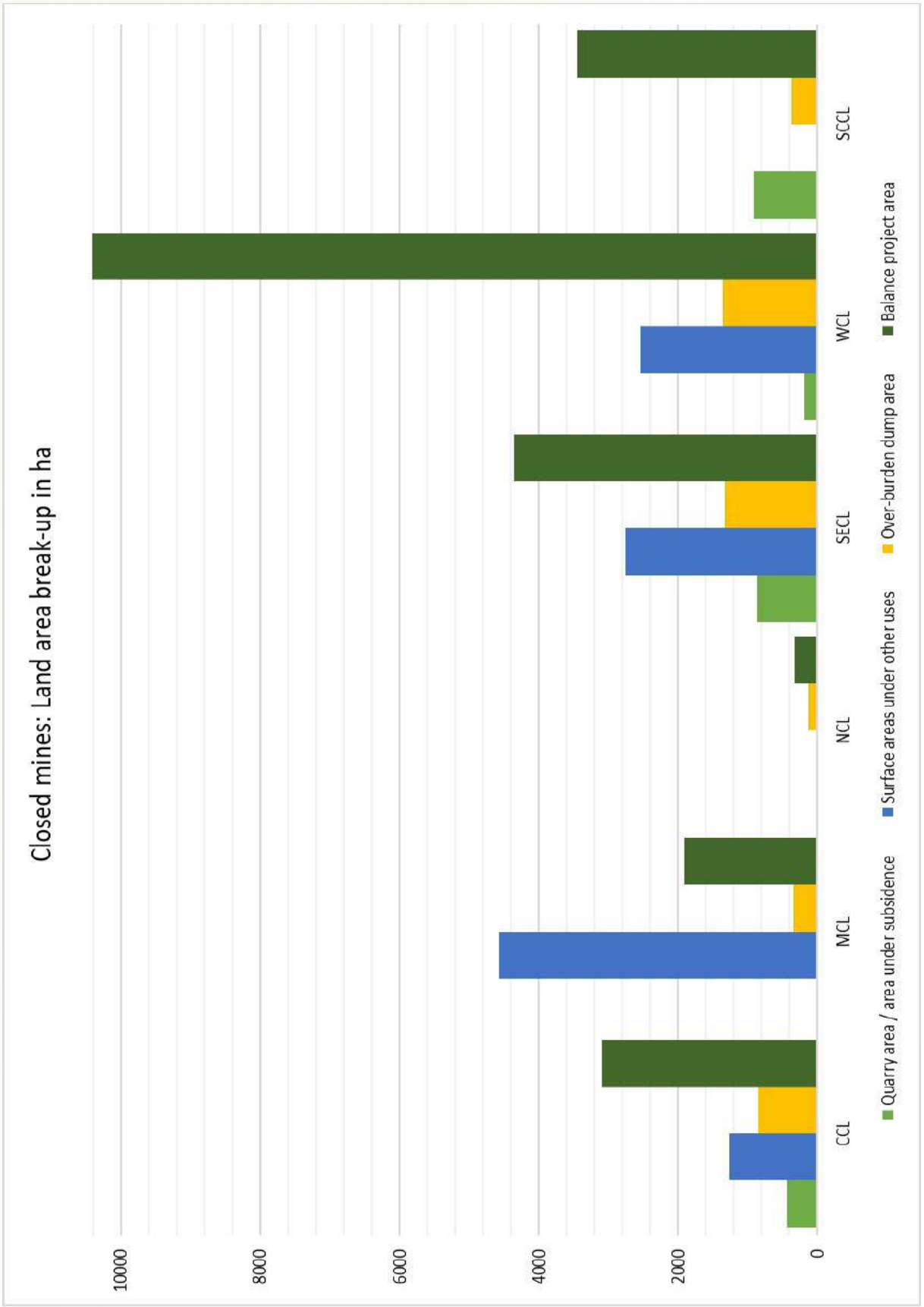


Figure 4.4(A): Land area break-up in closed mines (in ha)

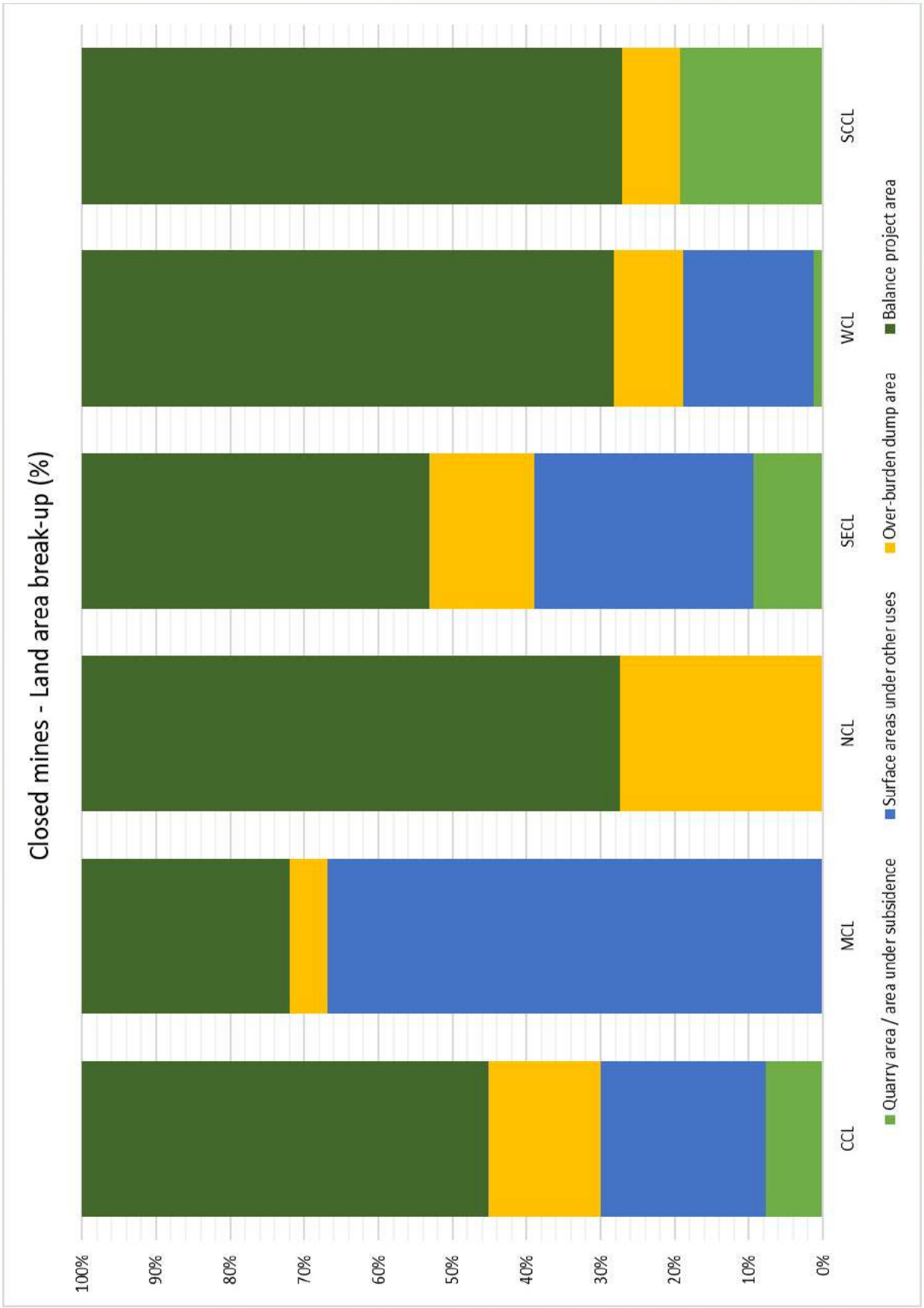
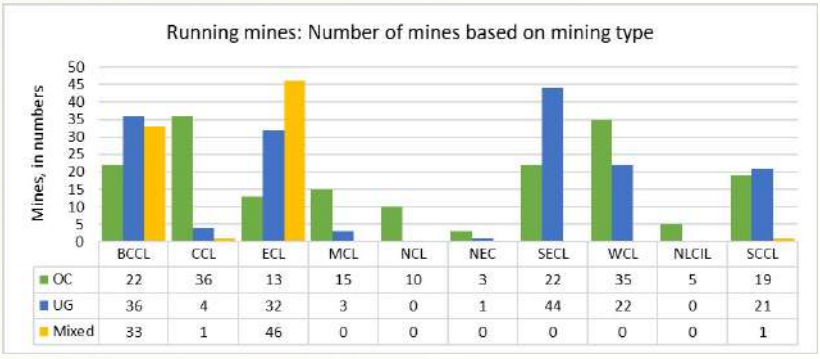


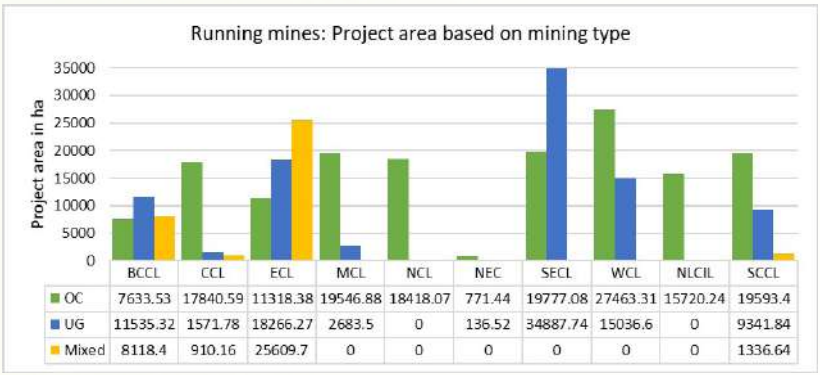
Figure 4.4(B): Land area break-up in closed mines (in percentage)

4.3 Status of land area for running mines

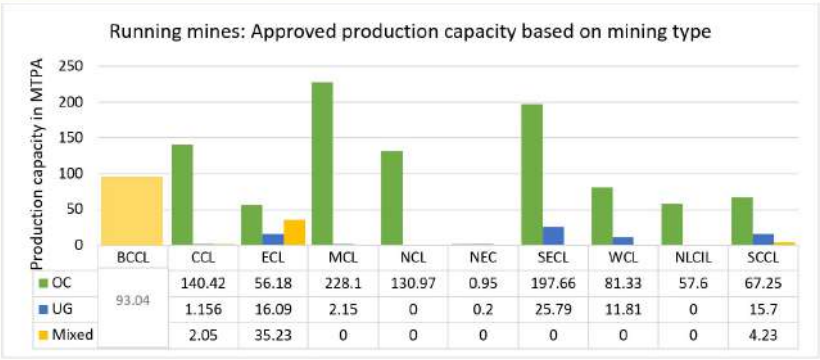
Coal PSUs have reported 424 running mines, of which 180 are opencast mines, 163 are underground mines and 81 are mixed mines spread over a lease area of 2,85,833.89 ha and accounting for an approved production capacity of 1167.9 MTPA. Opencast mines account for 1,58,082.92 ha which is 55.31% the project area, underground mines account for 93459.57 ha, which is 32.70% of the total running mines' area and mixed mines which account for 35974.90 ha which is 12.59% of the total running mines' area. The company wise[21] break-up w.r.t mines based on mining type and corresponding project area are presented in the graphs below.



	BCCL	CCL	ECL	MCL	NCL	NEC	SECL	WCL	NLCIL	SCCL
OC	22	36	13	15	10	3	22	35	5	19
UG	36	4	32	3	0	1	44	22	0	21
Mixed	33	1	46	0	0	0	0	0	0	1



	BCCL	CCL	ECL	MCL	NCL	NEC	SECL	WCL	NLCIL	SCCL
OC	7633.53	17840.59	11318.38	19546.88	18418.07	771.44	19777.08	27463.31	15720.24	19593.4
UG	11535.32	1571.78	18266.27	2683.5	0	136.52	34887.74	15036.6	0	9341.84
Mixed	8118.4	910.16	25609.7	0	0	0	0	0	0	1336.64



	BCCL	CCL	ECL	MCL	NCL	NEC	SECL	WCL	NLCIL	SCCL
OC	93.04	140.42	56.18	228.1	130.97	0.95	197.66	81.33	57.6	67.25
UG		1.156	16.09	2.15	0	0.2	25.79	11.81	0	15.7
Mixed		2.05	35.23	0	0	0	0	0	0	4.23

Figure 4.5 Running mines – Number of mines, corresponding project area and approved production capacity based on type of mining[22]

[21]In case of BCCL & ECL, the running mines' list also includes certain mines where operations are temporarily suspended for technical / financial reasons despite non-exhaustion of reserves.

[22]Net EC capacity of BCCL is taken as 93.04 MTPA, as the EC has been obtained on cluster basis (clusters may have OC, UG and mix mode mines) and peak production for the mines of a cluster differs at a given period

Areas under use for core mining activities including patches under subsidence, quarry areas and overburden dump areas account for 28.3% of the total project area (quarry / subsidence areas – 20.3%, Overburden dump areas – 8.0%). Other surface areas account for 5.6% of the project area, areas having infrastructures account for 9.4% of the project area and undisturbed patches account for 56.6% of the total project area.

The detailed table showing company wise[23] area break-up under these heads is presented in the table below.

Table 4.2: Land area break-up in running mines

Coal PSU	No. of mines	Project Area	Break-up of project area				
			Quarry area / area under sub-sidence	Over- burden dump area	Infrastructu re areas	Other surface areas	Undisturbe d areas
BCCL	91	27287.25	4277.8	845.54	3667.48	661.32	17835.11
CCL	41	20322.53	6064.35	1912.42	3732.01	355.18	8258.64
ECL	91	55194.35	4839.47	928.13	4216.33	1808.36	43401.86
MCL[24]	18	20546.88	6213.55	807.29	1588.53	49.87	10204.13
NCL	10	18418.07	6172.28	2304.59	3886.27	0	6054.93
SECL	66	54664.82	8868.46	1578.53	4699.68	7305.37	32212.79
WCL	57	42499.91	6537.89	6385.74	1425.64	3996.67	24154.21
NEC	4	907.96	314.5	138.31	51.27	0	403.88
CIL	378	239841.77	43288.3	14900.55	23267.21	14176.77	142525.55
NLCIL	5	15720.24	6080.71	2061.31	456.51	0	7121.71
SCCL	41	30271.88	8449.6	5885.74	3108.89	1616.48	11211.16
TOTAL	424	285833.89	57818.61	22847.6	26832.61	15793.25	160858.42
Percentage break-up			%	%	%	%	
BCCL			15.7	3.1	13.4	2.4	65.4
CCL			29.8	9.4	18.4	1.7	40.6
ECL			8.8	1.7	7.6	3.3	78.6
MCL			32.9	4.3	8.4	0.3	54.1
NCL			33.5	12.5	21.1	0	32.9
SECL			16.2	2.9	8.6	13.4	58.9
WCL			15.4	15	3.4	9.4	56.8
NEC			34.6	15.2	5.6	0	44.5
CIL			18.2	6.3	9.8	6	59.8
NLCIL			38.7	13.1	2.9	0	45.3
SCCL			27.9	19.4	10.3	5.3	37
TOTAL			20.3	8	9.4	5.6	56.6

[23]Excluded projects: Kapuria UG (Cluster XII, BCCL), Bhanora UG & OC (ECL), Mithapur OC (ECL), South Pachwara OC (NLCIL). Wr.t NEC, Ledo OC and Toping Colliery are considered under running mines, however closure notice for these 2 mines was submitted in 2022 and closure activities are under progress.

[24]Considering project area under running mines as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha)

Undisturbed areas reported by coal & lignite PSUs ranges from 32.9% (NCL) to 78.6% (ECL) of the project area; patches under infrastructure range between 2.9% (NLCIL) to 21.1% (NCL). Areas under active mining use like quarry / subsidence areas and overburden dumps range between 10.4% (ECL) to 51.8% (SCCL).

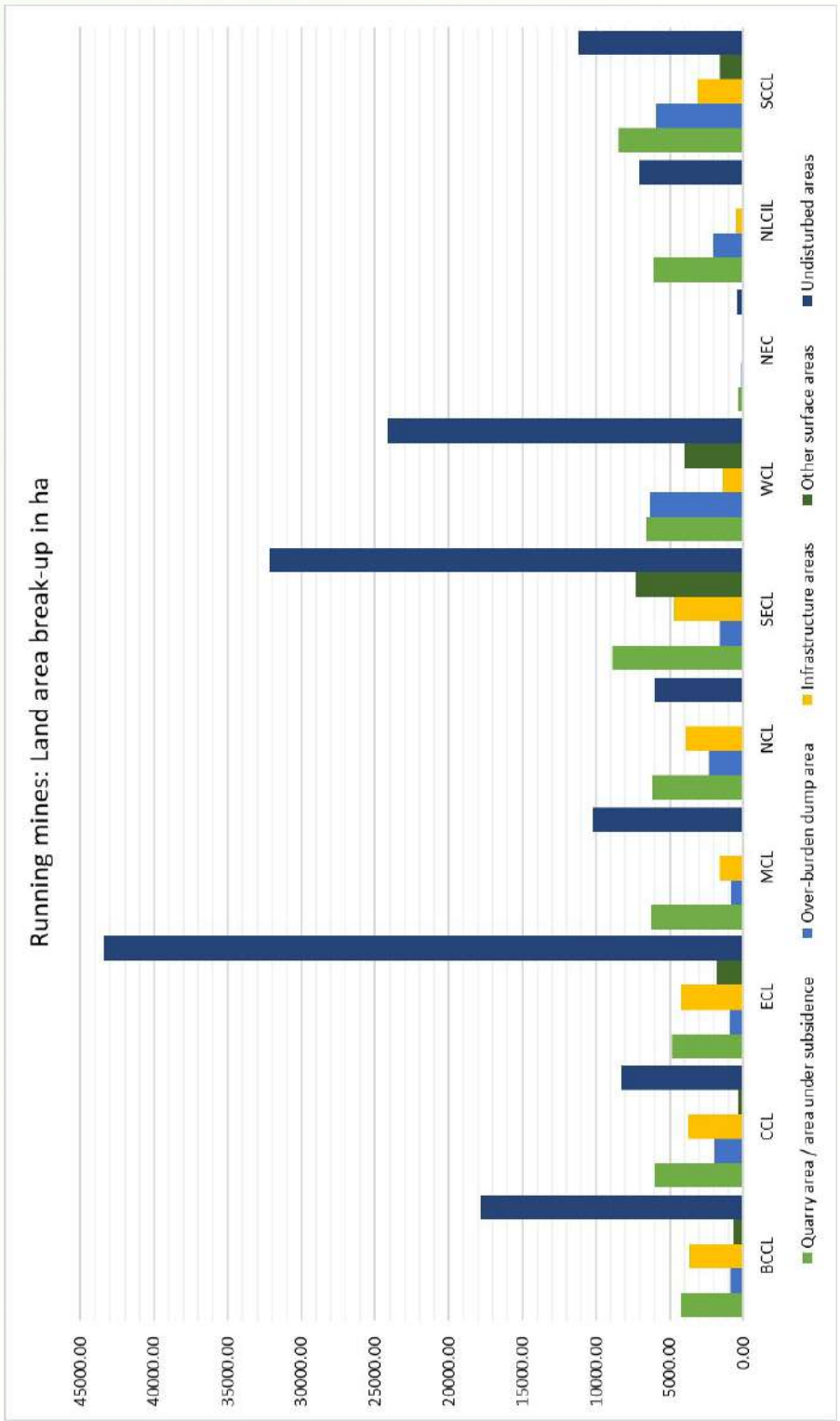


Figure 4.6 (A): Land area break-up in running mines (in ha)

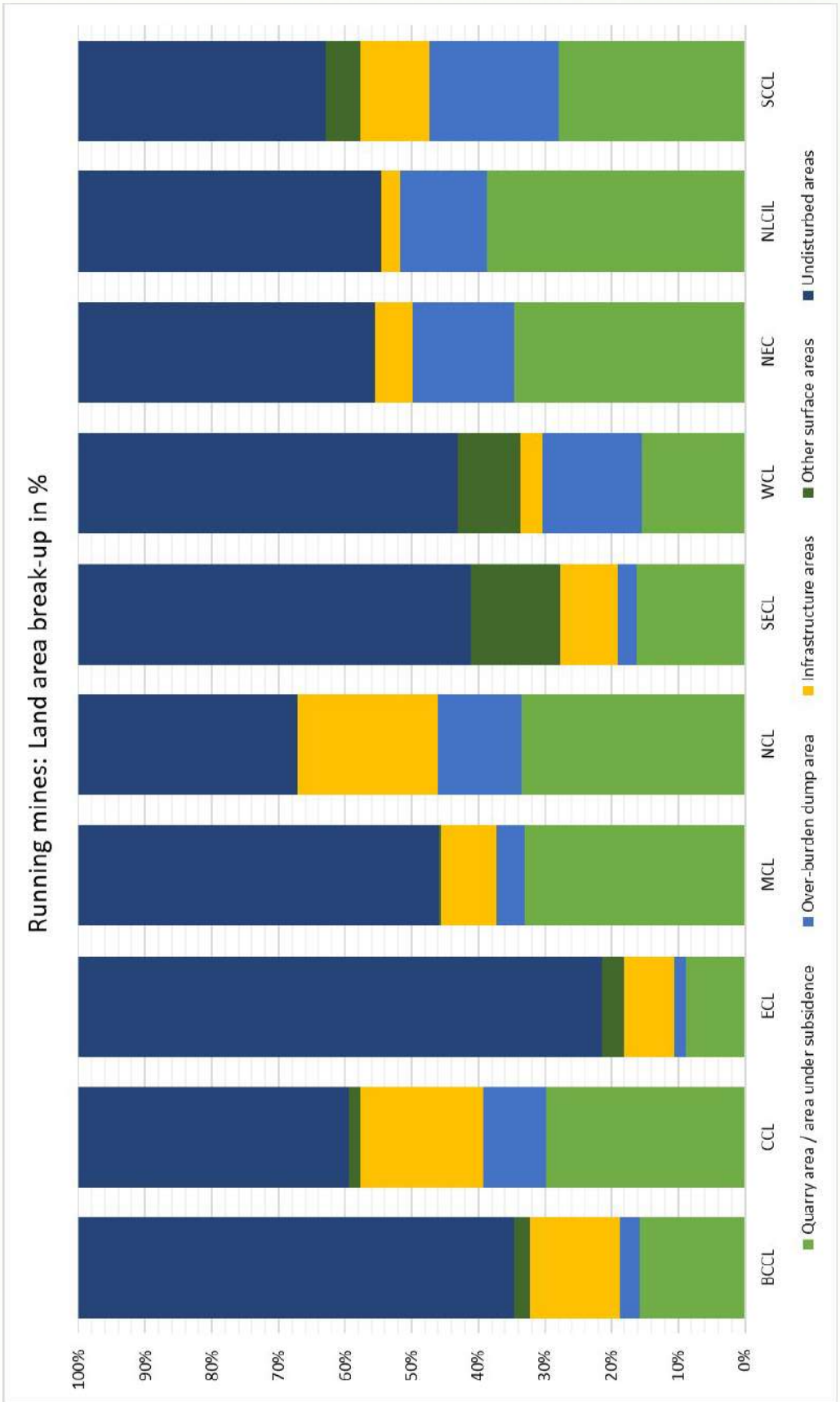
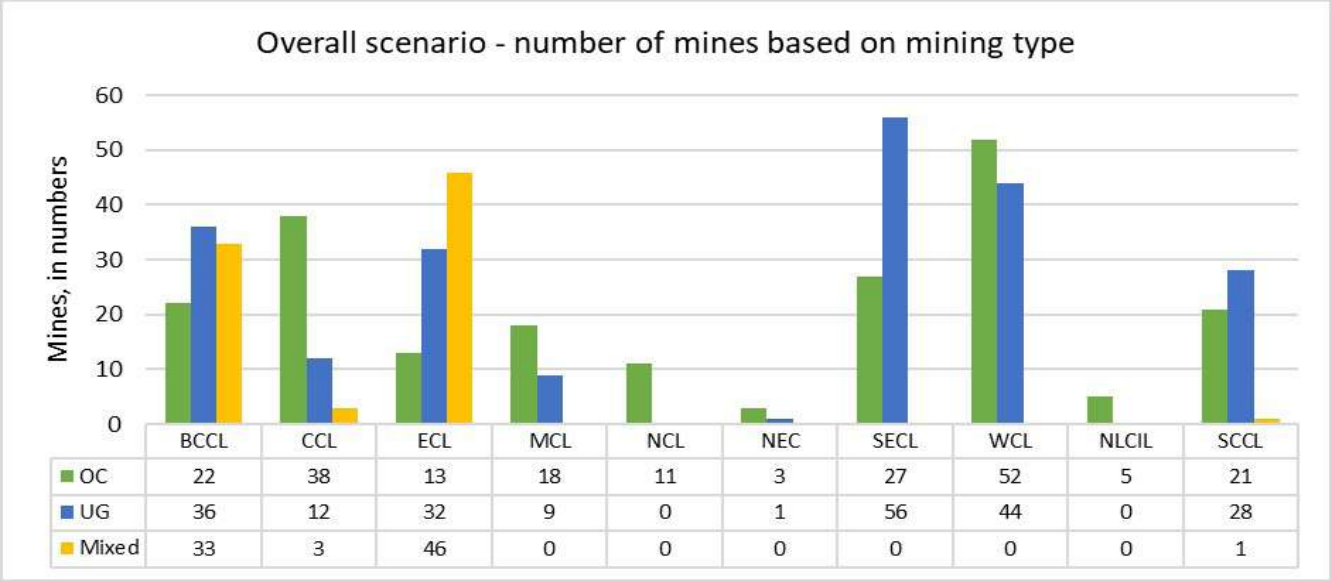


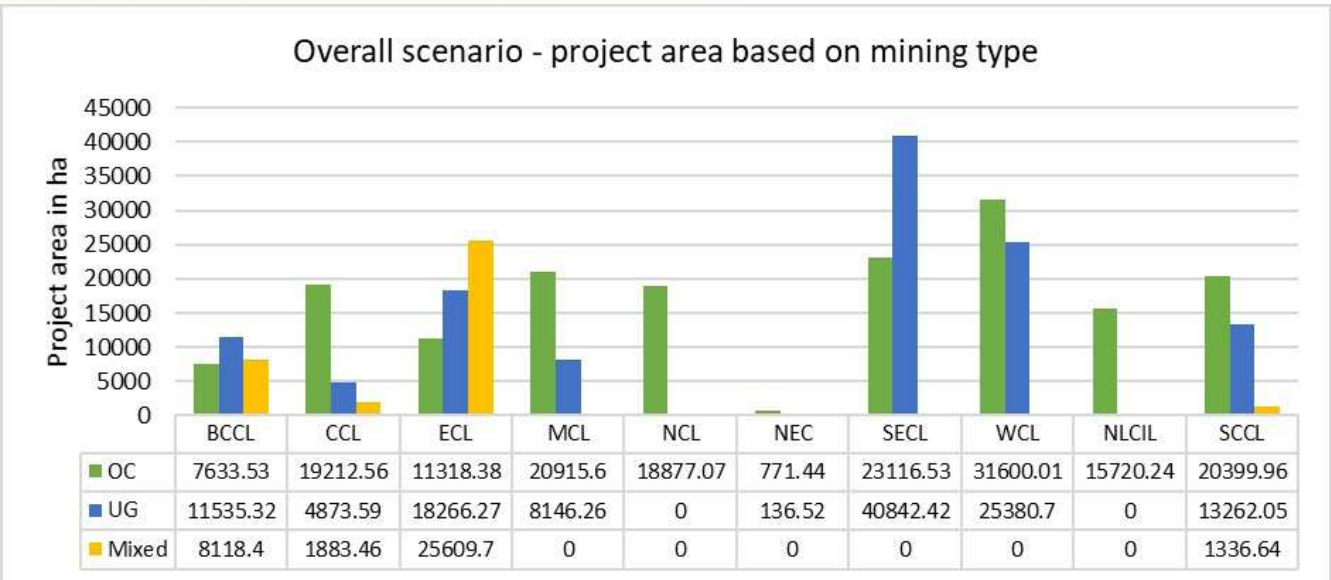
Figure 4.6(B): Land area break-up in running mines (in percentage)

4.4 Overall status of land under coal mining

Overall, the coal and lignite PSUs are operating 511 mines[25] (210 in opencast mode, 218 in underground mode and 83 in mix mode) over a total project area of 3,27,273.15 ha.



	BCCL	CCL	ECL	MCL	NCL	NEC	SECL	WCL	NLCIL	SCCL
OC	22	38	13	18	11	3	27	52	5	21
UG	36	12	32	9	0	1	56	44	0	28
Mixed	33	3	46	0	0	0	0	0	0	1



	BCCL	CCL	ECL	MCL	NCL	NEC	SECL	WCL	NLCIL	SCCL
OC	7633.53	19212.56	11318.38	20915.6	18877.07	771.44	23116.53	31600.01	15720.24	20399.96
UG	11535.32	4873.59	18266.27	8146.26	0	136.52	40842.42	25380.7	0	13262.05
Mixed	8118.4	1883.46	25609.7	0	0	0	0	0	0	1336.64

Figure 4.7: Overall scenario across coal PSUs – number of mines & project area

Overall, areas under subsidence, quarry areas and overburden dump areas and other surface area account for 35.2% of the total area (quarry / subsidence areas – 18.8%, overburden dumps – 8.5%, other surface areas – 7.7%), areas having infrastructure facilities account for 8.0% of the total area, whereas undisturbed patches and balance areas in closed mines forms 57% of the total area. The detailed table showing company wise area break-up under these heads is presented in the table below.

[25]This excludes data on certain new projects which are yet to commence fully and few closed legacy mines for which relevant data was not available in official records.

Table 4.3: Overall land area break-up across coal PSUs

Coal PSU	No. of mines	Project Area	Break-up of project area				
			Quarry area / area under subsidence	Over-burden dump area	Infrastructure areas	Other surface areas[26]	Undisturbed areas
BCCL	91	27287.25	4277.8	845.54	3667.48	661.32	17835.11
CCL	53	25969.61	6497.05	2761.76	3732.01	4720.3	8258.64
ECL	91	55194.35	4839.47	928.13	4216.33	1808.36	43401.86
MCL[27]	27	27378.36	6213.55	1156.29	1588.53	6532.36	10204.13
NCL	11	18877.07	6172.28	2430.59	3886.27	333	6054.93
SECL	83	63958.95	9736.49	2902.02	4699.68	14407.97	32212.79
WCL	96	56980.71	6718.89	7737.26	1425.64	16944.84	24154.21
NEC	4	907.96	314.5	138.31	51.27	0	403.88
CIL	456	276554.26	44770.03	18899.9	23267.21	45408.15	142525.55
NLCIL	5	15720.24	6080.71	2061.31	456.51	0	7121.71
SCCL	50	34998.65	9358.46	6257.15	3108.89	5062.98	11211.16
TOTAL	511	327273.15	60209.2	27218.36	26832.61	50471.13	160858.42
Percentage break-up			%	%	%	%	%
BCCL			15.7	3.1	13.4	2.4	65.4
CCL			25	10.6	14.4	18.2	31.8
ECL			8.8	1.7	7.6	3.3	78.6
MCL			24.2	4.5	6.2	25.4	39.7
NCL			32.7	12.9	20.6	1.8	32.1
SECL			15.2	4.5	7.3	22.5	50.4
WCL			11.8	13.6	2.5	29.7	42.4
NEC			34.6	15.2	5.6	0	44.5
CIL			16.3	6.9	8.5	16.5	51.9
NLCIL			38.7	13.1	2.9	0	45.3
SCCL			26.7	17.9	8.9	14.5	32
TOTAL			18.5	8.4	8.2	15.5	49.4

ECL (78.6%), BCCL (65.4%) and SECL (50.4%) have reported relatively large areas under undisturbed patches and balance areas. Areas with infrastructure range between 2.5% (WCL) to 20.6% (NCL). Areas under active mining use like quarry/subsidence areas and overburden dumps range between 10.4% (ECL) to 51.8% (NLCIL). Areas under direct mining influence are largest among NLCIL (51.8%), NEC (49.9%), NCL (45.6%) and SCCL (44.6%).

[26]Includes areas under non-mining uses

[27]Considering project area for running mines in MCL as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha)

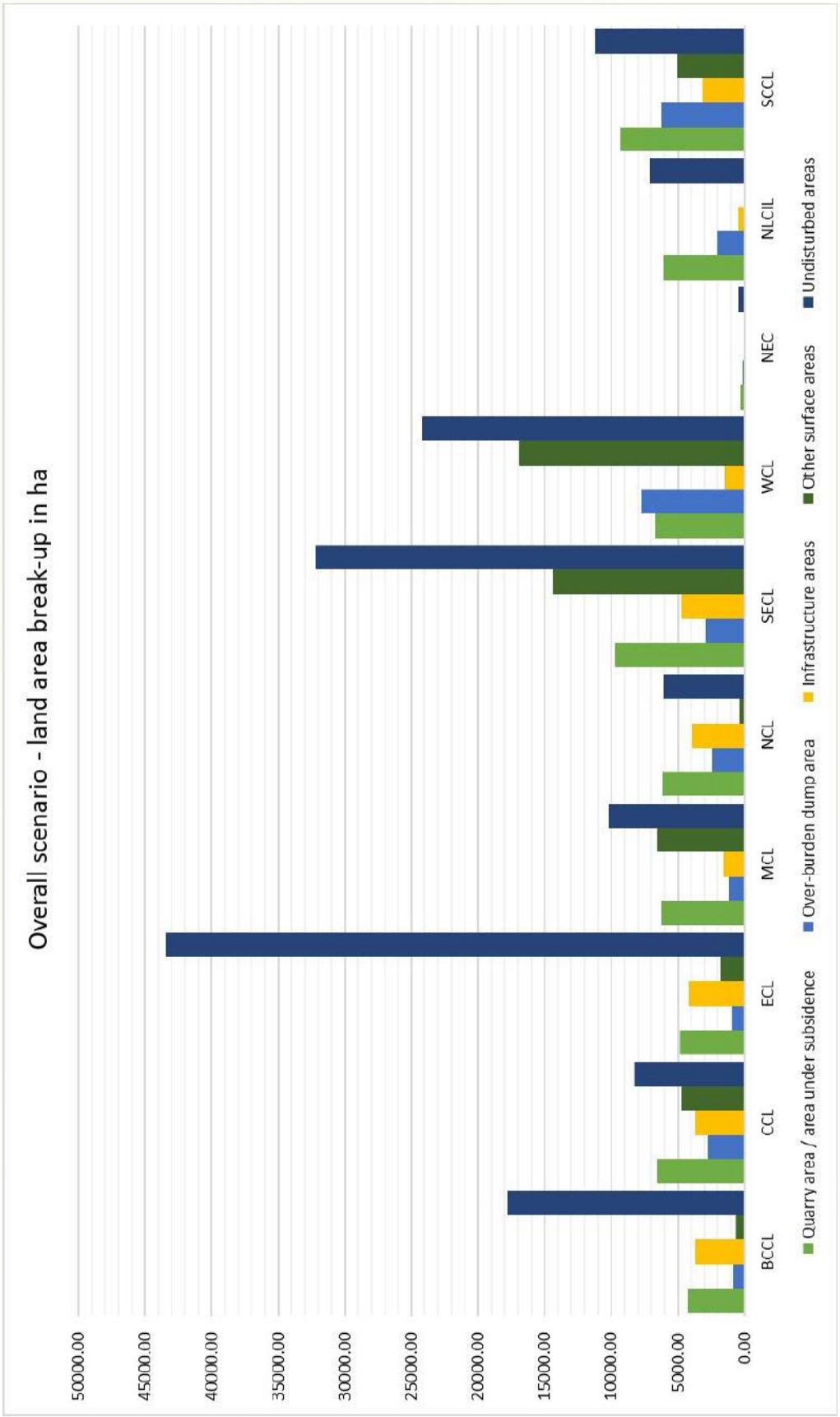


Figure 4.8 (A): Overall land area break-up across coal PSUs (in ha)

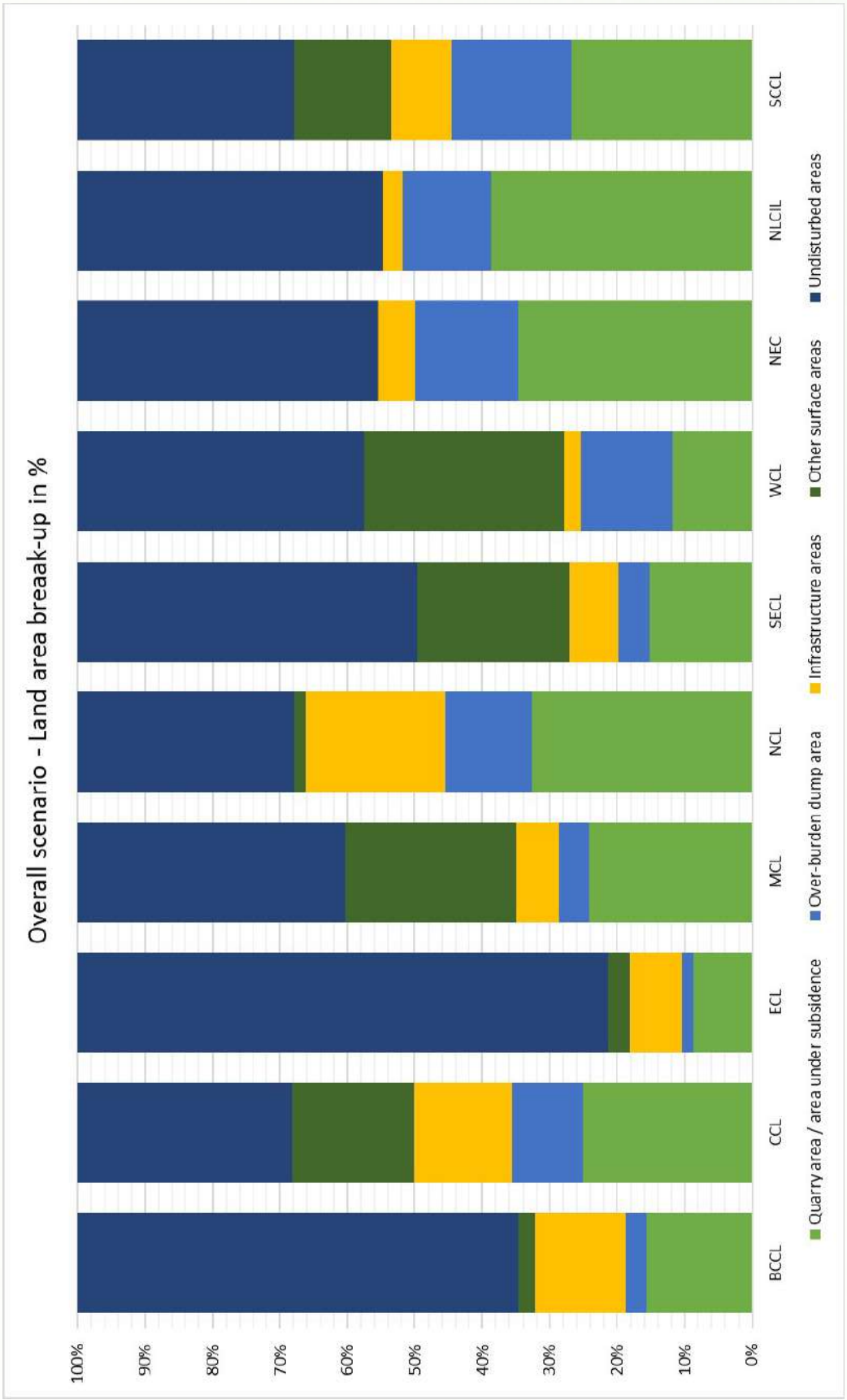


Figure 4.8(B): Overall land area break-up across coal PSUs (in percentage)

4.5 Status of forest land across coal companies

Of the total area under coal PSUs considered (3,27,273 ha), the share of forest land is 20.8% (68,186.9 ha) and the balance 79% (2,58,698.7 ha) is non-forest land. Broken forest area is 23,080.9 ha which is 33.8% of the total forest area acquired and 7.1% of the total project area. Company wise details on forest/ non-forest land are given in the table below.

It is to be noted here that the break-up for few mines in SECL & WCL slightly differs from the total project area on account of consideration of mining rights; also w.r.t. few closed mines, it is assumed that there is no forest land involved due to lack of data. Details are covered in the footnote.

Table 4.4: Status of forest land across coal companies

Coal Company	Total project area	Non-Forest Area	Forest Area	Broken Forest Area	Unbroken Forest Area
BCCL[28]	27287.3	26366.9	920.3	7.6	912.7
CCL	25969.4	15587.9	10381.4	5638	4743.5
ECL[29]	55194.4	54364.7	829.6	179.9	649.7
MCL	27378.4	20177.9	7200.4	2194.2	5006.3
NCL	18877.1	9966.9	8910.2	7222.9	1687.3
SECL[30]	63959.1	42822.8	21028.7	2380.7	18647.9
WCL[31]	56980.7	49926.7	6774.3	2034.2	4740.2
NEC	908	632.6	275.4	163.9	111.5
CIL Total	276554.2	219846.3	56320.4	19821.3	36499.1
NLCIL	15720.2	14682.1	1038.2	0	1038.2
SCCL[32]	34998.6	24170.3	10828.3	3259.6	7568.7
Total	327273	258698.7	68186.9	23080.9	45106
Percentage break-up		%	%	%	%
BCCL		96.6	3.4	0.0	3.3
CCL		60.0	40.0	21.7	18.3
ECL		98.5	1.5	0.3	1.2
MCL		73.7	26.3	8.0	18.3
NCL		52.8	47.2	38.3	8.9
SECL		67.0	32.9	3.7	29.2
WCL		87.6	11.9	3.6	8.3

[28]Excluded projects: Kapuria UG (Cluster XII)

[29]Excluded projects: Bhanora UG & OC, Mithapur OC

[30]Forest / Non-Forest break-up considered only for 938.61 ha in Bhatgaon UG mine. For Chachai UG (closed mine) it is assumed that there is no forest land due to lack of data

[31]Excludes data of 14 closed UG mines for which relevant data was not available in official records. For additional 21 closed mines across following areas – Majri (4 mines), Wani (1 mine), Umrer (1 mine), Nagpur (2 mines), Kanhan (5 mines), Pathakhera (2 mines), Chandrapur (2 mines), Wani North (2 mines), Ballarpur (1 mine) & Pench (1 mine) – it is assumed that there is no forest land involved due to lack of data. For 3 running mines – Manna Incline, Nandgaon Incline & Durgapur Rayatwari Colliery in Chandrapur Area, the forest & non- forest break-up is provided only for area under mining rights.

[32]Assuming no forest land involved in closed mines due to lack of data

NEC		69.7	30.3	18.0	12.3
CIL Total		79.5	20.4	7.2	13.2
NLCIL		93.4	6.6	0.0	6.6
SCCL		69.1	30.9	9.3	21.6
Total		79.0	20.8	7.1	13.8

Note: Figures in hectares (ha), percentage break-up has been presented in terms of total project area

Companies with the most forest land footprint include NCL (47.2%), CCL (40.0%) and SECL (32.9%). NCL (38.3%), CCL (21.7%) and NEC (18.0%) also account for the highest broken forest land.

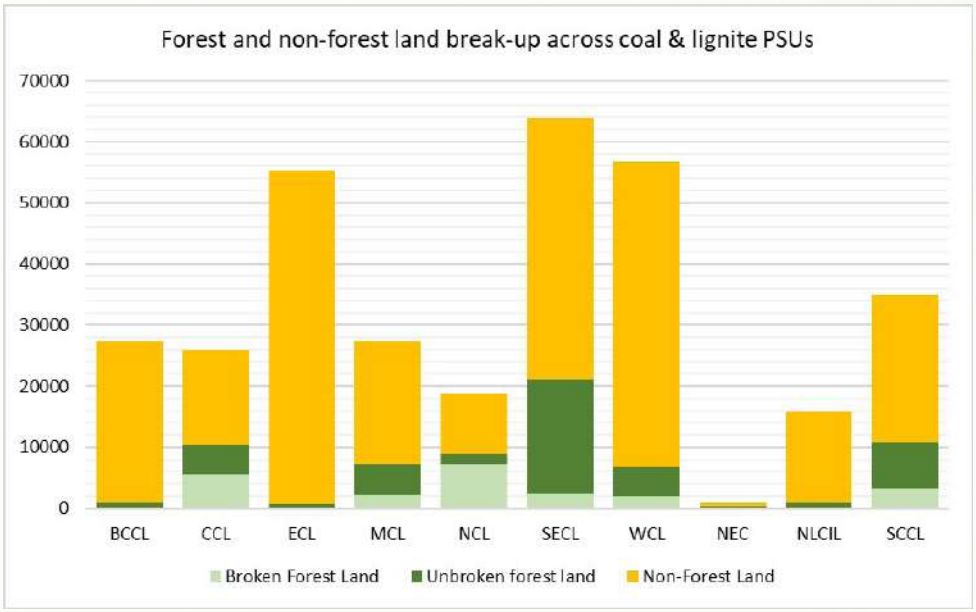


Figure 4.9(A): Forest / non-forest land across coal & lignite PSUs - break-up in ha

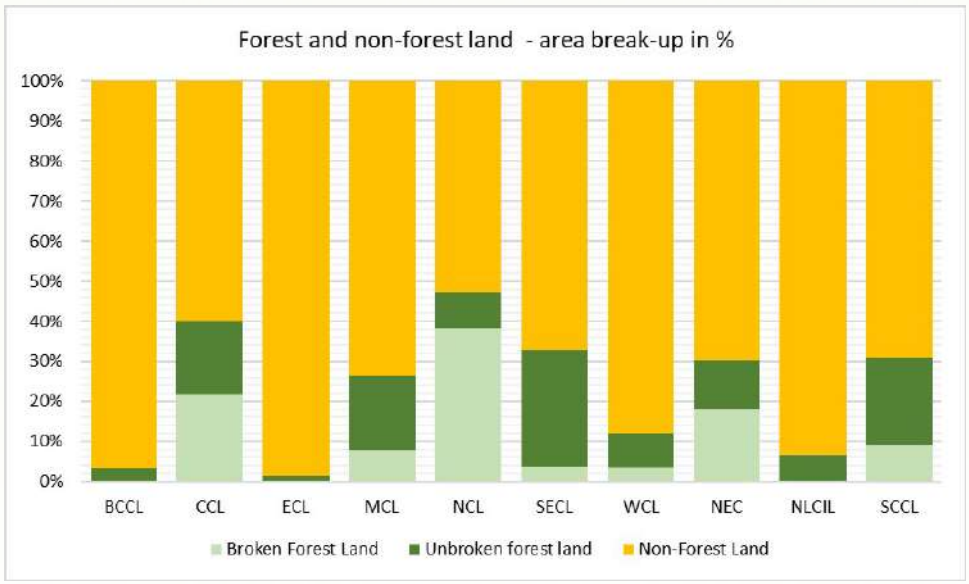


Figure 4.9(B): Forest / non-forest land across coal & lignite PSUs - % break-up

5

Greening Statistics For Closed Mines

5.0 Reclamation and plantation statistics in closed mines

Reclamation activities in closed mines are undertaken in line with the post closure reclamation strategy as a part of the Final Mine Closure Plan, for mines which have closed over the past decade. Reclamation is done in a planned stagewise manner. Quarries, subsided patches and overburden dumps are firstly levelled / benched in line with the final stage pit configuration as a part of the technical reclamation stage. Post technical reclamation stage, biological reclamation is undertaken in stages starting with grassing followed by shrubs and/or tree species. Plantation is also done over other areas in the project which includes avenue plantation, plantation near infrastructure and also outside project areas, etc. wherever feasible.

The company wise break-up for reclamation and plantation area in closed mines is presented in table 5.1 below. A summary showing reclamation and plantation based on mine type is also presented at table 5.2.

Table 5.1: Reclamation & plantation status w.r.t closed mines (company wise)

PSUs	No. of mines	Total project area (in ha)	Bifurcation of project area (ha)			Bifurcation of Areas under quarry/subsidence and other surface areas (ha)					
			Area lacking surface rights, under other non- mining uses	Area not amenable for plantation[33]	Areas under quarry/subsidence and other surface areas	Subsidence areas & surface areas under other uses	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation completed on balance areas	Areas amenable for future plantation
BCCL	0	0	-	-	-	-	-	-	-	-	-
CCL	12	5647.08	716.24	2218.78	2712.09	454.02	190.00	92.84	1093.20	347.50	534.53
ECL	0	0.0	-	-	-	-	-	-	-	-	-
MCL	9	6831.48	4571.1	1850.65	409.74	0.00	54.00	54.00	241.00	32.98	27.76
NCL	1	459.00	0.00	146.00	313.00	0.00	0.00	0.00	126.00	187.00	0.00
SECL	17	9294.13	2113.37	3233.37	3947.38	1076.71	6.47	322.54	1423.68	1009.56	108.41
WCL	39	14480.8	2505.19	9689.22	2286.36	38.40	505.14	245.70	781.70	392.13	323.31
NEC	0	0.00	-	-	-	-	-	-	-	-	-
CIL	78	36712.49	9905.90	17138.02	9668.57	1569.13	755.61	715.08	3665.58	1969.17	994.01
NLCIL	0	0.00	-	-	-	-	-	-	-	-	-
SCCL	9	4726.77	0.00	1622.33	3104.44	760.76	0.00	0.00	519.51	1666.84	157.33
TOTAL	87	41439.26	9905.90	18760.35	12773.01	2329.89	755.61	715.08	4185.09	3636.01	1151.34
BCCL	Percentage break-up		-	-	-	-	-	-	-	-	-
CCL			12.70	39.30	48.00	16.70	7.00	3.40	40.30	12.80	19.70
ECL			-	-	-	-	-	-	-	-	-
MCL			66.90	27.10	6.00	0.00	13.20	13.20	58.80	8.00	6.80
NCL			0.0	31.80	68.20	0.00	0.00	0.00	40.30	59.70	0.00
SECL			22.70	34.80	42.50	27.30	0.20	8.20	36.10	25.60	2.70
WCL			17.30	66.90	15.80	1.70	22.10	10.70	34.20	17.20	14.10
NEC			-	-	-	-	-	-	-	-	-
CIL			27.00	46.70	26.30	16.20	7.80	7.40	37.90	20.40	10.30
NLCIL			-	-	-	-	-	-	-	-	-
SCCL			0.00	34.30	65.70	24.50	0.00	0.00	16.70	53.70	5.10
TOTAL			23.90	45.30	30.80	18.20	5.90	5.60	32.80	28.50	9.00

[33] Includes areas not amenable for plantation on account of presence of water body / mine sump, presence of infrastructural amenities like roads, buildings, etc. May also include areas earmarked for future expansion. Such areas may become amenable in the future subject to feasibility and planning schedule.

Table 5.2: Reclamation and plantation status across closed mines based on mining type+

PSUs	No. of mines	Total project area (in ha)	Bifurcation of project area (ha)			Bifurcation of Areas under quarry/subsidence and other surface areas (ha)					
			Area lacking surface rights, under other non-mining uses	Area not amenable for plantation[34]	Areas under quarry/subsidence and other surface areas	Subsidence areas & surface areas under other uses	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation completed on balance areas	Areas amenable for future plantation
OC	30	11482.40	0.00	5296.47	6185.91	0.00	755.61	693.08	2659.58	1386.74	690.91
UG	55	28983.56	9905.90	12877.08	6200.60	2329.89	0.00	0.00	1285.01	2125.27	460.43
Mix	2	973.30	0.00	586.80	386.50	0.00	0.00	22.00	240.50	124.0	0.00
Total	87	41439.26	9905.90	18760.35	12773.01	2329.89	755.61	715.08	4185.09	3636.01	1151.34
OC	Percentage break-up		0.00	46.10	53.90	0.00	12.20	11.20	43.00	22.40	11.2.00
UG			34.20	44.40	21.40	37.60	0.00	0.00	20.70	34.30	7.40
Mix			0.00	60.30	39.70	0.00	0.00	5.70	62.20	32.10	0.00
Total			23.90	45.30	30.80	18.20	5.90	5.60	32.80	28.50	9.00

[34]Includes areas not amenable for plantation on account of presence of water body / mine sump, presence of infrastructural amenities like roads, buildings, etc. May also include areas earmarked for future expansion. Such areas may become amenable in the future subject to feasibility and planning schedule.

For closed mines, areas lacking surface rights (w.r.t UG / mixed mines) and certain areas under non-mining uses amount to 9,905.90 ha (which is 23.9% of the total project area). Areas not amenable for plantation at present are recorded as 18,760.35 ha (45.3% of the total project area). This includes areas not amenable for plantation on account of presence of water body/mine sump, presence of infrastructural amenities like roads, buildings, etc., and areas earmarked for future expansion. Given the latest guidelines from MoC[35] w.r.t management of mines discontinued / abandoned / closed before 2009, some portion under these areas may become amenable in the future subject to feasibility and in line with revision/ approval of mine closure plans.

Apart from the above, 12,773.01 ha (30.8% of the project area) is directly under the influence of mining which includes areas under subsidence / quarry and other mining related surface uses. Under this area, the status of reclamation and plantation is as follows:

- Biological reclamation over quarry and overburden dumps has been completed over 4,185.09 ha (i.e. 32.8%)
- Plantation over other areas has been done over 3,636.01 ha (i.e. 28.5%)
- Technical and biological reclamation is ongoing / to be taken up over 1,470.69 ha (i.e. 11.5%)
- Areas identified as amenable for plantation in the future account for 1,151.34 ha (9.0%).

The graphical representation of plantation status across closed mines for areas directly under the influence of mining as percentage break-up is presented hereunder.

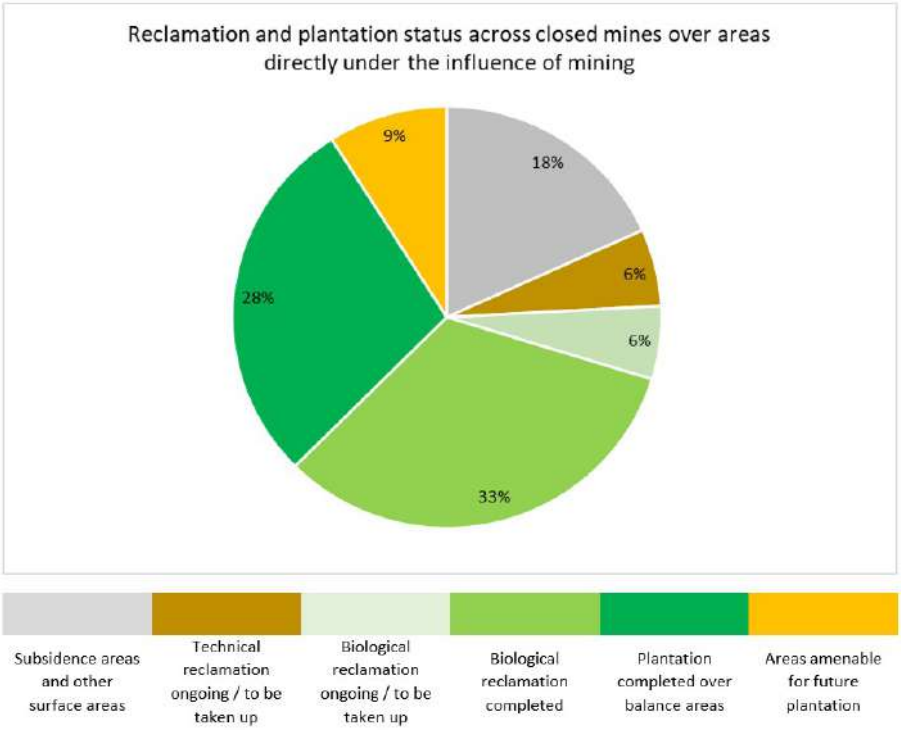


Figure 5.1: Reclamation and plantation status in closed mines over areas directly under the influence of mining

[35]Source: Guidelines for the Management of Mines discontinued / abandoned / closed before the year 2009 issued by MoC vide order dated 28.10.2022

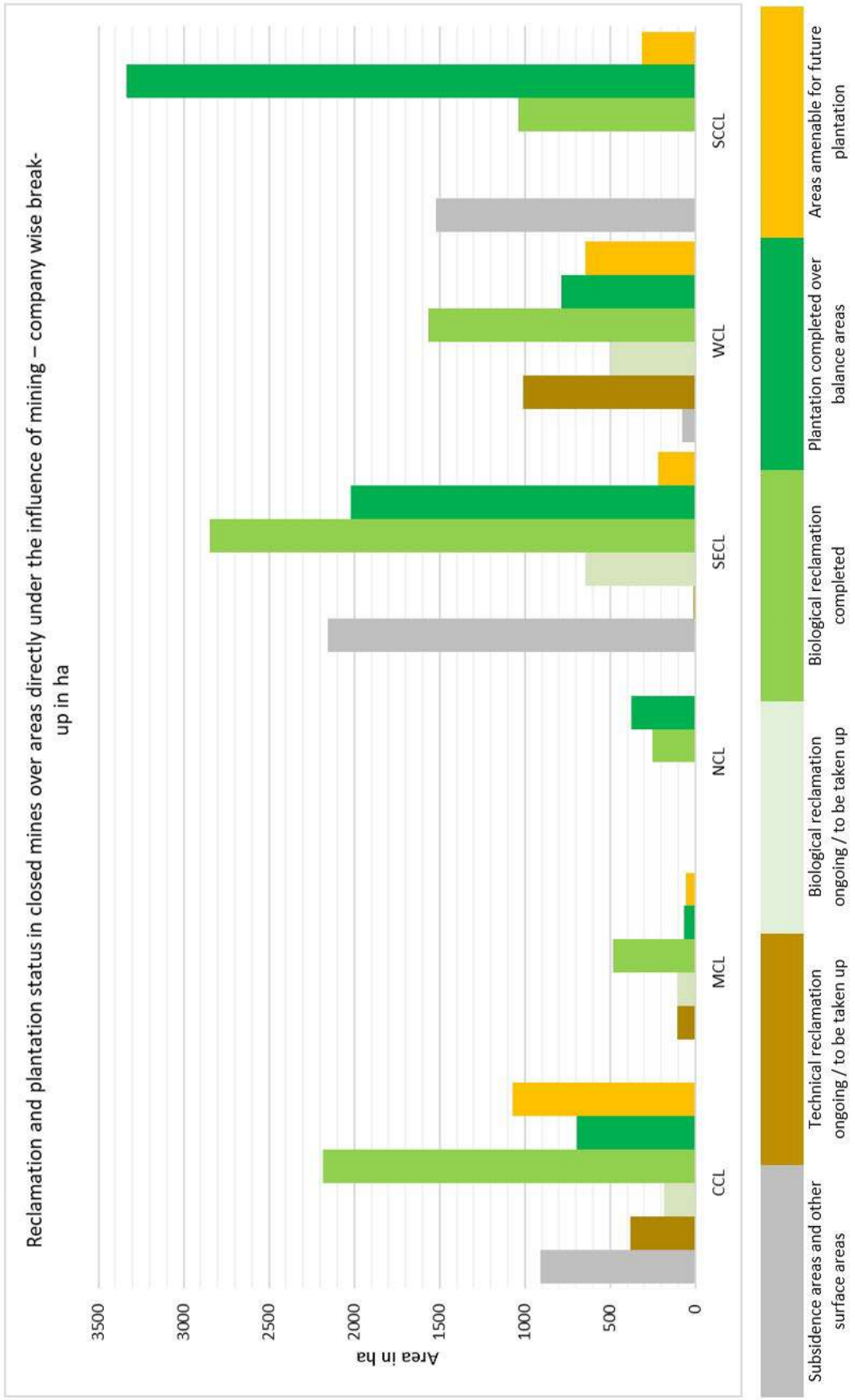


Figure 5.2(A): Reclamation and plantation status in closed mines over areas directly under the influence of mining – break-up in ha

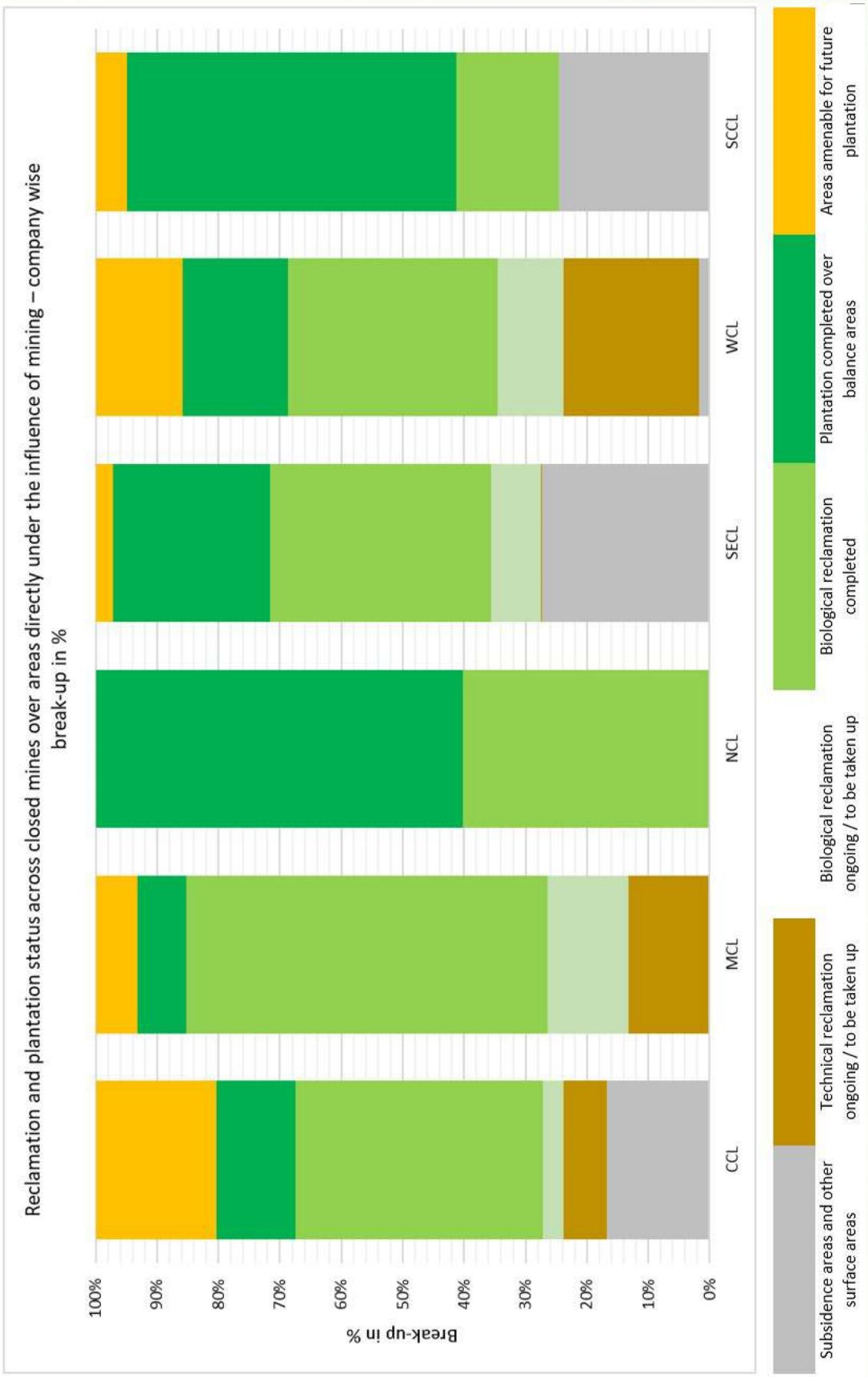


Figure 5.2(B): Reclamation and plantation status across closed mines over areas directly under the influence of mining – percentage break-up

5.1 Plantation density in closed coal mines

Across closed mines, approx. 157.77 lakhs plants have been planted within project area - of which 40.5% has been done on backfilled & subsidence areas, 18.3% on external overburden dumps and 41.2% on other areas within the project. Company wise details are provided in the table below. Plantation density has been calculated as saplings planted per hectare. The plantation density calculated across MCL, NCL and WCL are beyond 2500 nos. per ha.

Table 5.3: Plantation in closed mines (in numbers)

PSU	Area, in ha	Plantation break-up (plants in numbers)				Plantation density[36] (plants per ha)
		On backfilled & subsided areas	Over external OB dumps	Over other sites within the project area	TOTAL	
BCCL	0	-	-	-	-	-
CCL	5647.08	1418025	77500	1298025	2793550	1939
ECL	0	-	-	-	-	-
MCL	6831.48	401692	96389	97196	595277	2172.7
NCL	459	0	443747	415500	859247	2745.2
SECL	9294.13	3360133	223775	444050	4027958	1655.4
WCL	14480.8	595290	1255184	1253063	3103537	2643.9
NEC	0	-	-	-	-	-
CIL	36712.49	5775140	2096595	3507834	11379569	2019.5
NLCIL	0	-	-	-	-	-
SCCL	4726.77	619626	791325	2986437	4397388	2011.3
TOTAL	41439.26	6452781	2960171	6654590	16067542	2017.2

5.2 Plantation done outside project area in closed mines

Outside project lease, plantation of approx. 9.3 lakhs has been done over an area of 469.7 ha. Approx. 2.0 lakh saplings have also been distributed to communities around the projects and to other agencies.

MCL, WCL, SECL and SCCL have done considerable plantation outside project area in their respective coal mines. SCCL has also distributed 1,50,000 saplings among the communities surrounding its mines.

[36]Plantation density has been calculated by dividing the number of plants by net area reported under biological reclamation & plantation. There may be a slight margin of error considering survivability of plants and other regional factors

Table 5.4: Plantation outside project area by closed mines

Name of coal company	Plantation outside project area		Distribution of saplings / plants to communities and other agencies
	Area under plantation (Ha)	Plantation Numbers	
BCCL	-	-	-
CCL	0	3,000	15,500
ECL	-	-	-
MCL	47	2,06,372	36,000
NCL	0	0	0
SECL	10.4	26,000	1,000
WCL	27.8	69,125	3,930
NEC	-	-	-
CIL	85.2	3,04,497	56,430
NLCIL	-	-	-
SCCL	384.5	6,25,100	1,50,000
TOTAL	469.7	9,29,597	2,06,430

6

Greening Statistics For Running Mines

6.0 Reclamation and plantation statistics in running mines

Reclamation activities in running mines are planned in line with the calendar plan under the approved mining plan for the project. Under this, progressive reclamation activities are undertaken in a phase-wise manner involving technical followed by biological reclamation across excavated areas, subsided areas and internal as well as external overburden dumps. Plantation is also done over other viable areas in the project which includes avenue plantation, plantation near infrastructure, etc. wherever feasible.

The company wise break-up for reclamation and plantation area in running mines is presented in the table below. A summary showing reclamation and plantation based on mine type is also presented at table 6.2.

Table 6.1: Reclamation & plantation status w.r.t running mines (company wise)

PSUs	No. of mines	Approved production capacity (MTPA)	Total project area (ha)	Bifurcation of project area (ha)				Bifurcation of areas under active mining use (ha)					
				Areas lacking surface rights & other areas	Undisturbed areas	Areas not amenable for plantation	Areas under active mining use	Excavated quarry and subsidence areas	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation over balance areas	Areas amenable for future plantation
BCCL	91	93.0[37]	27287.25	0	17835.11	3335.47	6116.665	2757.24	1387.4	460.06	1179.97	294.365	37.63
CCL	41	143.6	20322.53	192.56	8258.64	1922.2	9949.09	2871.92	1626.01	1235.54	2405.89	232.53	1577.2
ECL	91	107.5	55194.35	0	43401.86	3412.31	8379.98	2067.87	2563.54	436.34	2508.21	450.1	353.92
MCL[38]	18	230.3	20546.88	0	8520.63	1066.34	9276.41	2390.41	2368.4	954.81	1357.08	650.55	1555.16
NCL	10	131	18418.07	0	5576.02	0	12842.05	1522.48	3514.48	272.38	3167.53	2590.98	1774.2
SECL[39]	66	223.5	54664.82	5465.48	30461.06	1866.55	16871.76	2866.42	2280.85	2443.97	4699.47	1684.42	2896.63
WCL	57	93.1	42499.91	3642.47	21190.66	460.55	17206.46	8206.25	2465.39	597.26	2009.01	1113.01	2815.54
NEC	4	1.2	907.96	0	126.74	10.1	771.12	199.11	109.12	120.36	24.22	0	318.31
CIL	378	1023.1	239841.77	9300.51	135370.7	12073.52	81413.54	22881.7	16315.19	6520.72	17351.38	7015.955	11328.59
NLCIL	5	57.6	15720.24	0	7121.71	40.06	8558.47	3525.55	1321.81	575.84	2718.81	88.87	327.59
SCCL	41	87.2	30271.88	0	11211.16	943.27	18117.44	1478.83	4896.45	4238.95	5337.59	1932.71	232.91
TOTAL	424	1167.9	285833.89	9300.51	153703.6	13056.85	108089.4	27886.08	22533.45	11335.51	25407.78	9037.535	11889.09
Percentage break-up													
BCCL				0	65.4	12.2	22.4	45.1	22.7	7.5	19.3	4.8	0.6
CCL				0.9	40.6	9.5	49	28.9	16.3	12.4	24.2	2.3	15.9
ECL				0	78.6	6.2	15.2	24.7	30.6	5.2	29.9	5.4	4.2
MCL				0	45.2	5.7	49.2	25.8	25.5	10.3	14.6	7	16.8
NCL				0	30.3	0	69.7	11.9	27.4	2.1	24.7	20.2	13.8
SECL				10	55.7	3.4	30.9	17	13.5	14.5	27.9	10	17.2
WCL				8.6	49.9	1.1	40.5	47.7	14.3	3.5	11.7	6.5	16.4
NEC				0	14	1.1	84.9	25.8	14.2	15.6	3.1	0	41.3
CIL				3.9	56.8	5.1	34.2	28.1	20	8	21.3	8.6	13.9
NLCIL				0	45.3	0.3	54.4	41.2	15.4	6.7	31.8	1	3.8
SCCL				0	37	3.1	59.8	8.2	27	23.4	29.5	10.7	1.3
TOTAL				3.3	54.4	4.6	38.3	25.8	20.8	10.5	23.5	8.4	11

[37]Net EC capacity of BCCL is taken as 93.04 MTPA, as the EC has been obtained on cluster basis and peak production for the mines of a cluster differs at a given period

[38]Considering project area for running mines in MCL as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha). Break-up is provided w.r.t leasehold area.

[39]Gare Pelma IV/1 mine was handed over by SECL on 07.07.21, thus the project was excluded and plantation area of 204.85 ha under said project is not considered under SECL

Table 6.2: Reclamation & plantation status across running mines based on mining type

PSUs	No. of mines	Total project area (ha)	Bifurcation of project area (ha)				Bifurcation of areas under active mining use (ha)					
			Areas lacking surface rights & other areas	Undisturbed areas	Areas not amenable for plantation	Areas under active mining use	Excavated quarry and subsidence areas	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation over balance areas	Areas amenable for future plantation
OC	180	158082.92	0.00	60293.25	3189.02	91233.57	21079.52	20988.95	10533.58	18176.11	8763.115	11692.29
UG	163	93459.57	9300.51	66906.50	6892.86	10359.99	5044.52	0.00	0.00	5315.47	0	0
Mix	81	35974.9	0.00	26503.84	2974.97	6495.89	1762.04	1544.5	801.93	1916.20	274.42	196.8
Total	424	285833.89	9300.51	153703.60	13056.85	108089.40	27886.08	22533.45	11335.51	25407.78	9037.535	11889.09
Percentage break-up												
OC			0.0	39.0	2.1	59.0	23.1	23.0	11.5	19.9	9.6	12.8
UG			10.0	71.6	7.4	11.1	48.7	0.0	0.0	51.3	0.0	0.0
Mix			0.0	73.7	8.3	18.1	27.1	23.8	12.3	29.5	4.2	3.0
Total			3.3	54.4	4.6	38.3	25.8	20.8	10.5	23.5	8.4	11.0

For running mines, areas lacking surface rights (w.r.t UG / mixed mines) and certain areas under non-mining uses amount to 9,300.51 ha (3.3% of the total project area) and undisturbed areas account for 1,53,703.59 ha (54.4% of the project area). Areas not amenable for plantation at present are recorded as 13,056.85 ha (4.6% of the total project area) – which includes areas not amenable for plantation on account of presence of water body / mine sump, presence of infrastructural amenities like roads, buildings, stockyards, sidings, etc., and areas earmarked for future expansion, patches acquired but pending clearances, etc.

Apart from the above, 1,08,089.45 ha (38.3% of the total project area) is directly under the influence of mining which includes areas under subsidence / quarry and other mining related surface uses. Under this area, the status of reclamation and plantation is as follows:

- Biological reclamation over quarry and overburden dumps has been completed over 25,407.78 ha (i.e. 23.5%)
- Plantation over other areas has been done over 9,037.54 ha (i.e. 8.4%)
- Technical and biological reclamation is ongoing / to be taken up over 33,868.96 ha (i.e. 31.3%)
- Areas identified as amenable for plantation in the future account for 11,889.09 ha (11.0%).
- Active quarry areas, active OB dumps and subsided areas account for 27,886.08 ha (25.8%)

The graphical representation of plantation status across running mines for areas directly under the influence of mining as percentage break-up is presented hereunder.

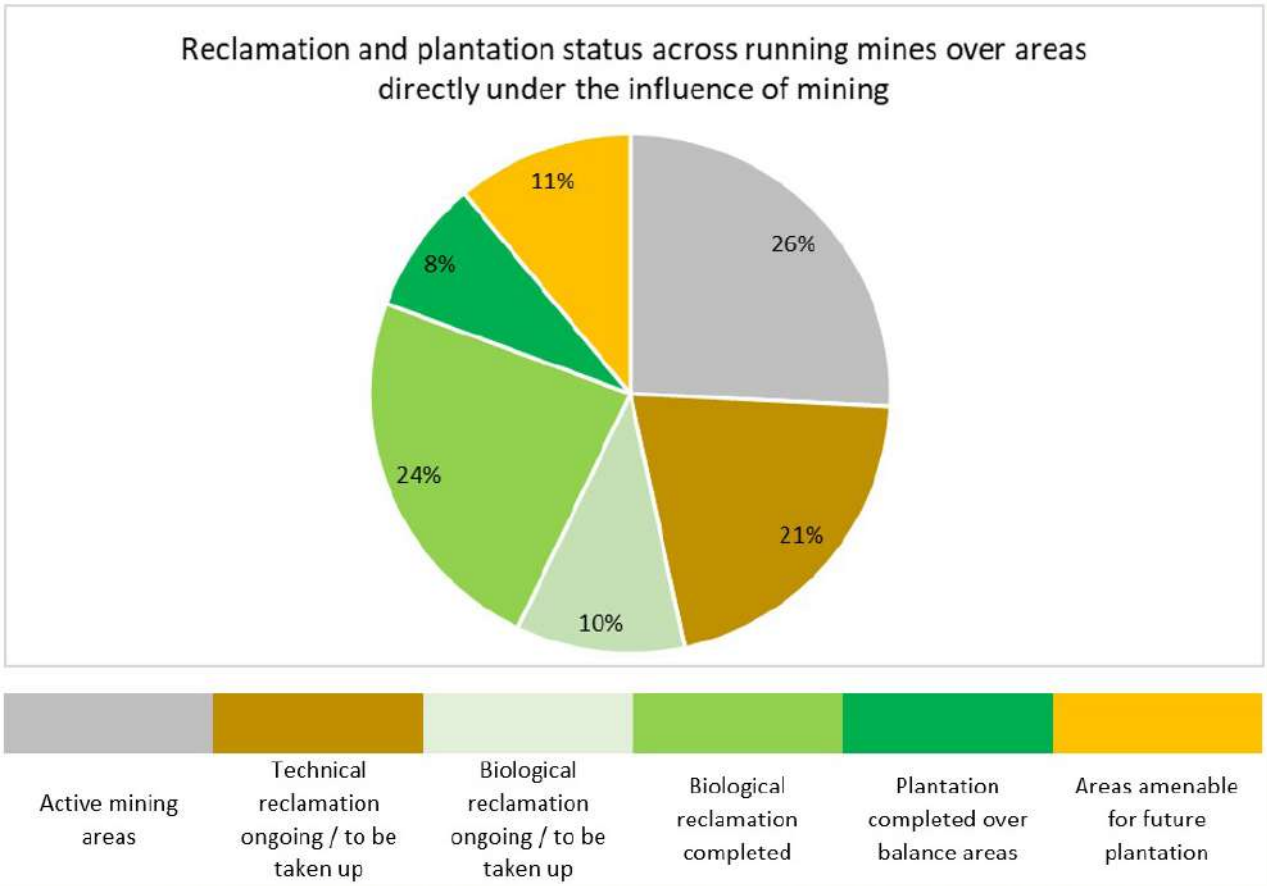


Figure 6.1: Reclamation and plantation status in running mines by coal PSUs over areas directly under the influence of mining

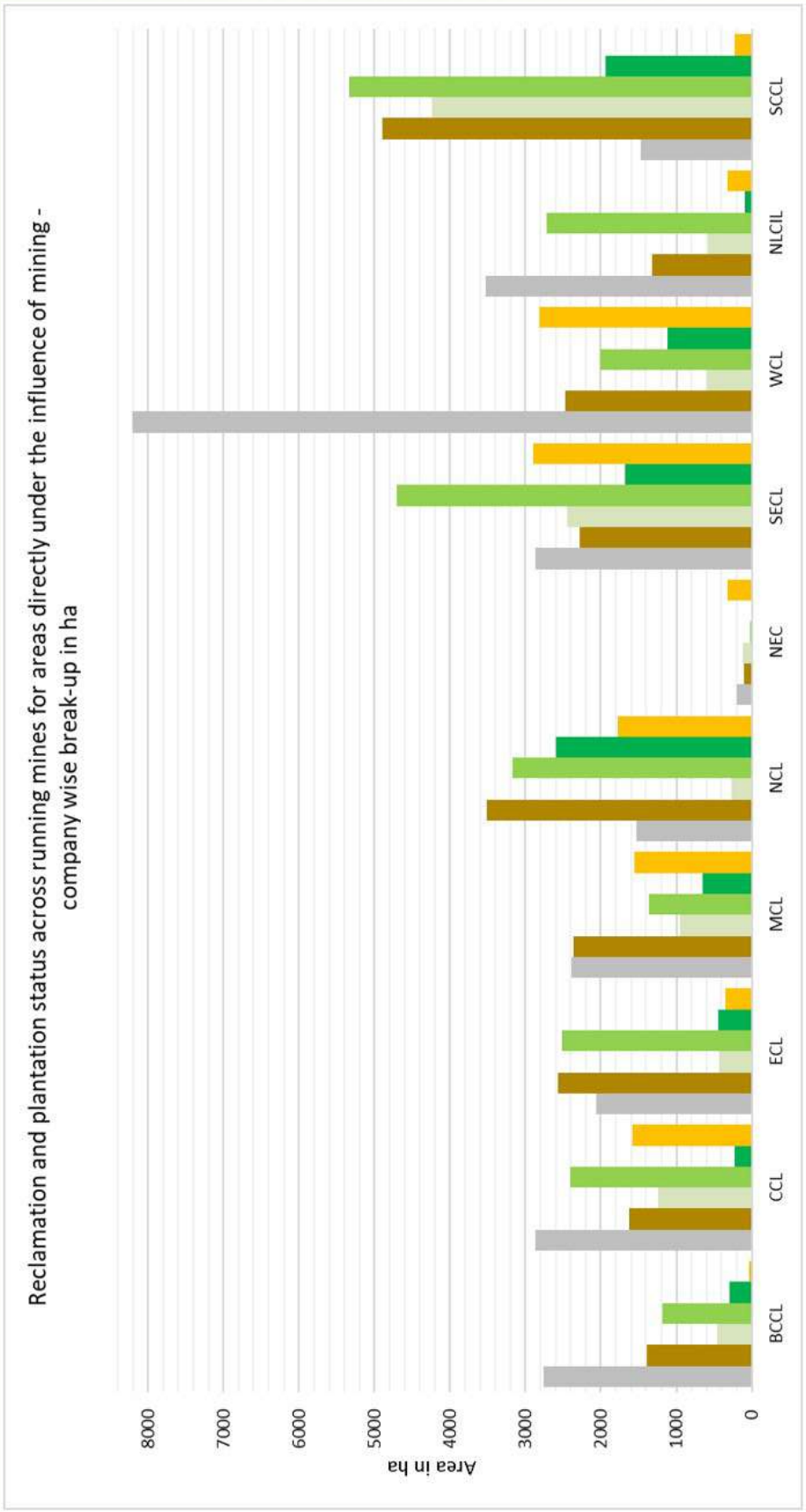


Figure 6.2(A): Reclamation and plantation status across running mines over areas directly under the influence of mining – break-up in ha

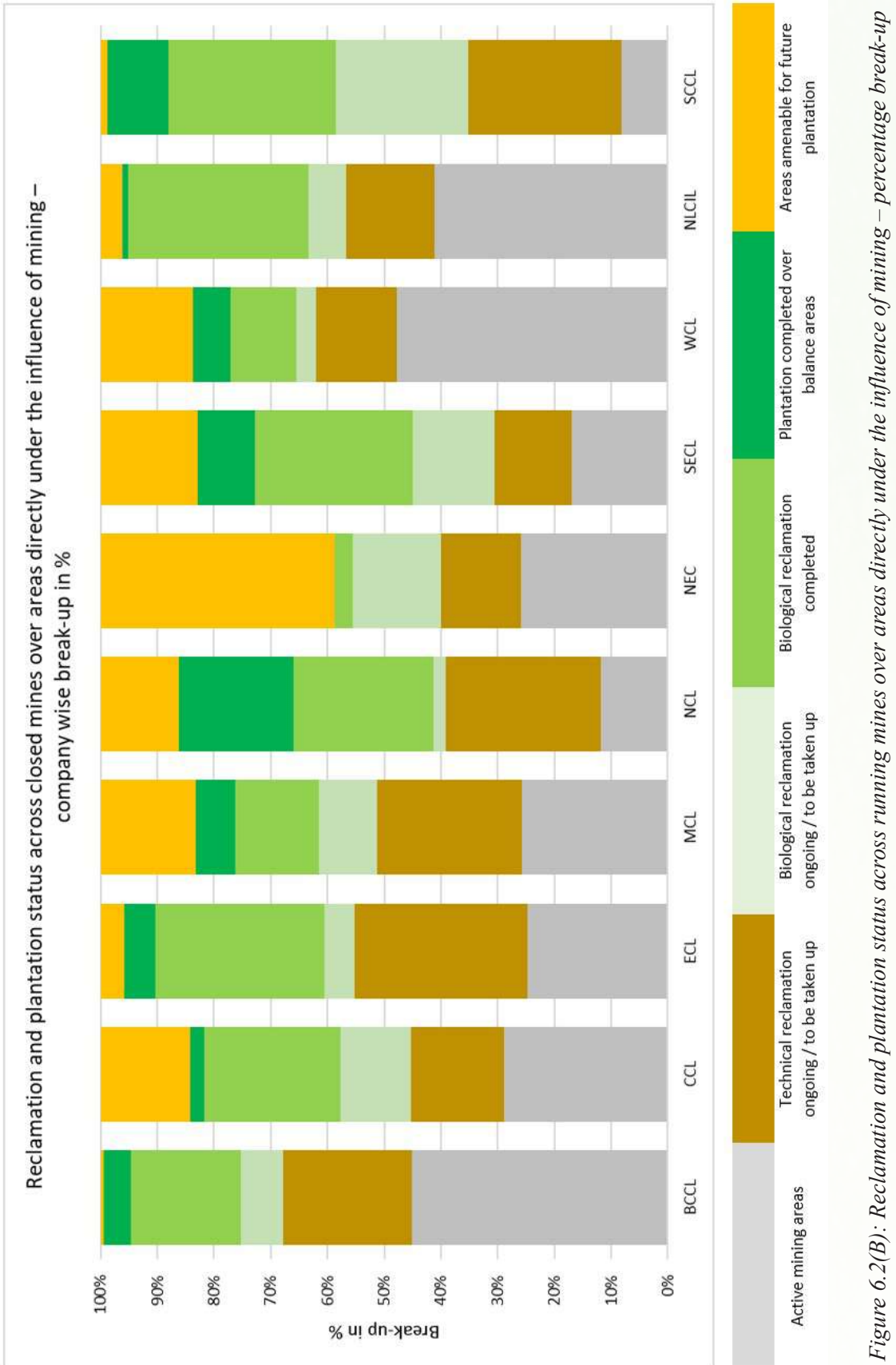


Figure 6.2(B): Reclamation and plantation status across running mines over areas directly under the influence of mining – percentage break-up

6.1 Plantation density in running coal mines

Across running mines, approx. 916.9 lakhs plants have been planted within project area - of which 27.2% has been done on backfilled & subsided areas, 26.0% on external overburden dumps and 46.9% on other sites within the project area. Company wise details are provided in the table below. Plantation density has been calculated as saplings planted per hectare. The plantation density calculated across NCL, SECL, WCL & NEC is above 2500 nos. per ha.

Table 6.3: Plantation in running mines (in numbers)

PSU	Area, in ha	Plantation break-up (plants in numbers)				Plantation density[40] (plants per ha)
		On backfilled & subsided areas	Over external OB dumps	Over other sites within the project area	TOTAL	
BCCL	27287.25	882231	400477	1840793	3123501	2118.6
CCL	20322.53	2210306	1600366	1352841	5163513	1957
ECL	55194.35	1325250	361250	4548609	6235109	2107.7
MCL[41]	20546.88	2236506	771762	1657594	4665862	2324.1
NCL	18418.07	11142194	4539184	7942346	23623724	4102.4
SECL	54664.82	4017718	4049871	10434945	18502534	2898.3
WCL	42499.91	711060	3738199	4641299	9090558	2911.8
NEC	907.96	53196	250616	7250	311062	12843.2
CIL	239841.77	22578461	15711725	32425677	70715863	2902.1
NLCIL	15720.24	1064459	285000	1514672	2864131	1020.1
SCCL	30271.88	1266480	7825932	9015571	18107983	2490.7
TOTAL	285833.89	24909400	23822657	42955920	91687977	2661.8

6.2 Plantation done outside project lease in running mines

Outside project area, plantation of approx. 279.2 lakhs has been done over an area of 7,266.2 ha. Approx. 207.26 lakh saplings have also been distributed to communities around the projects and to other agencies.

[40]Plantation density has been calculated by dividing the number of plants by net area reported under biological reclamation & plantation. There may be a slight margin of error considering survivability of plants and other regional factors.

[41]Considering project area for running mines in MCL as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha).

Table 6.4: Plantation outside project area by running mines

Name of coal company	Plantation outside project area		Distribution of saplings / plants to communities and other agencies
	Area under plantation (Ha)	Plantation Numbers	
BCCL[42]	68.4	11,290	14,900
CCL	531.4	12,84,090	66,460
ECL	41.2	1,72,350	61,800
MCL	116	1,89,400	2,47,664
NCL	45.0	28,500	64,125
SECL[43]	940.5	10,57,568	36,363
WCL	217.93	3,47,127	1,25,850
NEC	25.52	63,868	0
CIL	1985.9	31,54,193	6,17,162
NLCIL	58.57	50,109	70,500
SCCL	5221.7	2,47,19,775	2,00,52,472
TOTAL	**7266.2**	**2,79,24,077**	**2,07,40,134**

[42]Includes 60.4 ha plantation done outside lease area across washery sites
[43]Including 502.93 ha plantation done over area offices and other sites outside project area

7

Overall Greening Scenario

7.0 Greening statistics for all mines (closed + running)

The statistics presented under Chapters 5 & 6 for closed and running mines respectively have been summarized together in this chapter to gain insights on reclamation and plantation status in the coal PSUs.

The overall company wise break-up for reclamation and plantation area is presented in the table below. A summary showing reclamation and plantation based on mine type is also presented at table 7.2.

Table 7.1: Reclamation & plantation status - Overall status (company wise)

PSUs	No. of mines	Approved production capacity (MTPA)	Total project area (ha)	Bifurcation of project area (ha)				Bifurcation of areas under active mining use (ha)					
				Areas lacking surface rights & other areas	Undisturbed areas	Areas not amenable for plantation	Areas under active mining use	Excavated quarry and subsidence areas	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation over balance areas	Areas amenable for future plantation
BCCL[44]	91	93.00	27287.25	0.00	17835.11	3335.47	6116.67	2757.24	1387.40	460.06	1179.97	294.37	37.63
CCL	53	143.60	25969.61	908.80	8258.64	4140.98	12661.18	3325.94	1816.01	1328.38	3499.09	580.03	2111.73
ECL	91	107.50	55194.35	0.00	43401.86	3412.31	8379.98	2067.87	2563.54	436.34	2508.21	450.10	353.92
MCL[45]	27	230.30	27378.36	4571.10	8520.63	2916.99	9686.15	2390.41	2422.40	1008.81	1598.08	683.53	1582.92
NCL	11	131.00	18877.07	0.00	5576.02	146.00	13155.05	1522.48	3514.48	272.38	3293.53	2777.98	1774.20
SECL[46]	83	223.50	63958.95	7578.85	30461.06	5099.92	20819.13	3943.13	2287.32	2766.51	6123.15	2693.98	3005.04
WCL	96	93.10	56980.71	6147.66	21190.66	10149.77	19492.84	8244.65	2970.53	842.96	2790.71	1505.14	3138.85
NEC	4	1.20	907.96	0.00	126.74	10.10	771.12	199.11	109.12	120.36	24.22	0.00	318.31
CIL	456	1023.10	276554.26	19206.41	135370.72	29211.54	91082.12	24450.83	17070.80	7235.80	21016.96	8985.13	12322.60
NLCIL	5	57.60	15720.24	0.00	7121.71	40.06	8558.47	3525.55	1321.81	575.84	2718.81	88.87	327.59
SCCL	50	87.20	34998.65	0.00	11211.16	2565.60	21221.88	1478.83	4896.45	4999.71	5857.10	3599.55	390.24
TOTAL	511	1167.90	327273.15	19206.41	153703.59	31817.20	120862.47	29455.21	23289.06	12811.35	29592.87	12673.55	13040.43
Percentage break-up													
BCCL				0.0	65.4	12.2	22.4	45.1	22.7	7.5	19.3	4.8	0.6
CCL				3.5	31.8	15.9	48.8	26.3	14.3	10.5	27.6	4.6	16.7
ECL				0.0	78.6	6.2	15.2	24.7	30.6	5.2	29.9	5.4	4.2
MCL				17.8	33.2	11.4	37.7	24.7	25.0	10.4	16.5	7.1	16.3
NCL				0.0	29.5	0.8	69.7	11.6	26.7	2.1	25.0	21.1	13.5
SECL				11.8	47.6	8.0	32.6	18.9	11.0	13.3	29.4	12.9	14.4
WCL				10.8	37.2	17.8	34.2	42.3	15.2	4.3	14.3	7.7	16.1
NEC				0.0	14.0	1.1	84.9	25.8	14.2	15.6	3.1	0.0	41.3
CIL				7.0	49.2	10.6	33.1	26.8	18.7	7.9	23.1	9.9	13.5
NLCIL				0.0	45.3	0.3	54.4	41.2	15.4	6.7	31.8	1.0	3.8
SCCL				0.0	32.0	7.3	60.6	7.0	23.1	23.6	27.6	17.0	1.8
Total				5.9	47.2	9.8	37.1	24.4	19.3	10.6	24.5	10.5	10.8

[44]Net EC capacity of BCCL is taken as 93.04 MTPA, as the EC has been obtained on cluster basis and peak production for the mines of a cluster differs at a given period

[45]Considering project area for running mines in MCL as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha). Break-up is provided w.r.t leasehold area.

[46]Gare Pelma IV/1 mine was handed over by SECL on 07.07.21, thus the project was excluded and plantation area of 204.85 ha under said project is not considered under SECL

Table 7.2: Reclamation and plantation status – overall status based on mining type

PSUs	No. of mines	Total project area (ha)	Bifurcation of project area (ha)				Bifurcation of areas under active mining use (ha)					
			Areas lacking surface rights & other areas	Undisturbed areas	Areas not amenable for plantation	Areas under active mining use	Excavated quarry and subsidence areas	Technical reclamation ongoing / to be taken up	Biological reclamation ongoing / to be taken up	Biological reclamation completed	Plantation over balance areas	Areas amenable for future plantation
OC	210	167881.82	0.00	60293.25	8485.49	97419.49	21079.52	21744.56	11226.66	20835.69	10149.86	12383.2
UG	218	122443.13	19206.41	66906.50	19769.94	16560.59	6613.65	0.00	760.76	6600.48	2125.27	460.43
Mix	83	36948.20	0.00	26503.84	3561.77	6882.39	1762.04	1544.50	823.93	2156.70	398.42	196.80
Total	511	327273.15	19206.41	153703.59	31817.20	120862.47	29455.21	23289.06	12811.35	29592.87	12673.55	13040.43
Percentage break-up												
OC			0.0	36.3	5.1	58.6	21.6	22.3	11.5	21.4	10.4	12.7
UG			15.7	54.6	16.1	13.5	39.9	0.0	4.6	39.9	12.8	2.8
Mix			0.0	71.7	9.6	18.6	25.6	22.4	12.0	31.3	5.8	2.9
Total			5.9	47.2	9.8	37.1	24.4	19.3	10.6	24.5	10.5	10.8

Overall across running and closed mines, the areas lacking surface rights (w.r.t UG / mixed mines) and certain areas under non-mining uses amount to 19,206.41 ha (5.9% of the total project area) and undisturbed areas account for 1,53,703.59 ha (47.2% of the project area). Areas not amenable for plantation at present are recorded as 31,817.20 ha (9.8% of the total project area) – which includes areas not amenable for plantation on account of presence of water body / mine sump, presence of infrastructural amenities like roads, buildings, stockyards, sidings, etc., and areas earmarked for future expansion, patches acquired but pending clearances, etc. W.r.t closed mines, given the latest guidelines from MoC[47] w.r.t management of mines discontinued / abandoned / closed before 2009, some portion under these areas may become amenable in the future subject to feasibility and in line with revision / approval of mine closure plans.

Apart from the above, 1,20,862.47 ha (37.1% of the total project area) is directly under the influence of mining which includes areas under subsidence / quarry and other mining related surface uses. Under this area, the status of reclamation and plantation is as follows:

- Biological reclamation over quarry and overburden dumps has been completed over 29,592.87 ha (i.e. 24.5%)
- Plantation over other areas has been done over 12,673.55 ha (i.e. 10.5%)
- Technical and biological reclamation is ongoing / to be taken up over 36,100.41 ha (i.e. 29.9%)
- Areas identified as amenable for plantation in the future account for 13,040.43 ha (10.8%).
- Active quarry areas, active OB dumps and subsided areas account for 29455.21 ha (24.4%)

The graphical representation of plantation status (overall scenario) for areas directly under the influence of mining as percentage break-up is presented hereunder.

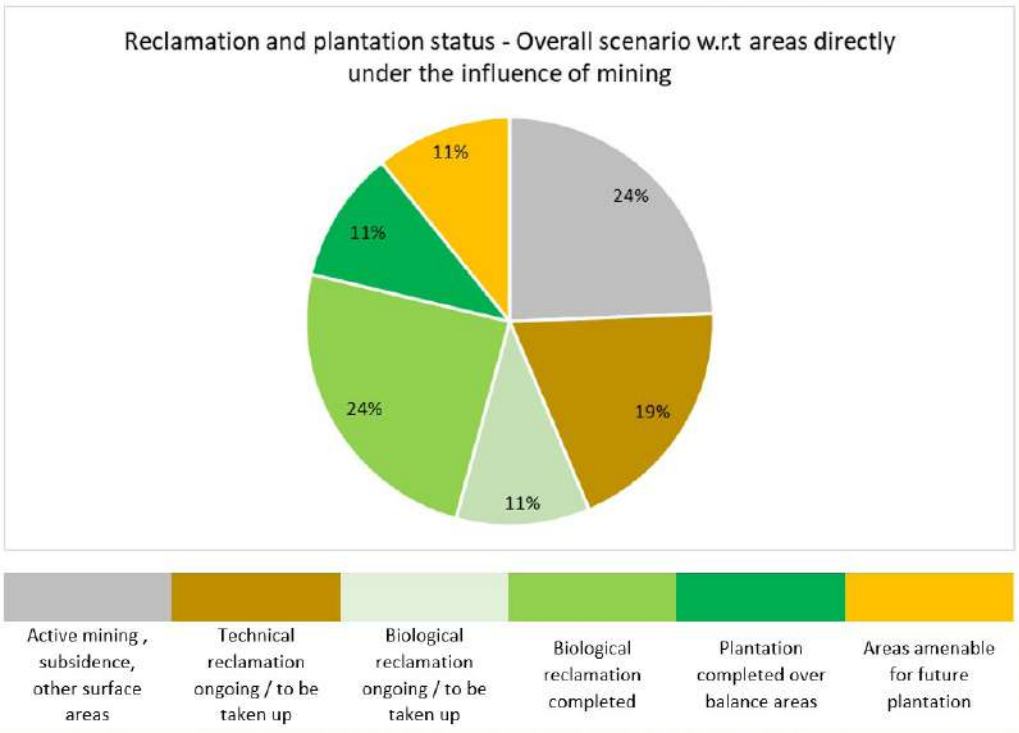


Figure 7.1: Reclamation and plantation status overall scenario over areas directly under the influence of mining

[47]Source: Guidelines for the Management of Mines discontinued / abandoned / closed before the year 2009 issued by MoC vide order dated 28.10.2022

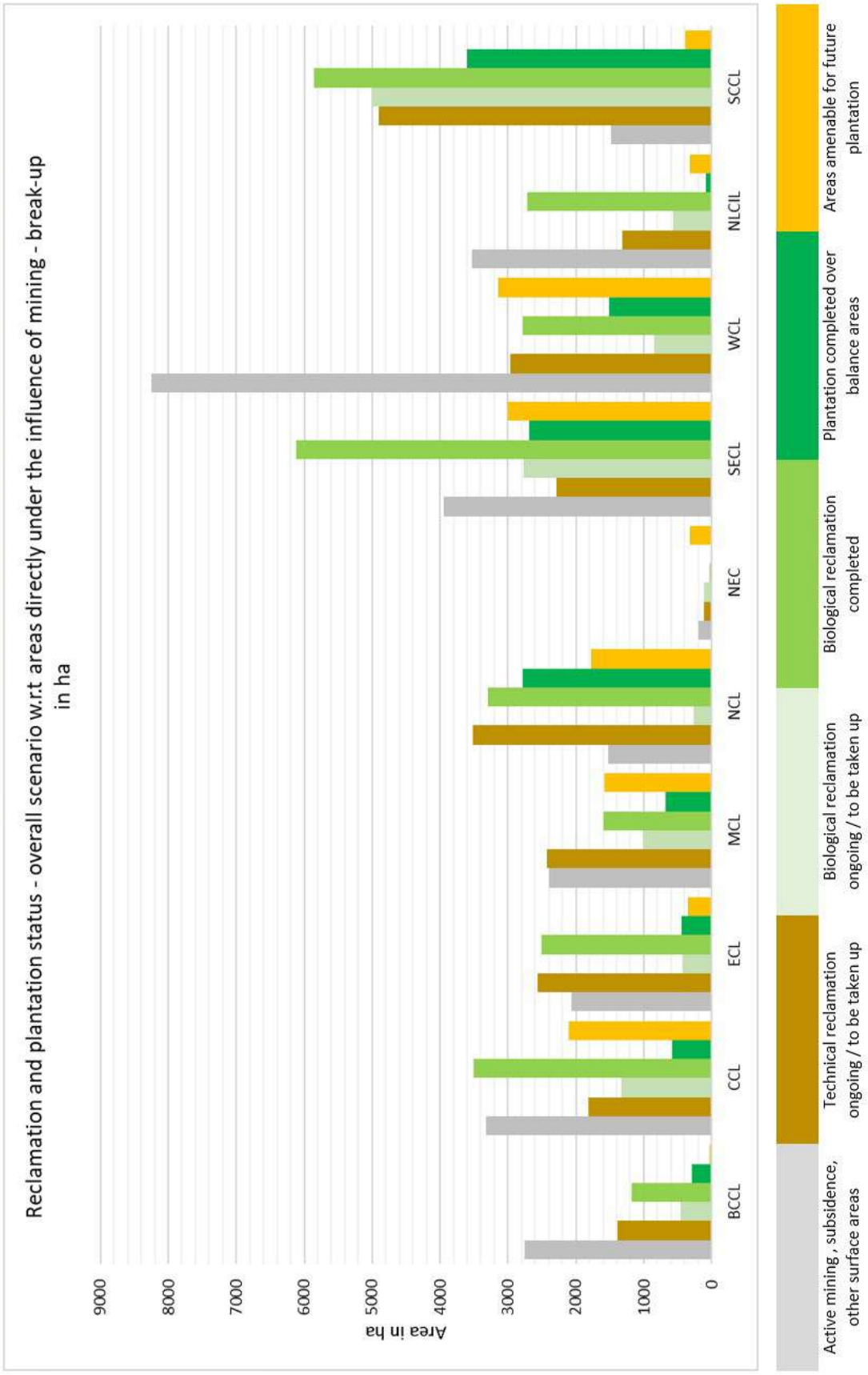


Figure 7.2(A): Reclamation and plantation status across coal PSUs (in ha)

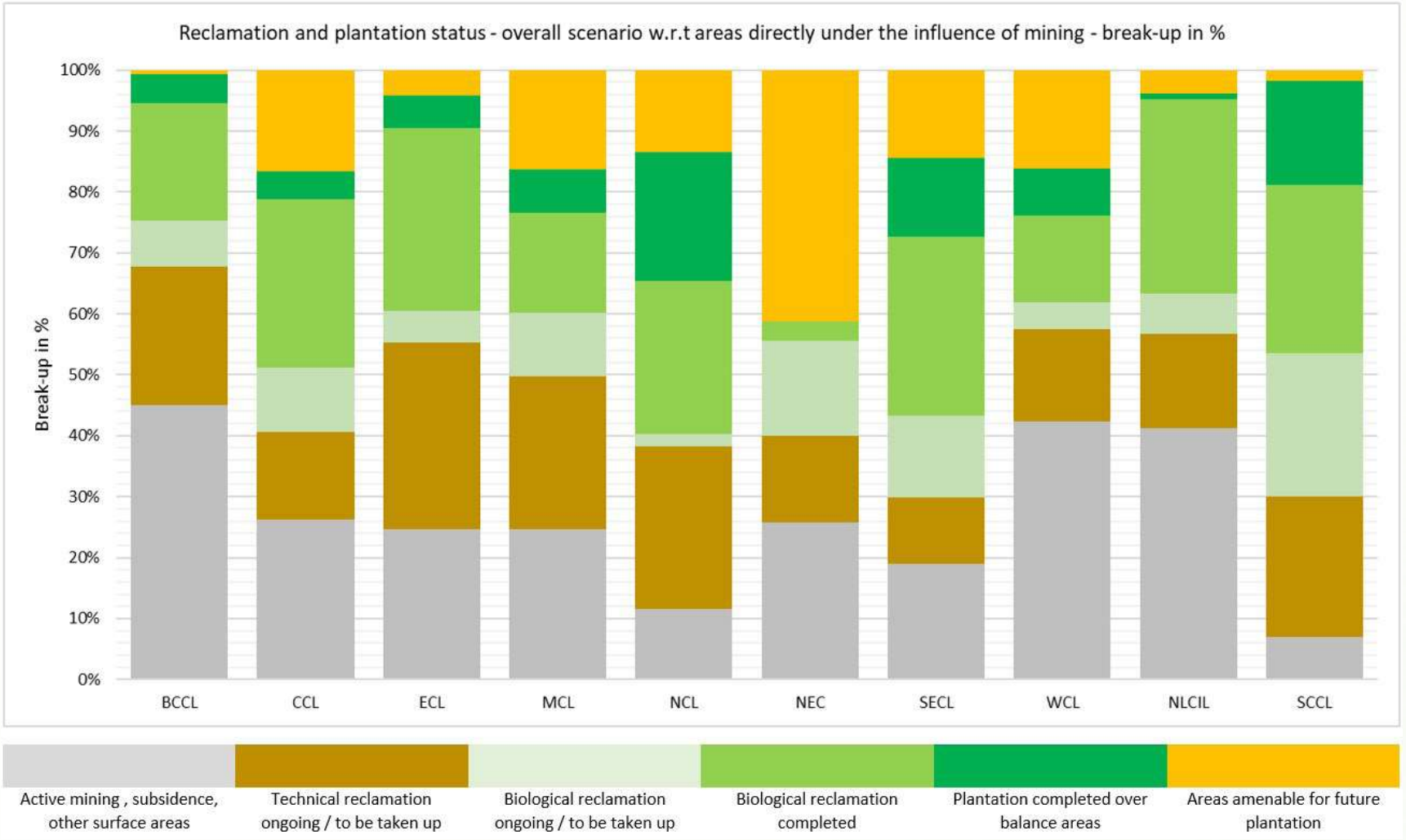


Figure 7.2(B): Reclamation and plantation status across coal PSUs – percentage break-up

7.1 Plantation density across coal mines

Across running mines, approx. 1074.65 lakh plants have been planted within project area - of which 29.1% has been done on backfilled & subsidence areas, 24.9% on external overburden dumps and 46.0% on other areas within the projects. Company wise details are provided in the table below. Plantation density has been calculated as saplings planted per hectare.

Table 7.3: Plantation across mines (in numbers)

PSU	Project area, in ha	Plantation break-up (plants in numbers)				Plantation density[48] (plants per ha)
		On backfilled & subsided areas	Over external OB dumps	Over other sites within the project area	TOTAL	
BCCL	27287.25	8,82,231	4,00,477	18,40,793	31,23,501	2118.6
CCL	25969.61	36,28,331	16,77,866	26,50,866	79,57,063	1950.7
ECL	55194.35	13,25,250	3,61,250	45,48,609	62,35,109	2107.7
MCL*	27378.36	26,38,198	8,68,151	17,54,790	52,61,139	2305.9
NCL	18877.07	1,11,42,194	49,82,931	83,57,846	2,44,82,971	4032.4
SECL	63958.95	73,77,851	42,73,646	1,08,78,995	2,25,30,492	2555.3
WCL	56980.71	13,06,350	49,93,383	58,94,362	1,21,94,095	2838.6
NEC	907.96	53,196	2,50,616	7,250	3,11,062	12843.2
CIL	276554.26	2,83,53,601	1,78,08,320	3,59,33,511	8,20,95,432	2736.3
NLCIL	15720.24	10,64,459	2,85,000	15,14,672	28,64,131	1020.1
SCCL	34998.65	18,86,106	86,17,257	1,20,02,008	2,25,05,371	2379.8
TOTAL	**327273.15**	**3,13,04,166**	**2,67,10,577**	**4,94,50,191**	**10,74,64,934**	**2542.6**

7.2 Plantation done outside project area across coal mines

Outside project area, plantation of approx. 288.53 lakhs has been done over an area of 7,735.9 ha. Approx. 209.46 lakh saplings have also been distributed to communities around the projects and to other agencies.

Table 7.4: Plantation outside project area across coal mines

Name of coal company	Plantation outside project area		Distribution of saplings / plants to communities and other agencies
	Area under plantation (Ha)	Plantation Numbers	
BCCL[49]	68.4	11,290	14,900
CCL	531.4	12,87,090	81,960
ECL	41.2	1,72,350	61,800
MCL	163.0	3,95,772	2,83,664
NCL	45.0	28,500	64,125
SECL[50]	950.90	10,83,568	37,363
WCL	245.7	4,16,252	1,29,780
NEC	25.5	63,868	0
CIL	2071.1	34,58,690	6,73,592
NLCIL	58.57	50,109	70,500
SCCL	5606.22	2,53,44,875	2,02,02,472
TOTAL	**7735.91**	**2,88,53,674**	**2,09,46,564**

[48]Plantation density has been calculated by dividing the number of plants by net area reported under biological reclamation & plantation. There may be a slight margin of error considering survivability of plants and other regional factors.

[49]Includes 60.4 ha plantation done outside lease area across washery sites

[50]Including 502.93 ha plantation done over area offices and other sites outside project area

7.3 Types of plantation undertaken in coal and lignite PSUs

The details on type of plantation & reclamation undertaken by the coal sector PSUs is provided under this section. As stated in previous chapters, the type of plantation undertaken depends on various factors such as site viability, calendar plan, future use for the sites as well as planned end use for the sites. Depending on the same, the plantation / reclamation may be bifurcated into the following heads:

* Plantation on reclaimed areas – biological reclamation done over excavated / overburden dump areas, usually native / forestry species are preferred
* Plantation in underground mines over degraded / subsided areas – reclamation done over subsided or degraded patches in UG mines
* Avenue plantation – plantation along haul roads and public transportation roads
* Plantation in colony – plantation near mine colonies / townships
* Plantation along infrastructure – plantation done in the vicinity of infrastructure features like sidings, stockyards, washeries, silos, project offices, workshops, etc.
* Block plantation – plantation over plain lands other than those covered in heads
* Agriculture – plantation done using food/fodder crops, or other agriculture species
* Horticulture / orchards – plantations done primarily using flowering / fruiting species with an aim to consume end produce
* Bamboo plantation – targeted bamboo plantations
* Grassing / seed ball plantations – usually an intermediary step in preparing the sites for biological reclamation

In addition to the above, many coal and lignite PSUs have also started developing patches along the principles of “Miyawaki” forests with an aim to have quick growth and self- sustaining ecosystems in short time spans.

The details on company wise plantation undertaken are provided in the table below:

Table 7.5: Type of plantation undertaken by coal companies (break-up in ha)

Plantation type	BCCL	CCL	ECL	MCL	NCL	SECL	WCL[51]	NEC	CIL	NLCIL	SCCL	TOTAL
Plantation on reclaimed areas	429.44	2175.12	633.8	1525.91	3293.5	4697.05	2152.68	24.22	14931.72	2450.12	5836.5	23218.34
Plantation in UG Mines over degraded/ subsided areas	15	337.59	502.77	-	-	1378.84	181	-	2415.2	-	-	2415.2
Avenue Plantation	-	14.2	146.72	263.81	2757.1	1281.29	107.14	-	4570.26	-	584.5	5154.76
Plantation in colony	-	144.53	49.21	-	-	189.48	159.88	-	543.1	-	-	543.1
Plantation around infrastructure	-	46.75	96.23	17.88	-	776.76	416.01	-	1353.63	41.86	-	1395.49
Block Plantation/ plain land plantation other than above	1029.89	1357.66	1501.08	468.99	-	447.6	1278.66	-	6083.87	280.98	3619.8	9984.65
Agriculture	-	0	-	-	-	-	-	-	-	22.74	-	22.74
Horticulture/ Orchard	-	2	28.5	-	-	-	-	-	30.5	11.99	-	42.49
Bamboo Plantation	-	0.4	-	5	20.91	45.2	-	-	71.51	-	-	71.51
Any other like grassing, seed ball plantation etc.	-	608.04	-	75	-	1	-	-	684.04	-	-	684.04
TOTAL[52]	**1474.33**	**4078.25**	**2958.31**	**2281.59**	**6071.51**	**8816.22**	**4295.37**	**24.22**	**29999.79**	**2807.69**	**10040.8**	**42848.28**

[51]Assumptions made for few mines by CMPDIL
[52]Excludes grassing

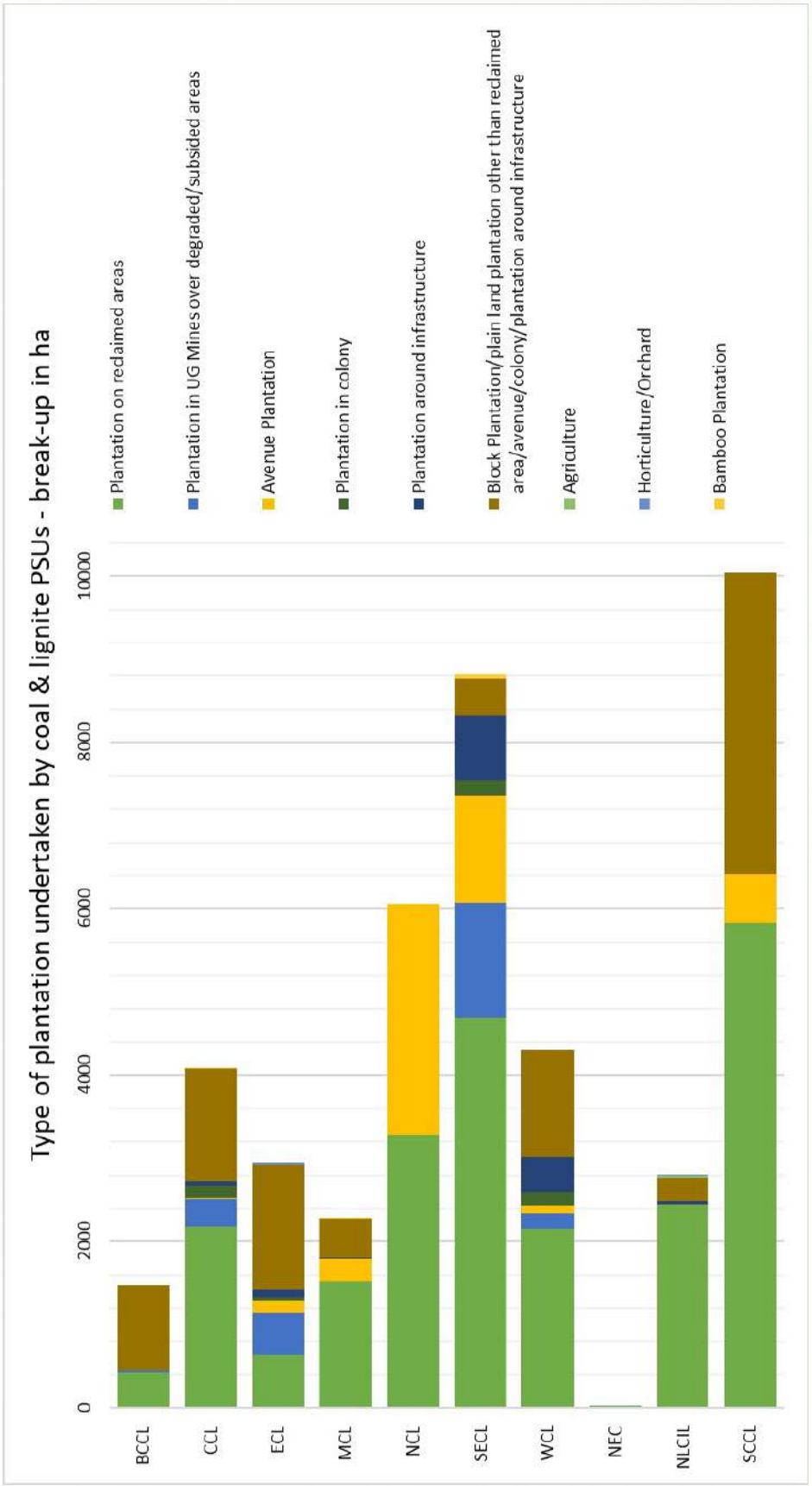


Figure 7.3(A): Type of plantation undertaken by coal & lignite PSUs (in ha)

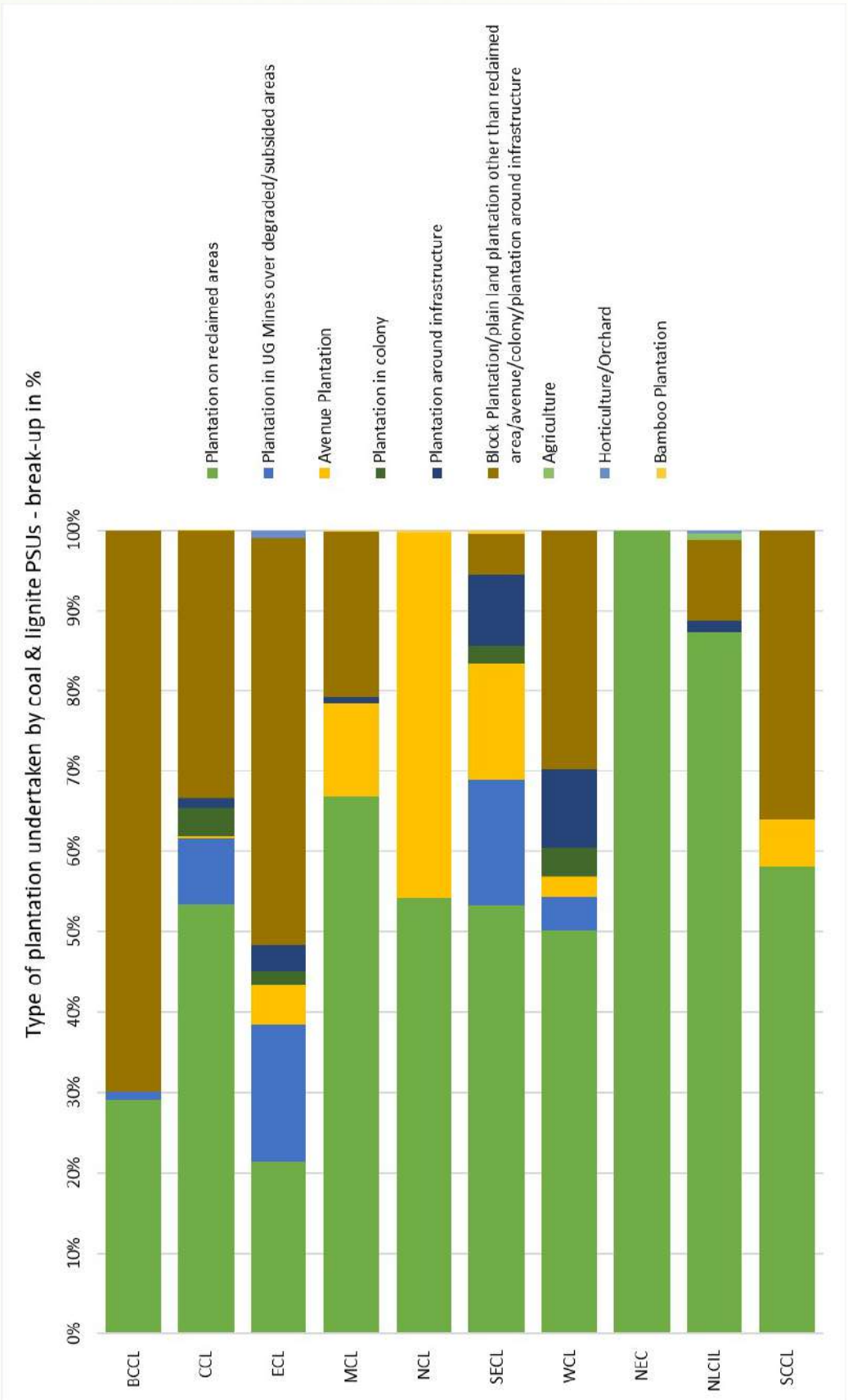


Figure 7.3(B): Type of plantation undertaken by coal & lignite PSUs – percentage break-up

8

Data Validation Through Comparison With Remote Sensing Studies

8.0 Need for data validation

The data presented in this report is based on information collected from the coal companies on a mine wise basis. The information has been submitted by the coal companies based on records available with them from mine / area & HQ level based on yearly plantation drives undertaken and reclamation activities across quarry and dump patches. On the other hand, reclamation studies based on satellite data is also being undertaken by the coal companies.

Thus, the validation exercise was recommended by MoC to undertake a comparative outlook w.r.t data collected by coal PSUs vis-à-vis the outcome of land reclamation monitoring based on satellite data.

In this regard, the validation exercise was done for CIL mines vide comparison with the satellite based reclamation studied during the same period.

8.1 Background w.r.t remote sensing based land reclamation monitoring

Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land which is the scarcest natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do affect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future. Remote sensing data with its various spectral and spatial resolutions, offers comprehensive and accurate information for mapping and monitoring of land use/cover over a period of time. By analysing the data of different time periods, various parameters of land use and vegetation cover can be determined.

CMPDIL is carrying out satellite data based Land Reclamation Monitoring of Mines for Coal India Limited (CIL) under two categories: a) OC mines producing more than 5 mcm Coal+OB on p.a. on annual basis (MT5) and b) producing less than 5 mcm Coal+OB p.a. (LT5) at an interval of three years in phase wise manner. The main parameters being monitored in this study are Technical Reclamation, Biological Reclamation, Active Mining Area, Excavated Area & Green Cover generated in the leasehold boundaries

of the selected projects. Furthermore, Land use/ vegetation cover mapping of 19 major coalfields is also carried out at an interval of 3 years in phase wise manner.

8.2 Objective

Objective of the land reclamation monitoring is to assess the area under backfilling, plantation, social forestry, active mining area, water bodies, and distribution of wasteland, agricultural land and forest in the leasehold area of the projects. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.

This study provides a very effective tool for monitoring of land reclamation in the mines of CIL under different subsidiaries as well as impact of mining on the land use and vegetation cover in various coalfield. These studies based on remote sensing satellite data provide the geo-environmental data-base of projects / coalfields sufficing the need of various mandates of MoEF&CC and also validate CIL's approach towards sustainable mining.

8.3 Validation methodology

In order to validate the data made available by the CIL subsidiaries w.r.t reclamation and plantation, the following satellite monitoring data was considered:

1. For mines less than 5 mcm (Coal+OB) p.a. – Remote Sensing data over the years 2020, 2021 & 2022 (since less than 5 mcm mines are monitored once in 3 years in phase-wise manner)

2. For mines more than 5 mcm Coal+OB - Remote Sensing data for the year 2022.

3. Projects other than those listed at 1 & 2 (mines not considered under regular monitoring) – Remote Sensing data for the year 2020 & 2021

The flow chart of methodology used in Digital Image Processing of Satellite Data for Land Reclamation Monitoring studies is given below:

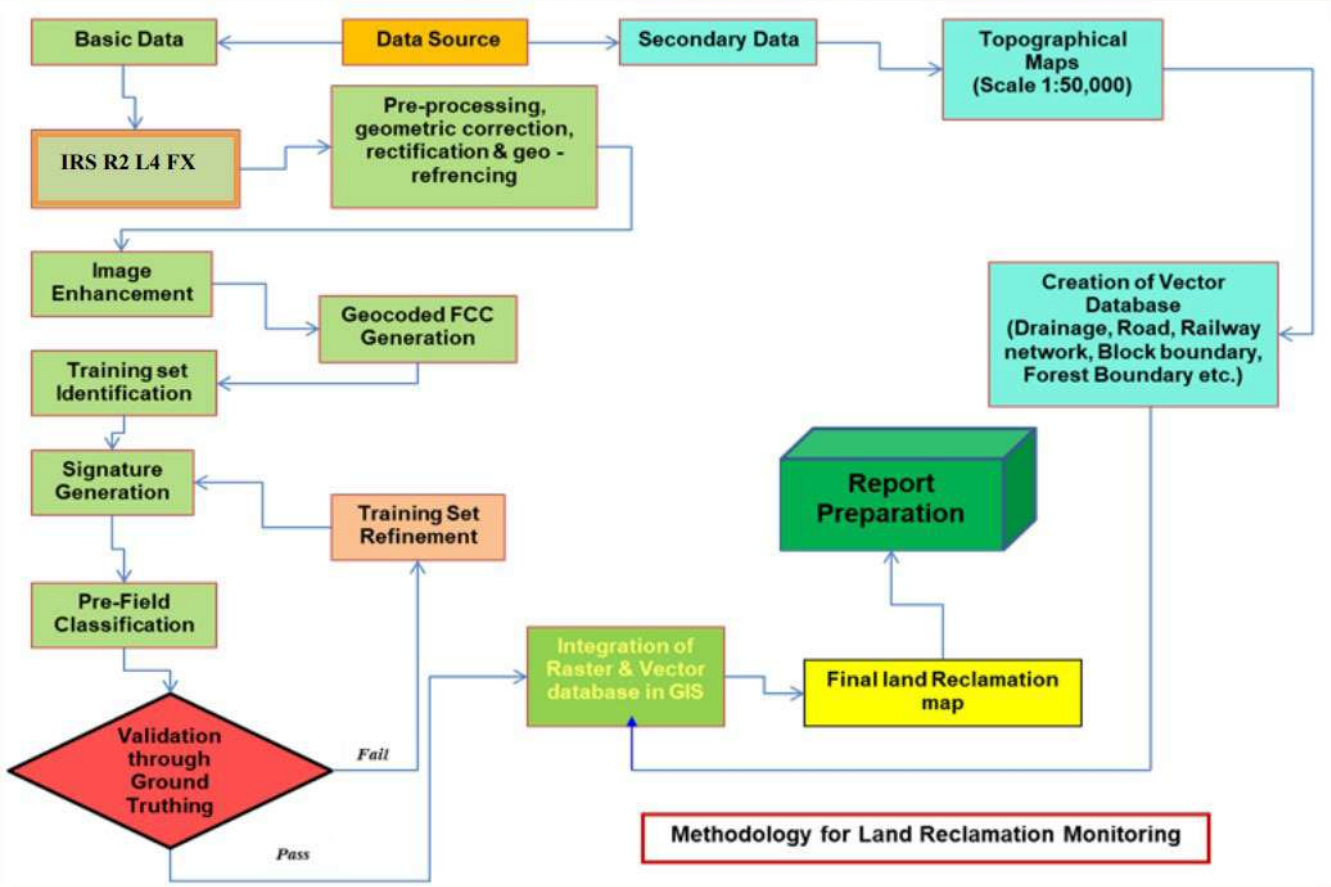


Figure 8.1: Methodology used in Digital Image Processing of satellite data for land reclamation monitoring studies

The results obtained through Digital Image Processing of the satellite data for the projects monitored under Land Reclamation Monitoring was consolidated and is presented hereunder.

8.4 Outcome of the validation study w.r.t CIL subsidiaries Data

285 mines & clusters were considered for this validation study spreading across a leasehold area of 278159 ha and the outcome of the same is presented in the tables below. Based on Remote Sensing Studies, Green Cover reported over CIL mines is estimated at 32116 ha, which is approximately 11.5% of the total leasehold area. This includes plantations done over Technically reclaimed area, external OB Dumps in 18292 ha (6.6%) and social forestry over 13824 ha (4.9%). Area under active mining and areas under technical reclamation is 39643 ha, which is cumulatively almost 14.3% of the total area. Land reclamation status map for few randomly selected projects are also showcased under figures 8.2 to 8.13.

Table 8.1: Summary of outcome from Remote Sensing validation (for CIL mines)

Category	Number of mines / clusters	Area in ha								
		Lease-hold Area	Reclamation		Other Plantations		Area under Active mining	Total Excavated Area	Green cover (In Project Leasehold Area)	Total Area under Reclamation
			Technical (Barren Backfilling)	Biological (Plantation on Backfilled Areas)	Plantation on External OB Dumps	Social Forestry /Avenue Plantation				
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i) =(d)+(e)+(h)	(j) = (e)+(f)+(g)	(k) = (d)+(e)
Mines with more than 5 mcm (Coal+OB) per annum (MT5)	76	86898	14415	5531	5522	5394	11644	31590	16447	19946
Mines with less than 5 mcm (Coal+OB) per annum (LT5)	112	132389	6435	2185	2948	6032	5719	14339	11165	8620
Projects not covered under regular monitoring	95	56808	401	354	741	2376	296	1051	3471	755
Projects dropped from Land Reclamation Monitoring (02)*	2	2064	554	997	14	22	179	1730	1033	1551
Total	285	278159	21805	9067	9225	13824	17838	48710	32116	30872

Note:

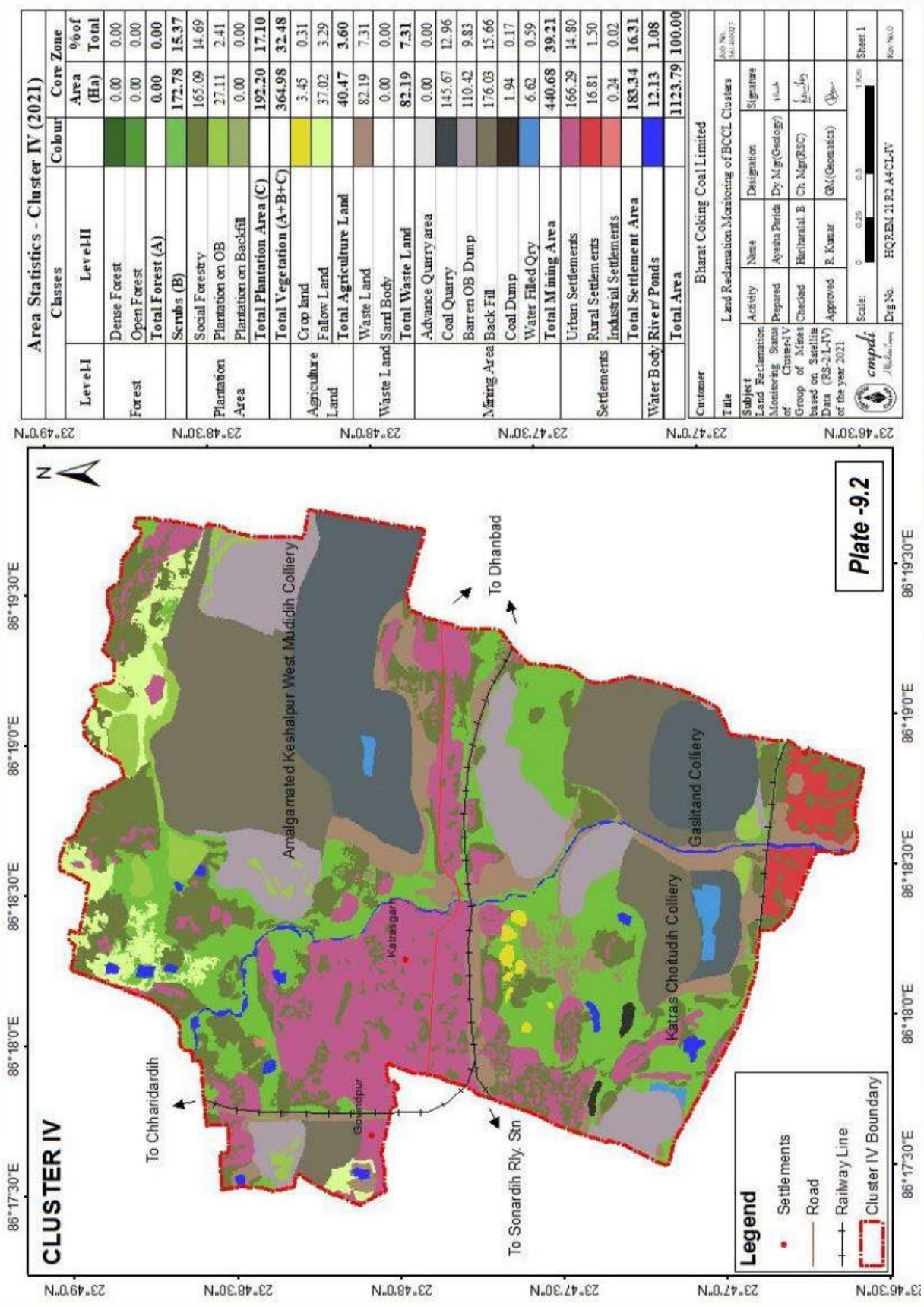
MT5: Projects producing more than 5 mcm (Coal+OB) p.a. category LT5: Projects producing less than 5 mcm (Coal+OB) p.a. category
One Cycle of Satellite Data based Land Reclamation Monitoring includes 3 sets of LT5 Projects and 1 set of MT5 Projects
*Dugga & Bishrampur OCPs were dropped from Land Reclamation Monitoring since 2020-21

Table 8.2: Subsidiary wise outcome from Remote Sensing validation (CIL Mines)

Subsidiary	Category	Number of mines / clusters	Area in ha								
			Leasehold Area	Reclamation		Other Plantations		Area under Active mining	Total Excavated Area	Green cover (In Project Leasehold Area)	Total Area under Reclamation
				Technical (Barren Backfilling)	Biological (Plantation on Backfilled Areas)	Plantation on External OB Dumps	Social Forestry / Avenue Plantation				
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i) =(d)+(e)+(h)	(j) =(e)+(f)+(g)	(k) = (d)+(e)
BCCL	LT5 (05)(2020)	5	7988	657	28	114	504	615	1300	646	685
	LT5 (05)(2021)	5	9412	713	62	150	757	443	1218	969	775
	LT5 (05)(2022)	5	8140	621	115	70	361	294	1030	546	736
	Other projects (01)	1	1899	0	0	0	150	0	0	150	0
	TOTAL (BCCL) (16)	16	27439	1991	205	334	1772	1352	3548	2311	2196
CCL	MT5 (15) (2022)	15	11386	1868	843	519	483	1088	3799	1845	2711
	LT5 (8)(2020)	8	3891	397	167	86	76	336	900	329	564
	LT5 (07)(2021)	7	3961	304	234	97	53	285	823	384	538
	LT5 (12)(2022)	12	6827	403	300	309	335	610	1313	944	703
	Other projects (14)	14	5714	64	133	96	597	130	327	826	197
	TOTAL (CCL) (56)	56	31779	3036	1677	1107	1544	2449	7162	4328	4713
ECL	MT5 (02) (2022)	2	4069	997	301	91	158	498	1796	550	1298
	LT5 (07)(2020)	7	10884	241	96	220	278	303	640	594	337
	LT5 (04)(2021)	4	18339	24	0	0	988	28	52	988	24
	LT5 (04)(2022)	4	30078	954	199	181	1304	649	1802	1684	1153
	Other projects (01)	1	655	0	0	0	36	8	8	36	0
	TOTAL (ECL) (18)	18	64025	2216	596	492	2764	1486	4298	3852	2812
MCL	MT5 (16) (2022)	16	17975	2958	805	324	399	2560	6323	1528	3763
	LT5 (07)(2020)	7	4288	74	226	27	55	28	328	308	300
	LT5 (01)(2021)	1	437	143	0	8	10	58	201	18	143
	LT5 (01)(2022)	1	1141	0	0	0	0	0	0	0	0
	Other projects (05)	5	4400	250	205	96	225	86	541	526	455
	TOTAL (MCL) (30)	30	28241	3425	1236	455	689	2732	7393	2380	4661

NCL	MT5 (10) (2022)	10	18418	3754	1184	1900	2371	3162	8100	5455	4938
	Other projects (01)	1	457	0	0	161	29	0	0	190	0
	TOTAL (NCL) (11)	11	18875	3754	1184	2061	2400	3162	8100	5645	4938
SECL	MT5 (19) (2022)	19	19951	3651	1975	1189	957	2229	7855	4121	5626
	LT5 (04)(2020)	4	5822	129	161	34	65	107	397	260	290
	LT5 (01)(2021)	1	523	86	140	0	80	0	226	220	226
	LT5 (04)(2022)	4	2440	170	154	5	94	44	368	253	324
	Other projects (22)	22	14497	17	10	0	985	0	27	995	27
	TOTAL (SECL) (50)	50	43233	4053	2440	1228	2181	2380	8873	5849	6493
WCL	MT5 (14) (2022)	14	15099	1187	423	1499	1026	2107	3717	2948	1610
	LT5 (15)(2020)	15	7760	485	68	760	402	913	1466	1230	553
	LT5 (11)(2021)	11	5408	522	114	409	341	452	1088	864	636
	LT5 (08)(2022)	8	3462	462	103	357	276	398	963	736	565
	Other projects (50)	50	28029	70	6	384	354	72	148	744	76
	TOTAL (WCL) (98)	98	59758	2726	714	3409	2399	3942	7382	6522	3440
NEC	LT5 (03)(2020)	3	1588	50	18	121	53	156	224	192	68
	Other projects (01)	1	1157	0	0	4	0	0	0	4	0
	TOTAL (NEC) (04)	4	2745	50	18	125	53	156	224	196	68
Others	Dropped projects (02)*	2	2064	554	997	14	22	179	1730	1033	1551
CIL Total (285)		285	278159	21805	9067	9225	13824	17838	48710	32116	30872

Other projects represent the projects not covered under regular monitoring (excluding MT5 & LT5)
*Dugga & Bishrampur OCPs were dropped from Land Reclamation Monitoring since 2020-21



Area Statistics - Cluster IV (2021)

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

Customer	Bharat Coking Coal Limited			Job No. 16140007
Title	Land Reclamation Monitoring of BCCL Clusters			
Subject	Land Reclamation Monitoring Status of Closer-IV Group of Mines based on Satellite Data (RS-2-LC-IV) of the year 2021	Activity	Name	Designation	Signature
		Prepared	Ayesha Parida	Dy. Mgr(Geology)	
		Checked	Hariharlal. B	Ch. Mgr(RSC)	
		Approved	R. Kumar	GM(Geomatics)	
		Scale:	0 0.25 0.5 1 Km		Sheet 1
		Drg No.	HQREM/21/R2/A4/CL-IV		Rev No.0

Figure 8.2: Land reclamation status based on satellite data of Cluster IV, BCCL for 2021

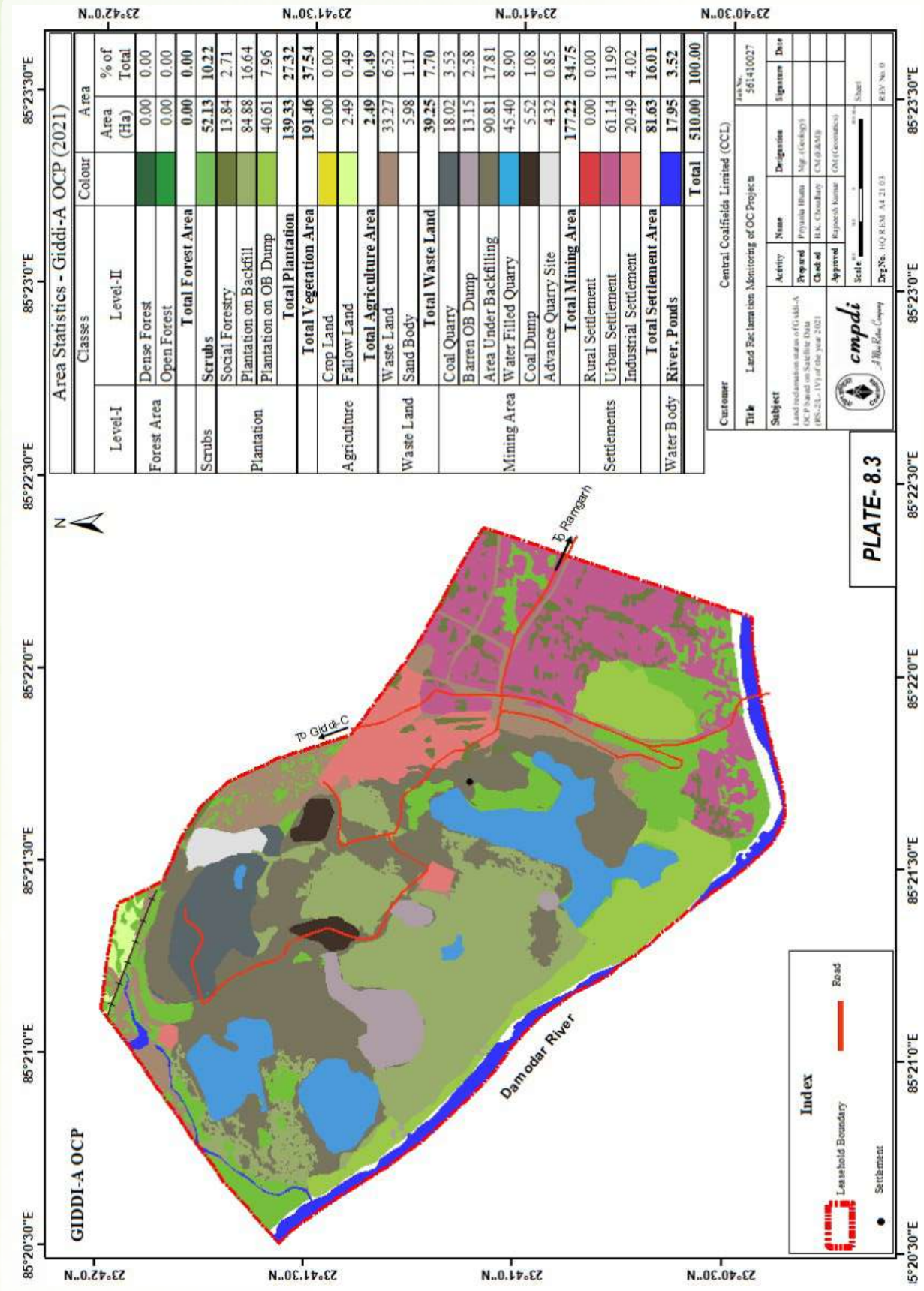
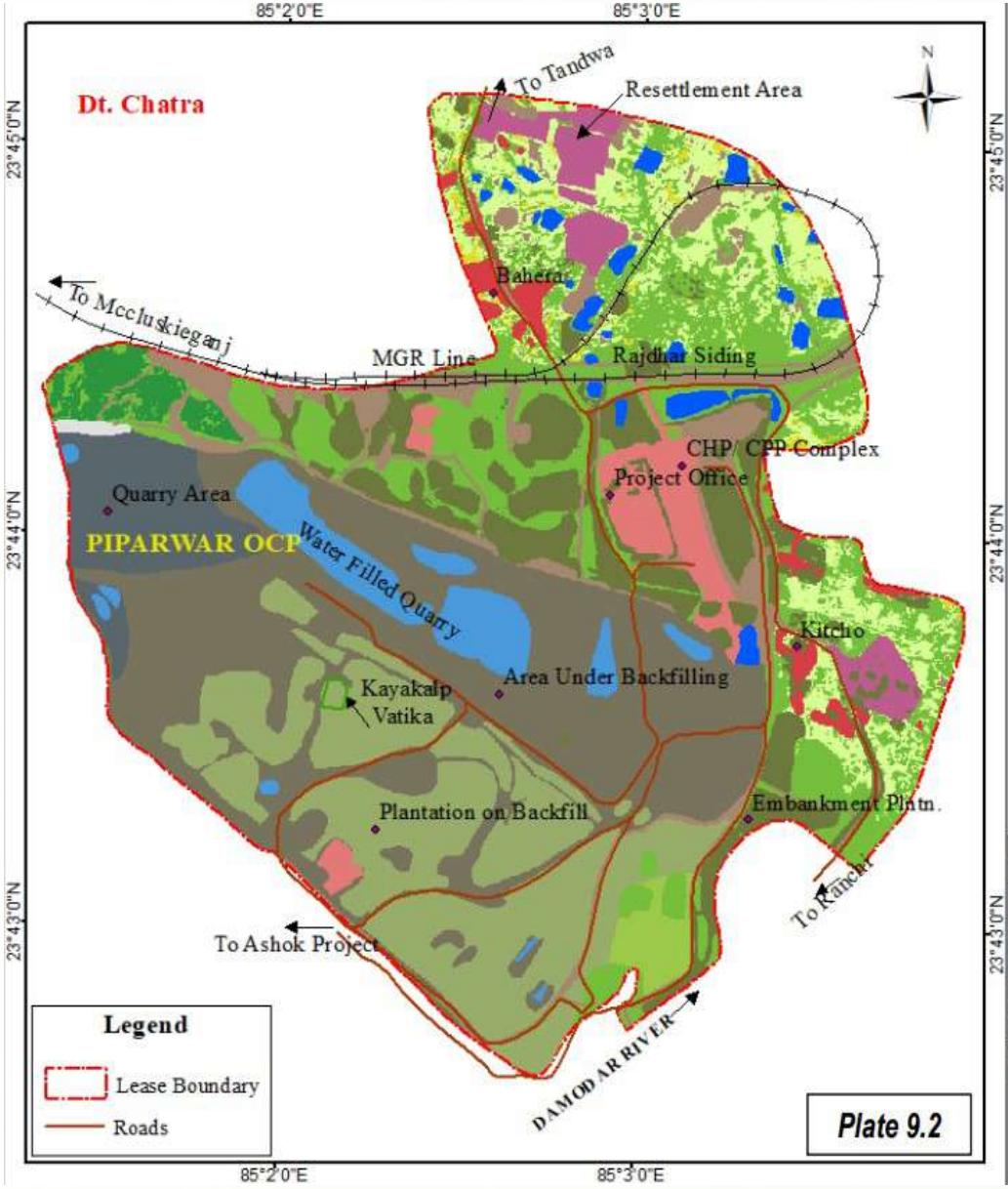


Figure 8.3: Land reclamation status based on satellite data of Giddi-A OC, CCL for 2021



Area Statistics - Piparwar OCP (2021)				
Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
Forest Area	Dense Forest		0.00	0.00
	Open Forest		0.16	1.43
	Total Forest Area		**0.16**	**1.43**
Scrubs	**Scrubs**		**1.23**	**10.98**
Plantation	Social Forestry		1.18	10.54
	Plantation on Backfill		1.85	16.52
	Plantation on OB Dump		0.19	1.70
	Total Plantation		**3.22**	**28.75**
	Total Vegetation Area		**4.61**	**41.16**
Agriculture	Crop Land		0.08	0.71
	Fallow Land		0.94	8.39
	Total Agriculture Area		**1.02**	**9.11**
Waste Land	Waste Land		0.83	7.41
	Sand Body		0.00	0.00
	Total Waste Land		**0.83**	**7.41**
Mining Area	Coal Quarry		0.51	4.55
	Barren OB Dump		0.00	0.00
	Area Under Backfilling		2.75	24.55
	Water Filled Quarry		0.45	4.02
	Coal Dump		0.00	0.00
	Advance Quarry Site		0.00	0.00
	Total Mining Area		**3.71**	**33.13**
Settlements	Rural Settlement		0.18	1.61
	Urban Settlement		0.29	2.59
	Industrial Settlement		0.38	3.39
	Total Settlement Area		**0.85**	**7.59**
Water Body	**River, Ponds**		**0.18**	**1.61**
		Total	**11.20**	**100.00**

Customer	Central Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject Land Reclamation Monitoring Status of Piparwar OCP based on Satellite Data (RS-2/L-IV) of the year 2021	Activity	Name	Designation	Signature	
	Prepared	Hariharalal B	Ch. Mgr(System)		
	Checked	Tilak Mandal	Ch. Mgr(RSC)		
	Approved	R. Kumar	GM(Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 km				Sheet 1
	Drg No. HQ REM 21 3 A4 02				Rev No.0

Figure 8.4: Land reclamation status based on satellite data of Piparwar OC, CCL for 2021

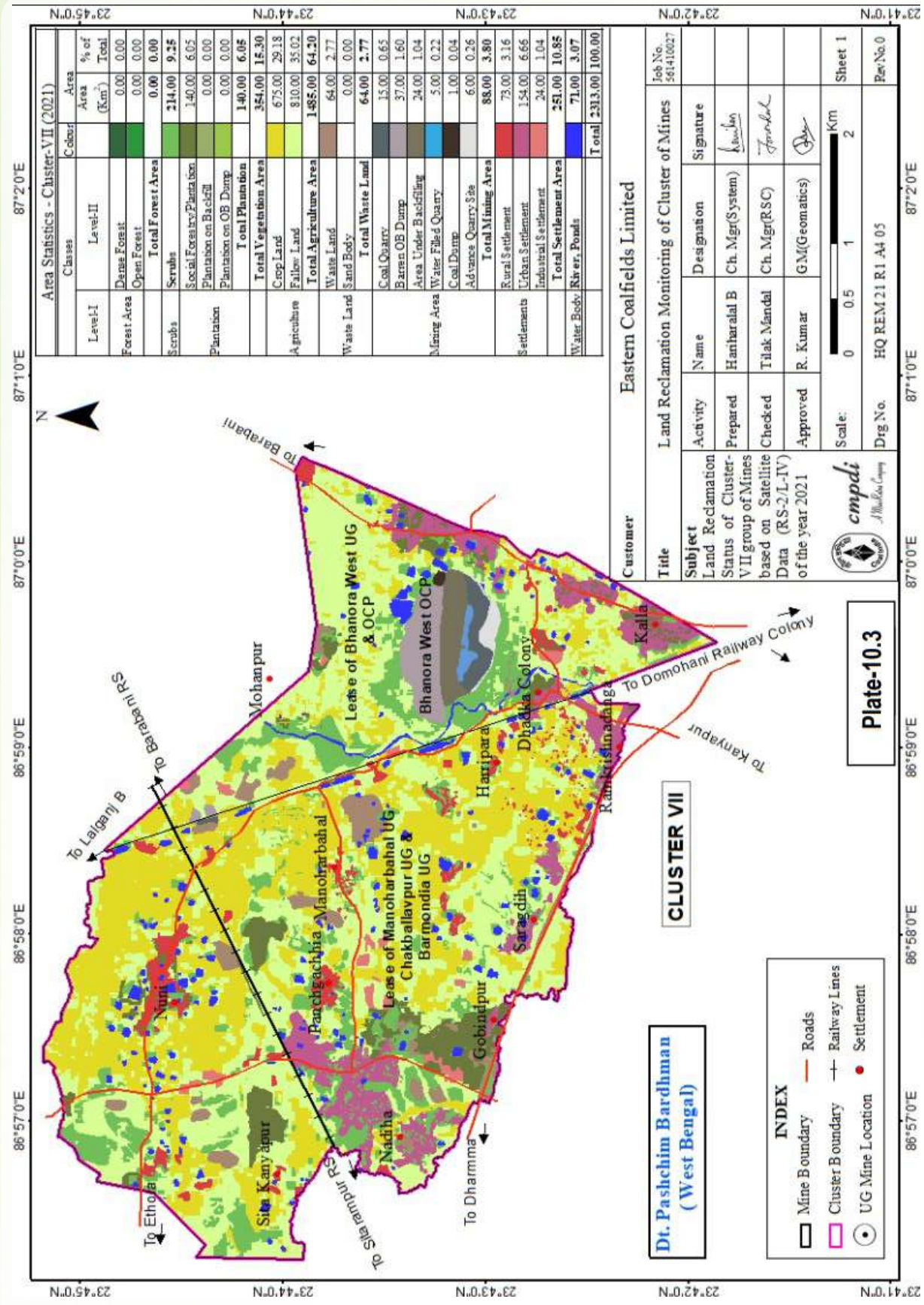


Figure 8.5: Land reclamation status based on satellite data of Cluster VII, ECL for 2021

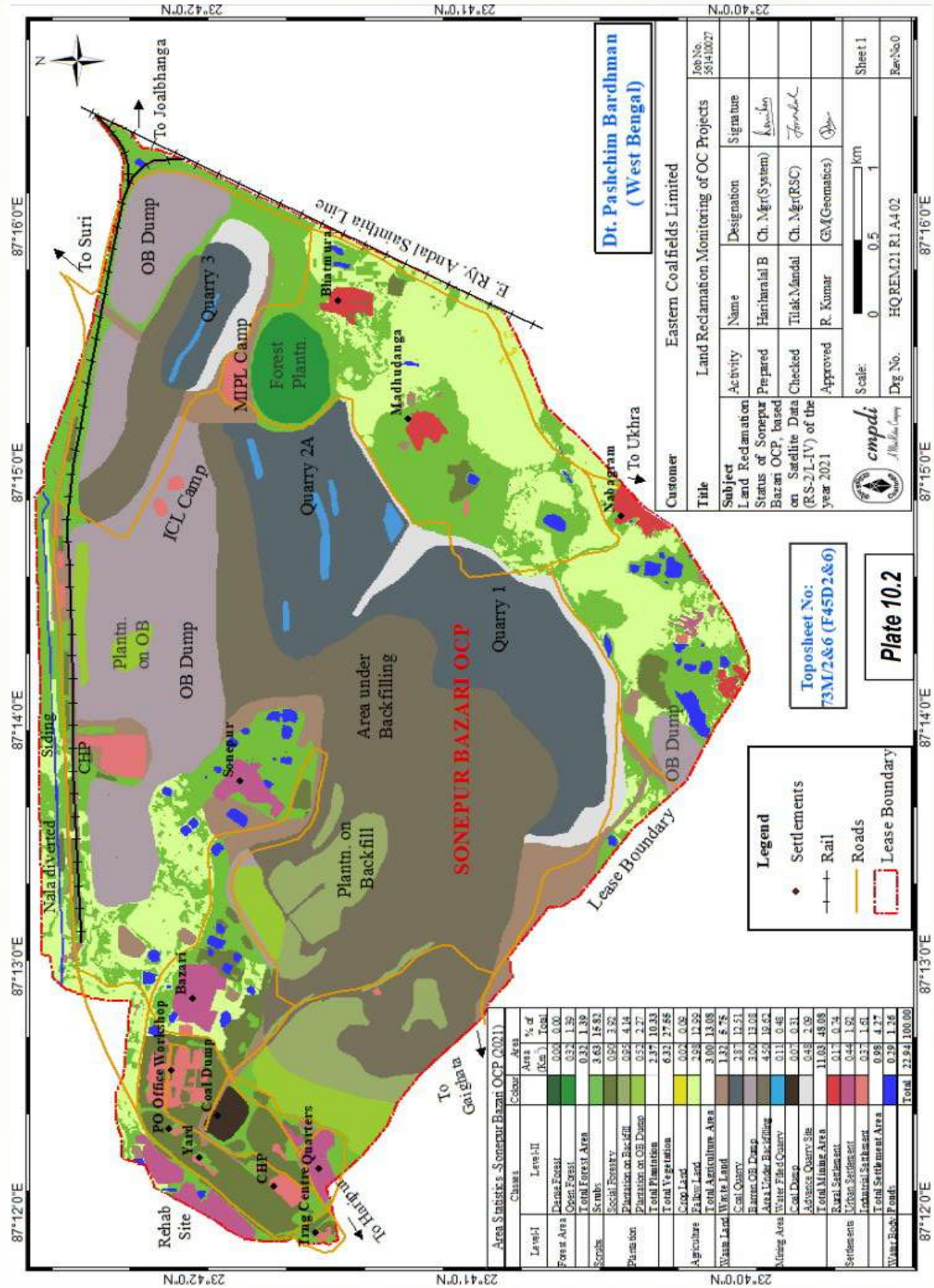


Figure 8.6: Land reclamation status based on satellite data of Sonepur Bazari OC, ECL for 2021

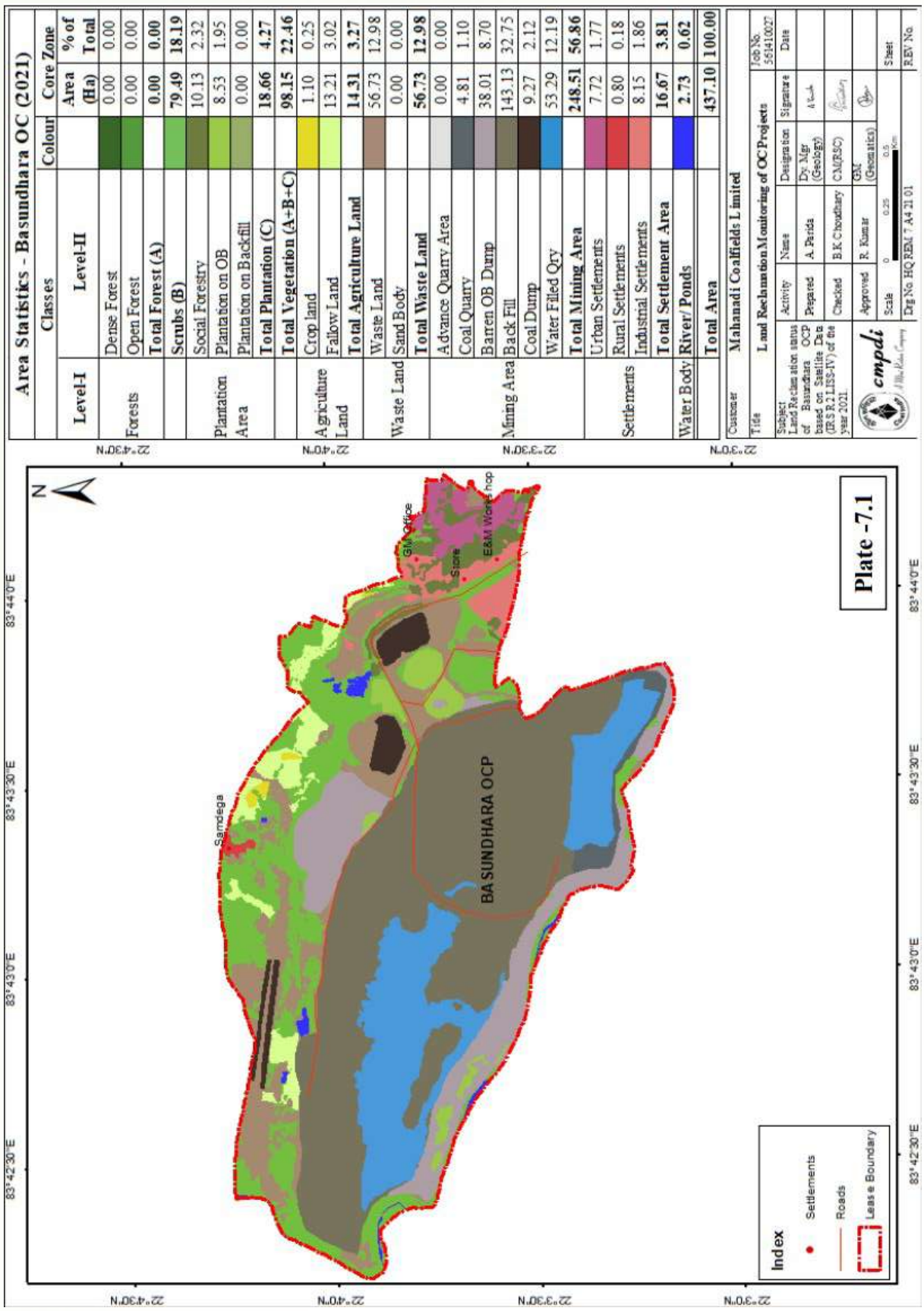
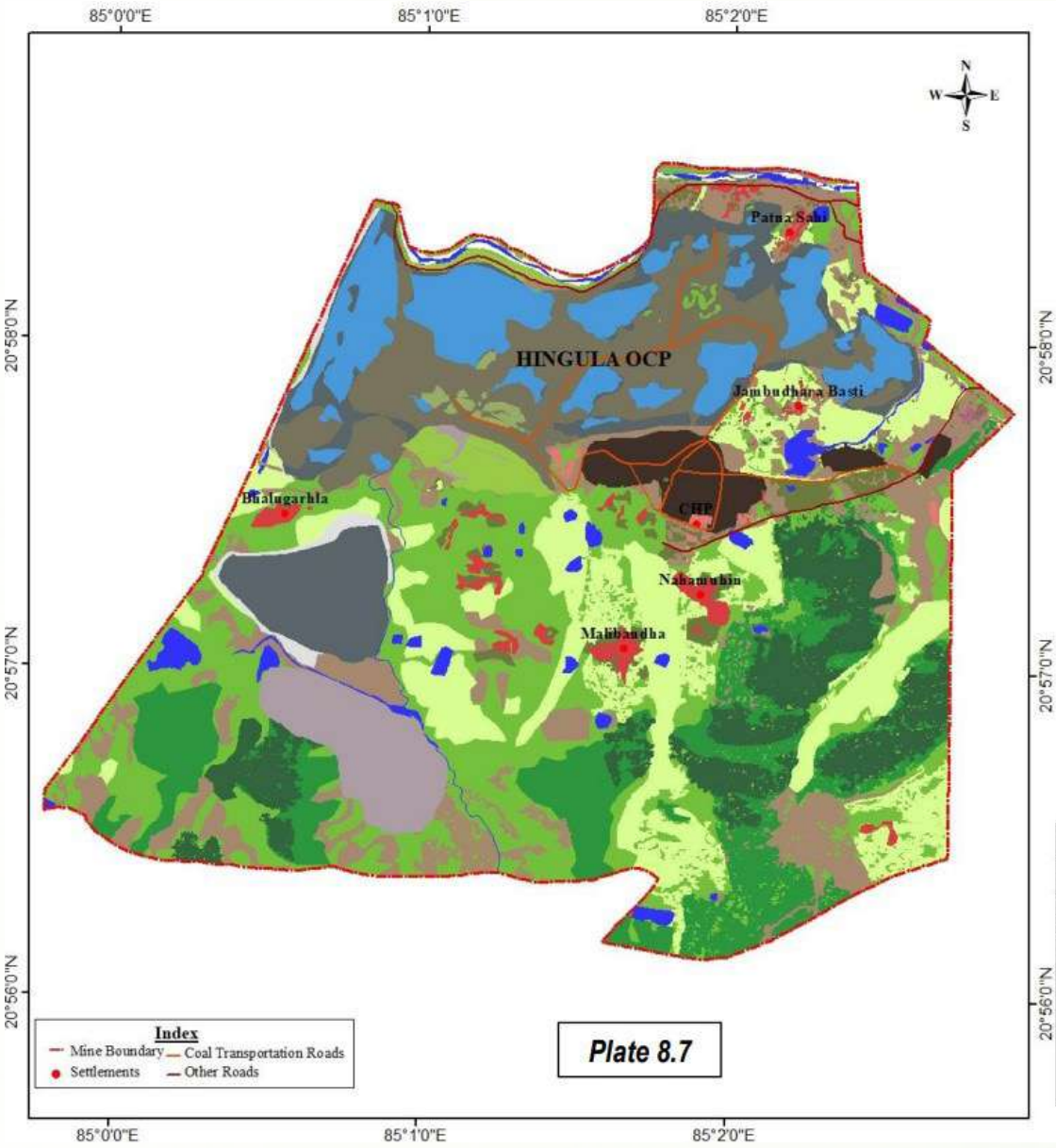


Figure 8.7: Land reclamation status based on satellite data of Basundhara OC, MCL for 2021



Area Statistics - Hingula OCP (2021)				
Classes		Colour	Area	
Level-I	Level-II		Area (Km^2)	% of Total
Forest	Dense Forest		1.15	7.30
	Open Forest		1.6	10.16
	Total Forest(A)		**2.75**	**17.46**
Scrubs	**Scrubs (B)**		**3.05**	**19.37**
Plantation	Social Forestry		0.29	1.84
	Plantation on Backfill		0.06	0.38
	Plantation on OB Dump		0.21	1.33
	Total Plantation (C)		**0.56**	**3.56**
	Total Vegetation(A+B+C)		**6.36**	**40.38**
Agriculture	**Agriculture Land**		2.26	14.35
Waste Land	Waste Land		1.81	11.49
	Sand Body		0.06	0.38
	Total Waste Land		**1.87**	**11.87**
Mining Area	Coal Quarry		0.99	6.29
	Barren OB Dump		0.54	3.43
	Area Under Backfilling		1.50	9.52
	Water Filled Quarry		1.14	7.24
	Coal Dump		0.39	2.48
	Advance Quarry Site		0.12	0.76
	Total Mining Area		**4.68**	**29.71**
Settlements	Rural Settlement		0.22	1.40
	Urban Settlement		0.01	0.06
	Industrial Settlement		0.03	0.19
	Total Settlement Area		**0.26**	**1.65**
Water Body	**River, Ponds**		**0.32**	**2.03**
		Total	**15.75**	**100.00**

Customer	Mahanadi Coalfields Limited				
Title	Land Reclamation Monitoring of OC Projects				Job No. 561410027
Subject Land Reclamation Status of Hingula OCP based on Satellite Data (R2A/L-IV) of the year 2021	Activity	Name	Designation	Signature	Date
	Prepared	A. Biswas	Mgr.(Geology)		
	Checked	T. Mondal	CM (RSC)		
	Approved	R. Kumar	GM (Geomatics)		
cmpdi	Scale: 0 0.25 0.5 1 Km				Sheet 1
	Drg No. HQ REM 07 A4 21 07				Rev No.0

Figure 8.8: Land reclamation status based on satellite data of Hingula OC, MCL for 2021

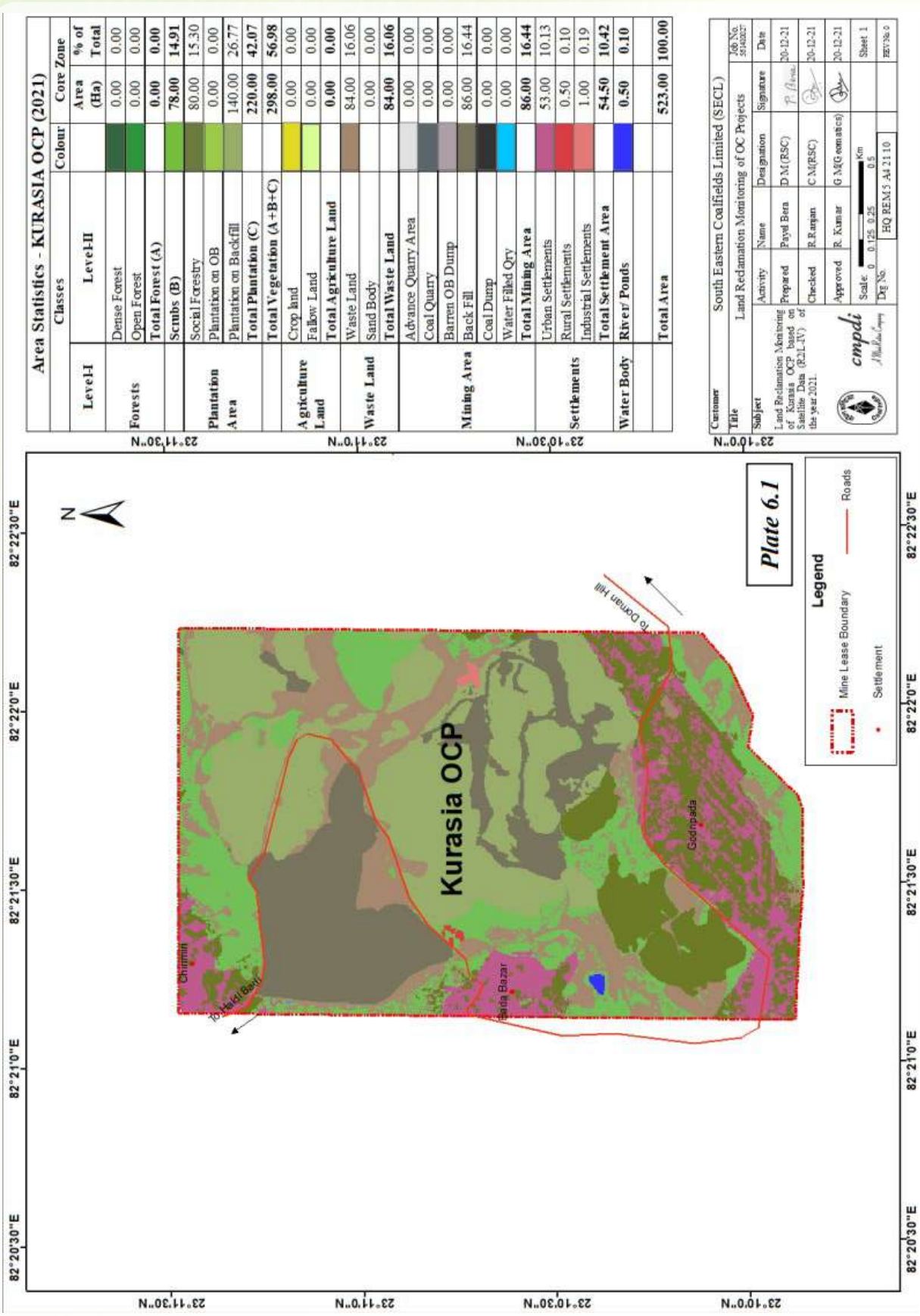


Figure 8.9: Land reclamation status based on satellite data of Kurasia OC, SECL for 2021

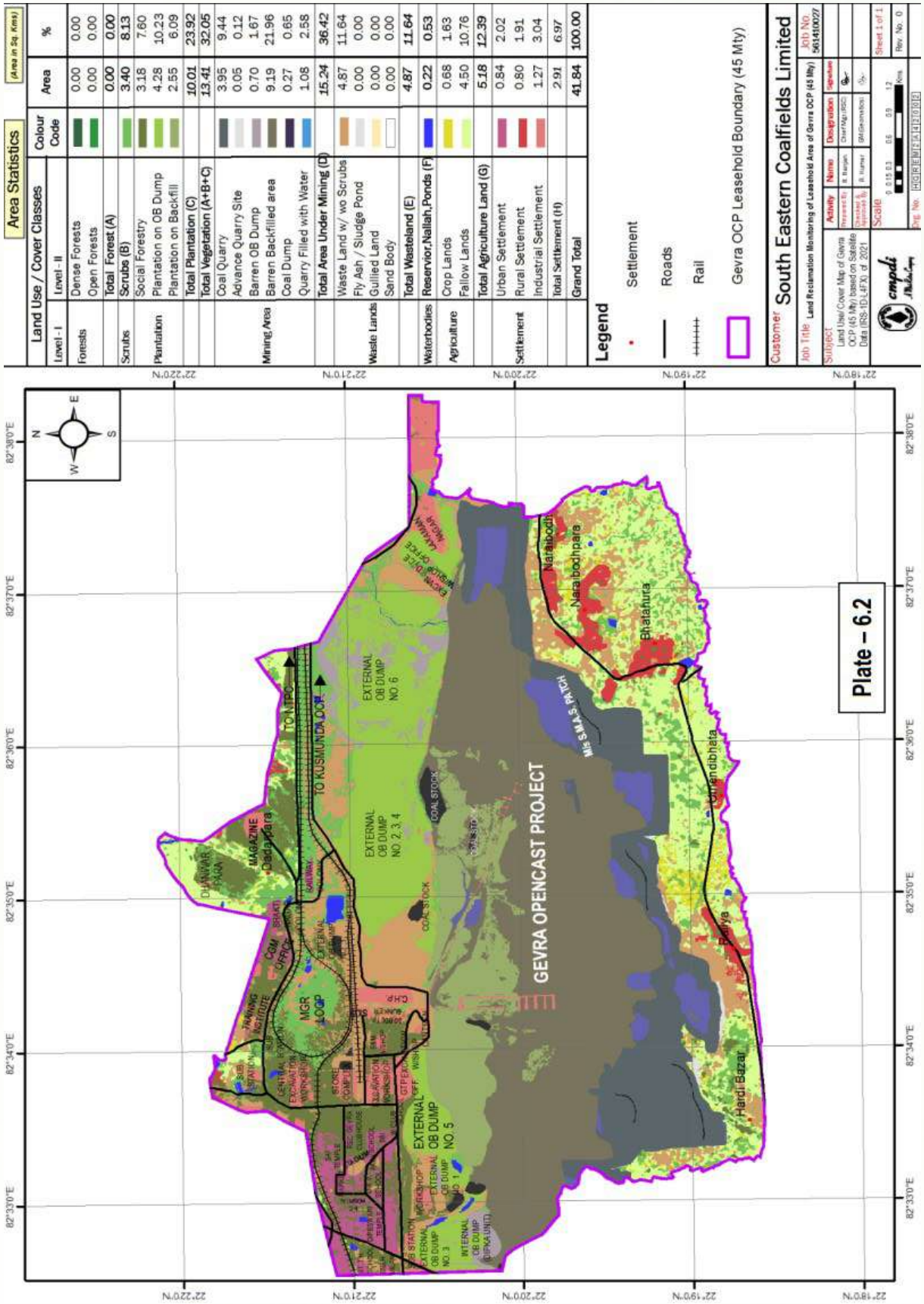
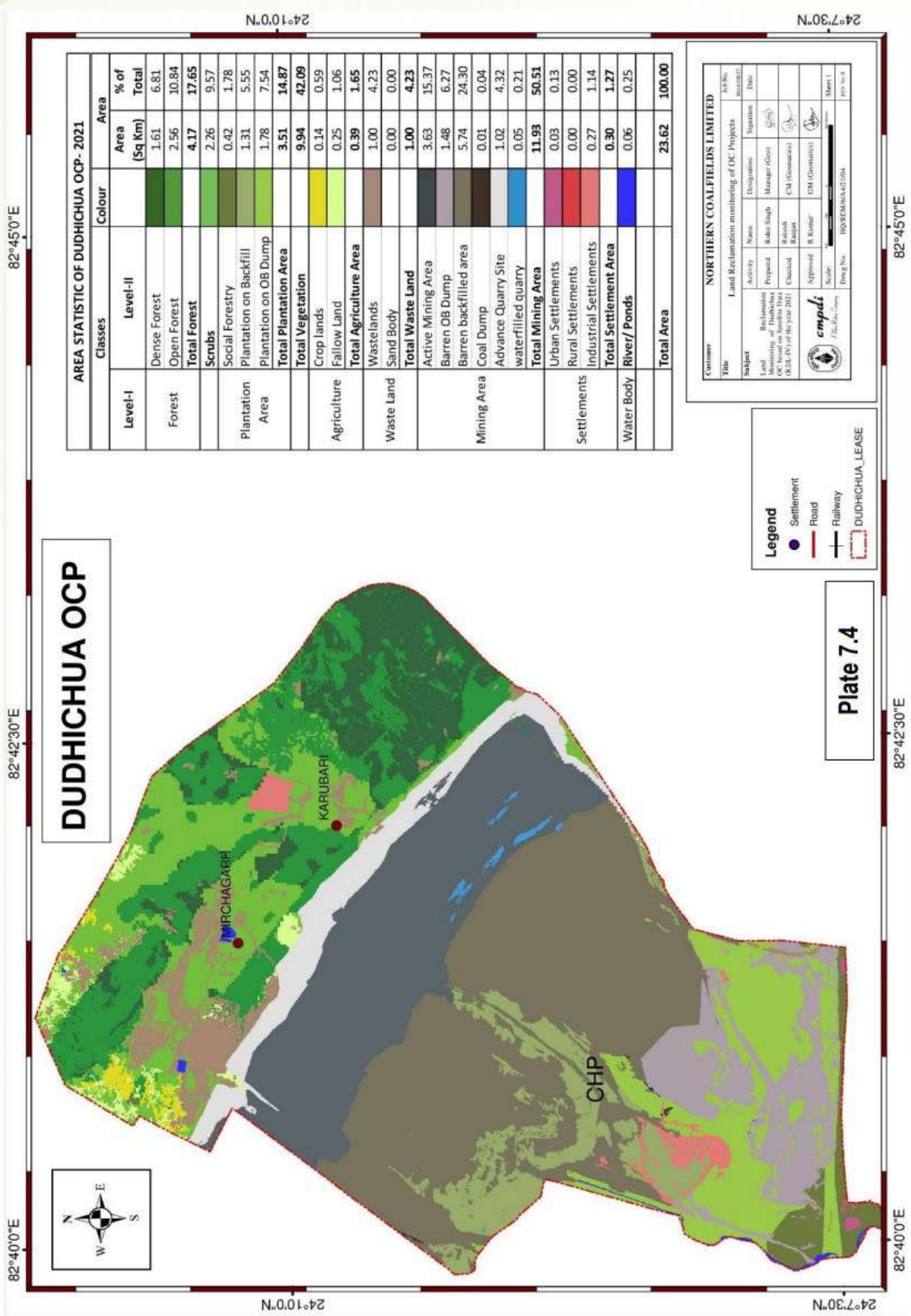


Figure 8.10: Land reclamation status based on satellite data of Gevra OC, SECL for 2021



AREA STATISTIC OF DUDHICHUA OCP- 2021				
Classes		Colour	Area	
Level-I	Level-II		Area (Sq Km)	% of Total
Forest	Dense Forest		1.61	6.81
	Open Forest		2.56	10.84
	Total Forest		**4.17**	**17.65**
Plantation Area	**Scrubs**		2.26	9.57
	Social Forestry		0.42	1.78
	Plantation on Backfill		1.31	5.55
	Plantation on OB Dump		1.78	7.54
	Total Plantation Area		**3.51**	**14.87**
	Total Vegetation		**9.94**	**42.09**
Agriculture	Crop lands		0.14	0.59
	Fallow Land		0.25	1.06
	Total Agriculture Area		**0.39**	**1.65**
Waste Land	Wastelands		1.00	4.23
	Sand Body		0.00	0.00
	Total Waste Land		**1.00**	**4.23**
Mining Area	Active Mining Area		3.63	15.37
	Barren OB Dump		1.48	6.27
	Barren backfilled area		5.74	24.30
	Coal Dump		0.01	0.04
	Advance Quarry Site		1.02	4.32
	waterfilled quarry		0.05	0.21
	Total Mining Area		**11.93**	**50.51**
Settlements	Urban Settlements		0.03	0.13
	Rural Settlements		0.00	0.00
	Industrial Settlements		0.27	1.14
	Total Settlement Area		**0.30**	**1.27**
Water Body	**River/ Ponds**		0.06	0.25
	Total Area		**23.62**	**100.00**

Figure 8.11: Land reclamation status based on satellite data of Dudhichua OC, NCL for 2021

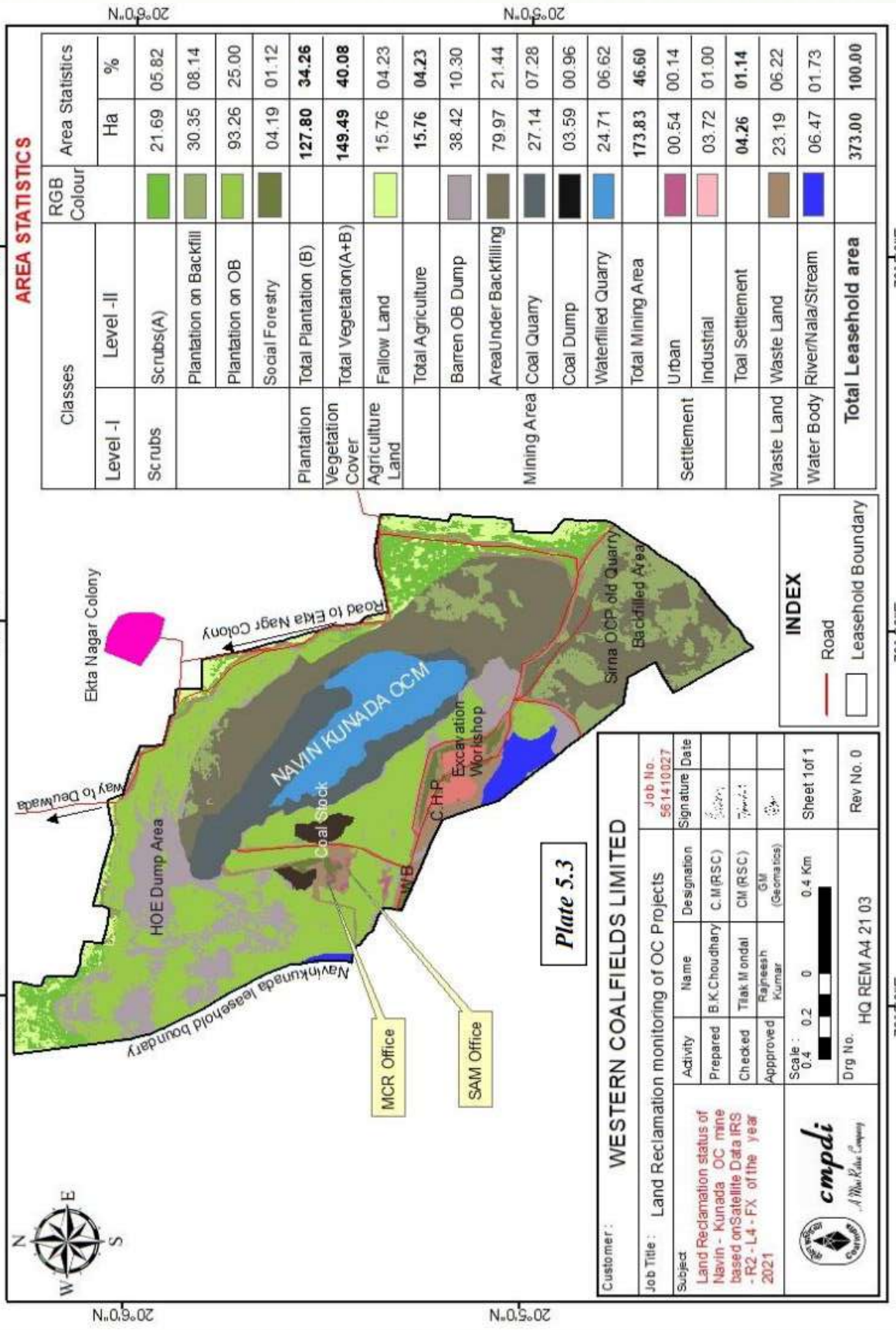


Figure 8.12: Land reclamation status based on satellite data of Navin Kunada OC, WCL for 2021

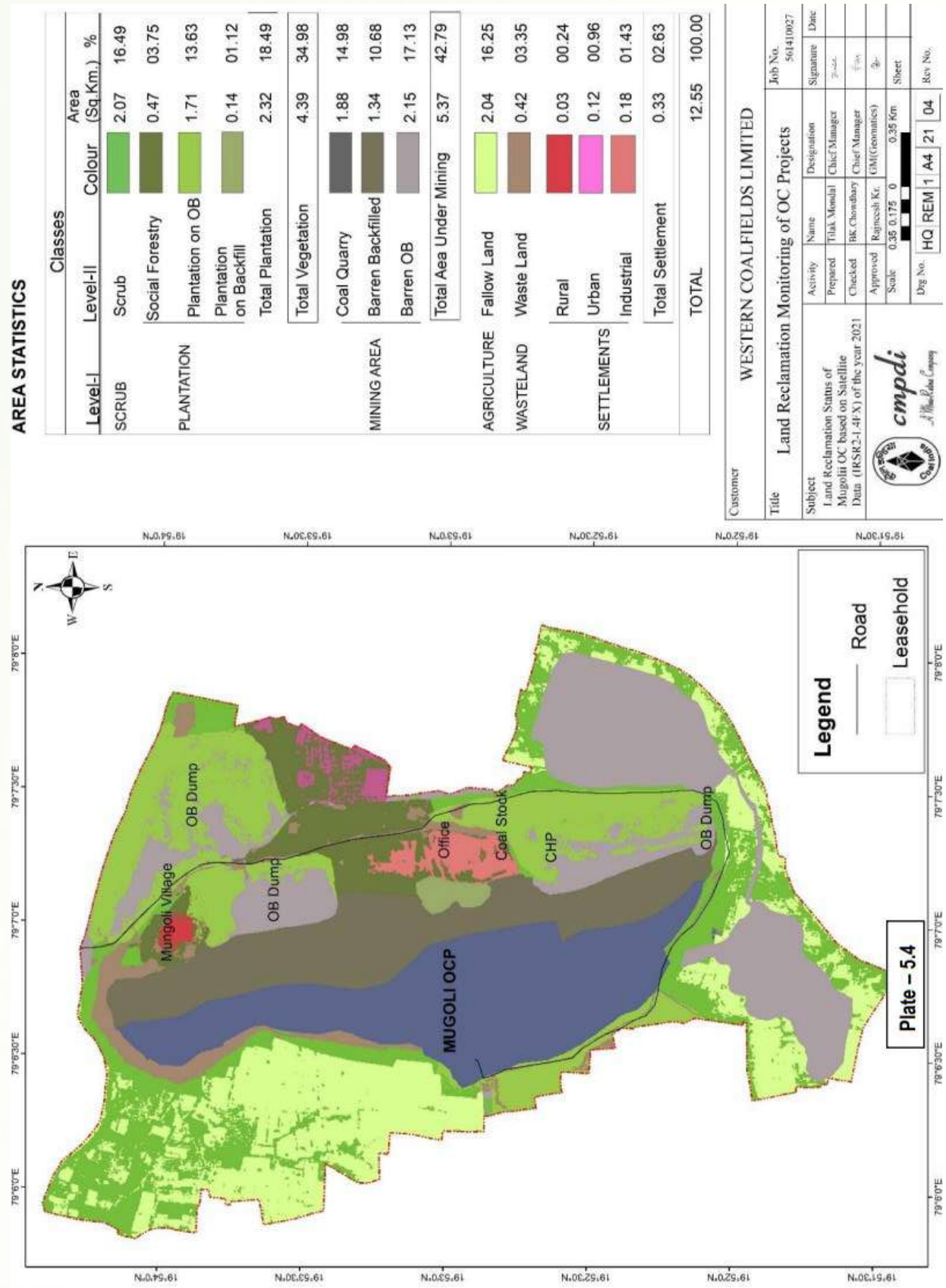


Figure 8.13: Land reclamation status based on satellite data of Mugoli OC, WCL for 2021

8.5 Comparison of Remote Sensing data with data provided by CIL subsidiaries

CIL Subsidiaries have provided data regarding mining and plantation activities. The comparison of two sets of data i.e. data obtained from remote sensing studies and the data provided by CIL subsidiaries is listed below.

Table 8.3: Comparison of remote sensing data with data provided by CIL subsidiaries

Head	Data as per remote sensing studies	Data from subsidiaries provided for Greening Initiatives Report	Percentage difference (%)
Total leasehold area (ha)	278159	276554.3	0.6
Area under active mining + Technically reclaimed area (ha)	39643	41521.6	-4.7
Green cover (ha) (Biological reclamation + Plantation over balance areas / Social forestry)	32116	30002.1	6.6

It is evident from the table above that the total area under plantation done by CIL subsidiaries (including biological reclamation on technically reclaimed areas – 21,016.96 ha and plantation done over other areas in the mine – 8,985.13 ha) is reported as 30,002.09 ha. As compared with the data from remote sensing studies (32,116 ha), there is a difference of 6.6%, which may be deemed acceptable considering the scale of data and difference in data collection and interpretation techniques.

9

Ground Truth Survey At Select Sites

9.0 Ground truthing at select sites

In order to validate the data submitted by coal companies, ground truthing was carried out at some of the project sites across coal & lignite PSUs. Glimpses of the reclamation activities are presented in this chapter along with geotagged photographs.

The company wise name of mine selected is listed hereunder:

- BCCL – Katras Area
- CCL – North Urimari OC, Barka Sayal
- ECL – Jhanjhra UG, Jhanjhra Area
- MCL – Kulda OC, Basundhara Area
- NCL – Krishnashila OC
- SECL - Manikpur OC, Korba Area and Jamuna OC, Jamuna Kotma Area
- WCL – Gokul OC, Umrer Area
- NLCIL – Mine – I
- SCCL – Gauthami Khani (GK) OC, Jawahar Khani (JK)-5 OC, Ramagundam (RG) OC

Katras Area, BCCL – Till FY 21-22, reclamation and plantation has been carried out over 60.78 ha which includes plantation on reclaimed areas, avenue plantation as well as block plantation. Species planted include native fruit bearing species and timber species. Geotagged photographs captured during ground truth survey are presented in below.

Figure 9.1: Glimpses of reclamation & plantation at Katras Area, BCCL

North Urimari OC, Barka Sayal Area, CCL – Biological reclamation has been carried out over external OB dumps using fruit bearing & forestry species. Geotagged photographs captured from two reclaimed patches admeasuring 3.9 ha & 9 ha each are presented in below.

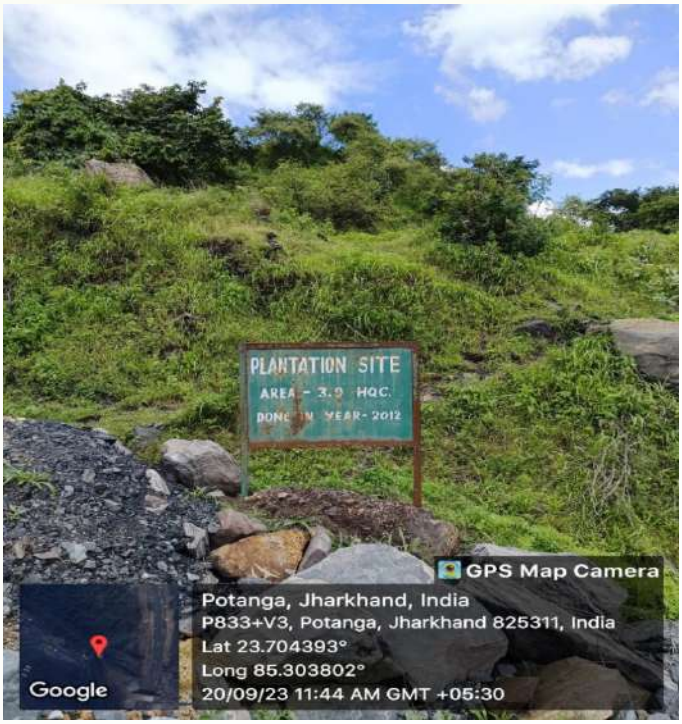


Figure 9.2: Glimpses of reclamation & plantation at North Urimari OC, Barka Sayal Area, CCL

Jhanjra UG, Jhanjra Area, ECL – Till FY 21-22, plantation has been undertaken over 256.5 ha, mostly over subsided areas. Geotagged photographs captured during ground truth survey are presented in below.

Figure 9.3: Glimpses of reclamation & plantation at Jhanjhra UG, Jhanjhra Area, ECL

Kulda OC, Basundhara Area, MCL – Till FY 21-22, biological reclamation & plantation has been done over 30.46 ha area. Plantation has been ongoing over patches since 2007. Geotagged photographs captured during ground truth survey are presented in below.

Figure 9.4: Glimpses of reclamation and plantation at Kulda OC, Basundhara Area, MCL

Krishnashila OC, NCL – Till FY 21-22, biological reclamation & plantation has been done over 143.55 ha area – of which 69.7 ha is over internal dumps and 73.85 ha was over external OB dumps. Miyawaki plantation has also been done over a reclaimed patch. Geotagged photographs captured during ground truth survey are presented in below.

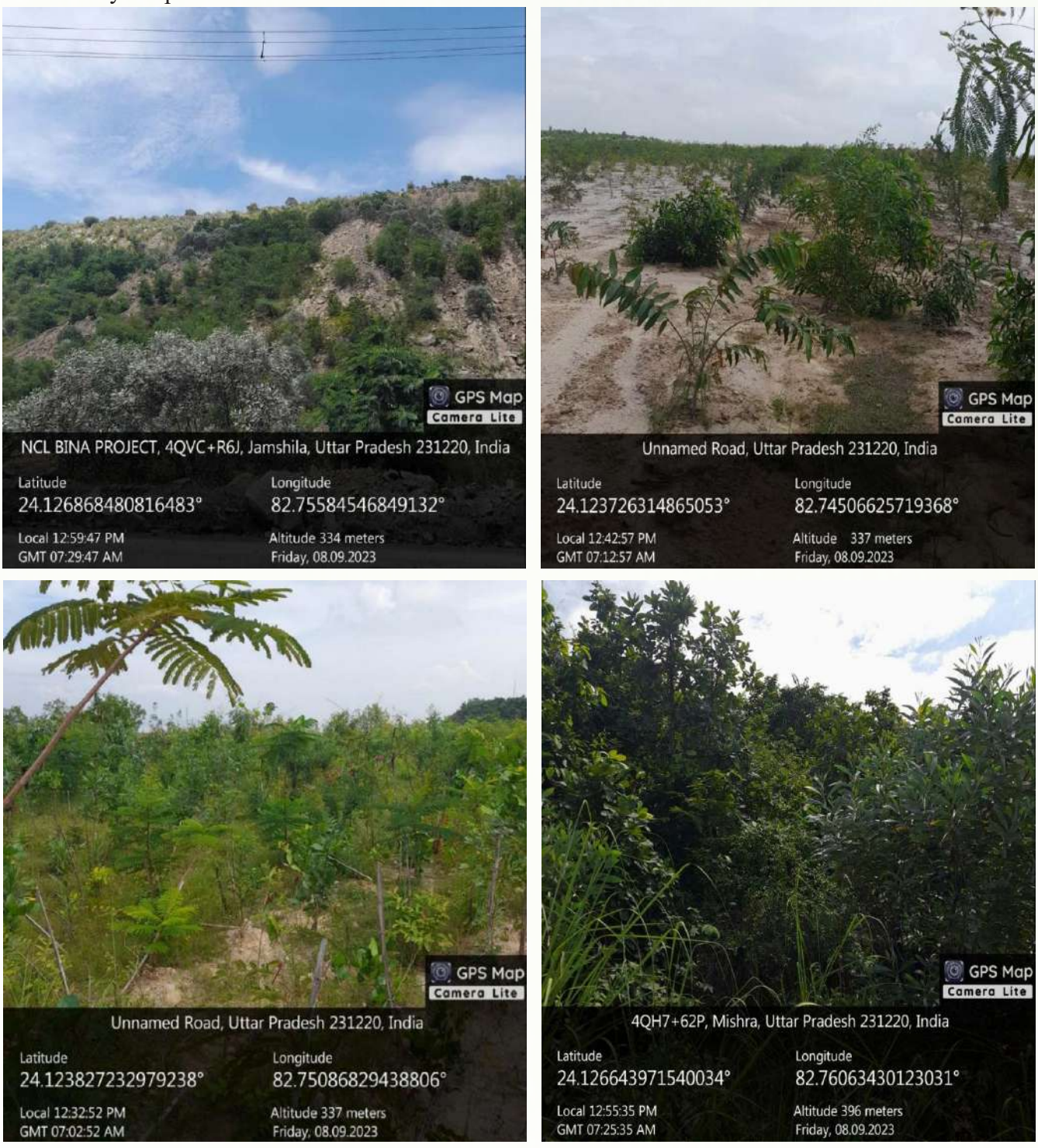


Figure 9.5: Glimpses of reclamation & plantation at Krishnashila OC, NCL

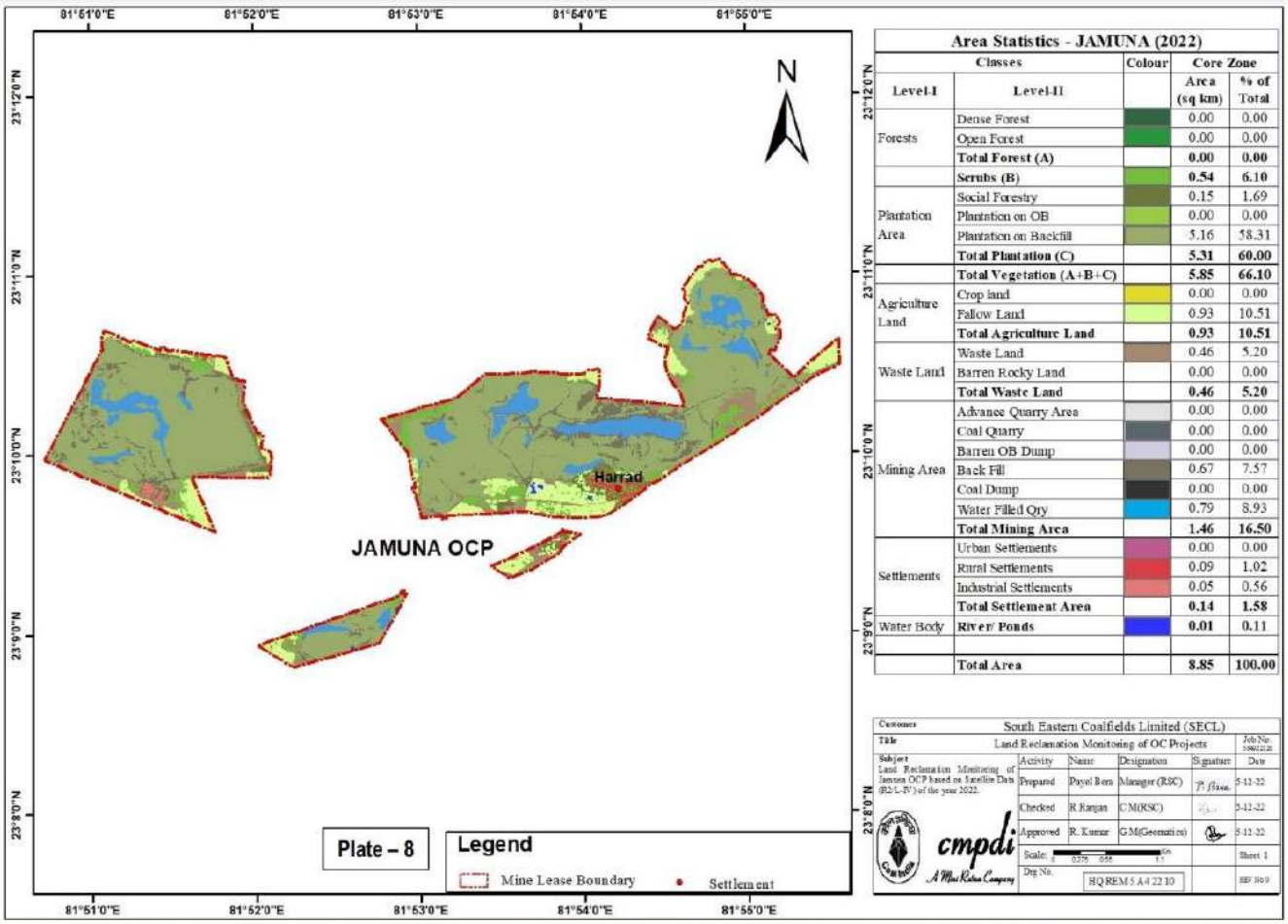
Manikpur OC, Korba Area, SECL - Till FY 21-22, biological reclamation & plantation has been done over 226.5 ha area – of this 177.8 ha is over reclaimed areas and 48.7 ha is avenue plantation. Geotagged photographs captured during ground truth survey are presented in below.

Figure 9.6: Glimpses of reclamation & plantation at Manikpur OC, Korba Area, SECL

Jamuna OC, Jamuna Kotma Area, SECL - Plantation has been carried out on de-coaled areas which include diverted forest land as well as non-forest land.

The plantation carried out on non-forest - backfilled as well as external overburden dumps, is best suitable for Accredited Compensatory Afforestation (ACA), a system of proactive afforestation to be used to obtain approval for non- forestry use of forest land.

Under the guidance of Ministry of Coal, Coal/Lignite PSUs are making extensive efforts to identify non-forest afforested land for compensatory afforestation in future to promote ACA and expedite the Forest Clearance process. Coal/Lignite PSUs have identified about 2838 Ha afforested non-forest de-coaled land so far for compensatory afforestation as per the ACA guidelines. Jamuna OC project is one of the many such examples.



Area Statistics - JAMUNA (2022)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (sq km)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**0.54**	**6.10**
Plantation Area	Social Forestry		0.15	1.69
	Plantation on OB		0.00	0.00
	Plantation on Backfill		5.16	58.31
	Total Plantation (C)		**5.31**	**60.00**
	Total Vegetation (A+B+C)		**5.85**	**66.10**
Agriculture Land	Crop land		0.00	0.00
	Fallow Land		0.93	10.51
	Total Agriculture Land		**0.93**	**10.51**
Waste Land	Waste Land		0.46	5.20
	Barren Rocky Land		0.00	0.00
	Total Waste Land		**0.46**	**5.20**
Mining Area	Advance Quarry Area		0.00	0.00
	Coal Quarry		0.00	0.00
	Barren OB Dump		0.00	0.00
	Back Fill		0.67	7.57
	Coal Dump		0.00	0.00
	Water Filled Qry		0.79	8.93
	Total Mining Area		**1.46**	**16.50**
Settlements	Urban Settlements		0.00	0.00
	Rural Settlements		0.09	1.02
	Industrial Settlements		0.05	0.56
	Total Settlement Area		**0.14**	**1.58**
Water Body	**River/ Ponds**		**0.01**	**0.11**
	Total Area		**8.85**	**100.00**

Figure 9.7: Reclamation Monitoring by Satellite for 2022-23 of Jamuna OC, Anuppur, MP

Figure 9.8: Satellite image comparison for the years 1985 vs 2023 w.r.t Jamuna OC, Anuppur, MP

Figure 9.9(A): Plantation on overburden (OB) dump of Jamuna OC (Lush green Plantation)

Figure 9.9(B): Plantation on overburden (OB) dump of Jamuna OC (Lush green Plantation)

Gokul OC, Umrer Area, WCL - Till FY 21-22, plantation has been done over 30 ha area, of which 10 ha plantation was completed during 2018-19 & balance 20 ha was done during 2019-20. Geotagged photographs captured during ground truth survey are presented in below.

Figure 9.10: Glimpses of reclamation & plantation at Gokul OC, Umrer OC, WCL

Mine – I, NLCIL – Till FY 21-22, biological reclamation has been completed over 1556.49 ha – of which 1078.35 ha is over internal dumps and 478.14 ha is over external OB dumps. Hi-tech cultivation practices are also being done over reclaimed patches. Geotagged photographs shared by NLCIL are presented below.

Figure 9.11: Glimpses of reclamation & plantation at Mine – I, NLCIL

Gauthami Khani (GK) OC, Jawahar Khani (JK) – 5 OC, Ramagundam (RG) OC - 1, SCCL – Till FY 21-22, biological reclamation and plantation has been done over 470.84 ha, 283.04 ha and 267.26 ha respectively under these projects. Geotagged photographs shared by SCCL are presented below.

Figure 9.12: Glimpses of reclamation & plantation at GK OC, JK-5 OC & RG OC – 1, SCCL

10

Summary & Conclusion

10.0 Conclusion

The coal mining, like any other mining activity, is a site-specific industry and the mineral has to be excavated from its place of occurrence. Since majority of coal production at present comes from opencast mining for the obvious reason of more production and productivity, the land degradation is inevitable. Though, such degradation results in loss of agriculture, forests and biodiversity and aesthetics, it also opens up avenues for the new type of post mining land usage that can be utilised for the local community in a better and planned manner.

With the issuance of Mine Closure Guidelines in 2009, it has become mandatory for all the mines to have mine closure plan that encompasses progressive as well as final mine closure plans. The concurrent reclamation is being practices and mine closure audit is undertaken to ensure that progressive mine closure and biological reclamation go hand in hand with mining operations to ensure restoration of ecology and biodiversity at the earliest possible and render the degraded area into productive land usage.

10.1 Summary w.r.t reclamation and plantation statistics

Based on the analysis of data, the following summary w.r.t reclamation and plantation statistics for coal & lignite PSUs is arrived at:

a) Total project area reported across coal & lignite PSUs is 3,27,273.2 ha. This excludes few old closed mines for which relevant data was unavailable as well as few planned projects which have not commenced full scale operations.

b) Majority of the project area 1,53,703.6 ha (~47.2%) are undisturbed areas. Areas lacking surface rights and other patches under non-mining uses account for 19,206.41 ha (5.9% of the total project area). This may change in the future based on land use planning changes in line with mining plans.

c) Areas reported to be non-amenable for plantation account for 31,817.20 ha (9.8% of the total project area). This includes areas having presence of water body / mine sump, infrastructural amenities like roads, buildings, stockyards, sidings, etc., and areas earmarked for future expansion, patches acquired but pending clearances, etc. W.r.t closed mines, given the latest guidelines from MoC w.r.t management of mines discontinued / abandoned / closed before 2009, some portion under these areas may become amenable in the future subject to feasibility and in line with revision / approval of mine closure plans.

d) Forest land within lease accounts for 68,186.9 ha, averaging at 20.9% of the project area. Broken forest land so far is 23,080.90 ha, averaging at 7.1% of the project area.

e) For both opencast as well as underground mines, the land footprint is considerable and reclamation monitoring must be done with equal significance.

f) Areas directly under the influence of mining (including quarry areas, subsided areas, OB dumps, other surface uses, infrastructure areas, etc.) account for 1,20,862.5 ha (37.1% of the total project area).

   a. Areas under active mining uses (excavated, quarry, subsidence patches and other surface uses) account for 29,455.21 ha (24.4% of net area directly under the influence of mining)

   b. Biological reclamation over excavated areas, quarry, subsidence patches and overburden dumps has been done over 29,592.87 ha (24.5% of net area directly under the influence of mining) and plantation over other areas has been done over 12,673.55 ha (10.5% of net area directly under the influence of mining) – thus total reclamation has been executed over 42,266.4 ha, which is 35% of the area directly under the influence of mining. Of this, 34,445.3 ha has been done over running mines, which is almost 81.5% of the total plantation and balance 7,821.1 ha (i.e. 18.5%) has been reported from closed mines.

   c. As for future scope for reclamation, areas where technical & biological reclamation is under progress or to be done account for 36,100.4 ha (29.9% of net area directly under the influence of mining). Of this, 33,868.9 ha is available under running mines and 2,231.5 ha is available under closed mines.

   d. Areas where plantation may be taken up in the future account for 13,040.43 ha, which is 10.8% of the net area directly under the influence of mining.

g) Thus the net scope for future plantation is almost 49,140.8 ha – which accounts for 40.7% of the the net area directly under the influence of mining. This reflects the long- term plantation scope for coal sector and is subject to project planning and other project specific criteria.

h) In addition, there will also be future scope for plantation based on identification of amenable patches in the future from the areas currently reported as non-amenable for plantation.

Table 10.1: Overall statistics - reclamation and plantation across coal & lignite PSUs

PSUs	No. of mines	Total project area (ha)	Active mining patches, subsidence areas, other surface areas	Areas not amenable for plantation	Break-up within project area (in ha)						Net plantation achieved within project area (ha)	Plantation done outside project areas (ha)	Overall plantation achieved (ha)
					Areas lacking surface rights & other areas	Undisturbed areas	Technical/ Biological reclamation ongoing / to be taken up	Areas amenable for future plantation	Biological reclamation completed	Plantation over balance areas			
BCCL	91	27287.25	2757.24	3335.47	0	17835.11	1847.46	37.63	1179.97	294.37	1474.34	68.4	1542.74
CCL	53	25969.61	3325.94	4140.98	908.8	8258.64	3144.39	2111.73	3499.09	580.03	4079.12	531.39	4610.51
ECL	91	55194.35	2067.87	3412.31	0	43401.86	2999.88	353.92	2508.21	450.1	2958.31	41.22	2999.53
MCL	27	27378.36	2390.41	2916.99	4571.1	10204.13	3431.21	1582.92	1598.08	683.53	2281.61	163.02	2444.63
NCL	11	18877.07	1522.48	146	0	5576.02	3786.86	1774.2	3293.53	2777.98	6071.51	45.00	6116.51
SECL	83	63958.95	3943.13	5099.92	7578.85	30461.06	5053.83	3005.04	6123.15	2693.98	8817.13	950.89	9768.02
WCL	96	56980.71	8244.65	10149.77	6147.66	21190.66	3813.49	3138.85	2790.71	1505.14	4295.85	245.68	4541.53
NEC	4	907.96	199.11	10.1	0	126.74	229.48	318.31	24.22	0	24.22	25.52	49.74
CIL	456	276554.26	24450.83	29211.54	19206.41	137054.22	24306.6	12322.6	21016.96	8985.13	30002.09	2071.12	32073.21
NLCIL	5	15720.24	3525.55	40.06	0	7121.71	1897.65	327.59	2718.81	88.87	2807.68	58.57	2866.25
SCCL	50	34998.65	1478.83	2565.6	0	11211.16	9896.16	390.24	5857.1	3599.55	9456.65	5601.22	15057.87
TOTAL	511	327273.15	29455.21	31817.2	19206.41	155387.09	36100.41	13040.43	29592.87	12673.55	42266.42	7735.91	50002.33

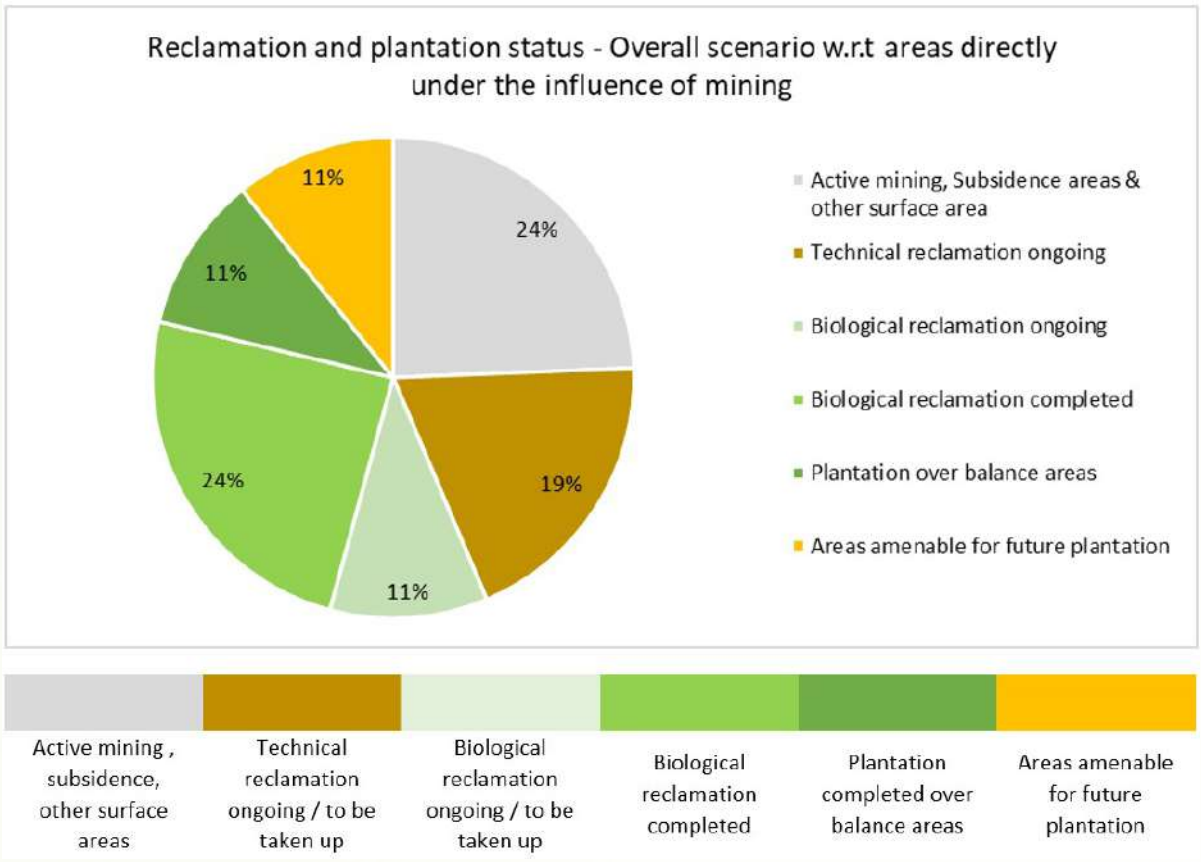


Figure 10.1: Land reclamation and plantation – Overall status across coal & lignite PSUs

Table 10.2: Summary of statistics w.r.t reclamation and plantation by coal & lignite PSUs

Sl.No.	Attributes	Value	Remarks, if any
1	Total geographical area (TGA) of the country (ha)	32,90,00,000	
2	Area of coal mining including closed mines (ha)	3,27,273	
3	Percentage of coal mining area vis-à-vis TGA (%) including closed mines	0.1	
4	Area of degraded land on account of mining (subsidence/OB Dump/mined out area and other surface areas) (ha)	1,37,902	42.14% of total coal mining area
5	Area biologically reclaimed so far (ha)	29592.87	9.04% of total coal mining area
6	Plantation at other locations (ha)	12673.55	3.87% of total coal mining area
7	Balance area available for reclamation (ha)	36100.41	11.03% of total coal mining area
8	Other area available for plantation in future (ha)	13040.43	3.98% of total coal mining area
9	Forest land	68,186.89	

Sl.No.	Attributes	Value	Remarks, if any
10	Forest land diverted / broken so far (ha)	23080.88	Against the broken forest land, reclamation + plantation done so far is over 42,266.42 ha
11	No. of saplings planted so far within mining area (nos.)	10,74,64,934	
12	No. of sapling planted outside and distributed to community and other agencies (nos.)	4,98,00,238	
13	Plantation created for every ha of forest land broken (ha / ha)	1.83	83% reclamation + plantation done in excess of forest land broken

Given timely planning and monitoring over these identified patches and no major change in land use, coal companies may go on to achieve plantation over almost 28.1% of the total project area going forwards. A future roadmap for plantation was prepared in consultation with the coal companies and the same has been presented further in this chapter.

It goes without saying that achievement of such plantation targets are subject to challenges like changes in reclamation schedules, diversion of reclaimed areas for alternate purposes, future expansion plans, surrender of surface rights, etc.

For forestland diverted for mining activities, NPV is being made to compensate for the loss of eco-system services. In addition, compensatory afforestation over twice the area on degraded forestland is being undertaken. In addition, the mined-out area is being reclaimed as per reclamation plan of mine. It may therefore be concluded that diversion of forestland for mining is being compensated for.

10.2 Summary w.r.t type of plantation undertaken

The thrust on plantation in the mining sector has provided avenues to mine operators to opt for new varieties of useful plant species like medicinal plants, fruit bearing trees, bamboo plantations, ornamental plants, etc. which have resulted into better aesthetics of the reclaimed sites. Some of the sites are now in the process of creation of eco-parks. Such sites are being integrated with local tourism circuit for attracting tourists.

Coal companies are now planning plantations/reclamations with the objective for restoration of ecology and biodiversity of the degraded mine sites. Some demonstration work has already been completed in BCCL, CCL, NCL, etc. The experience gained will be replicated at other sites in a phased manner. *Miyawaki plantation* is another avenue which is being explored by mining companies – certain mine patches are already being developed as *"Miyawaki forests"*.

10.3 Mines showing highest progress w.r.t plantation and reclamation (company wise)

Based on the submitted data, select mines from each coal PSUs showing highest percentage in terms of reclamation have been presented hereunder. The top three mines having highest percentage of reclamation / plantation w.r.t total project area have been listed in the table below.

Table 10.3: Mines showing highest progress w.r.t plantation & reclamation

PSU	Name of project	Area / Cluster	Status of mine	Project area (ha)	Total plantation area / reclamation done so far (ha)	Plantation area as percentage of project area (%)
BCCL	Padugora UG	Cluster XIII	Inoperative	17.6	15.0	85.2
	Phularitand OC, Muraidih UG, Shatabdi OC	Cluster II, Barora	Running	1118.7	307.9	27.5
	Muchraidih UG	Cluster XIII	Inoperative	83.2	20.0	24.0
CCL	Kuju UG	Kuju	Closed	258.7	216.0	83.5
	Sawang Colliery	Kathara	Closed	641.3	364.5	56.8
	Argada UG	Argada	Closed	544.5	215.0	39.5
ECL	Barmondia UG	Salanpur	Production suspended	665.0	212.8	32.0
	Khottadih UG & OC	Pandaveshwar	Running	770.0	179.5	23.3
	Chapapur I OC & UG	Mugma	Running	480.0	95.0	19.8
MCL	Jagannath OC	Jagannath	Running	553.9	169.6	30.6
	Chhendipada OC	Bharatpur	Closed	24.3	7.3	30.0
	Belpahar OC	Lakhanpur	Running	1440.0	416.6	28.9
NCL	Gorbi OC	-	Closed	459.0	313.0	68.2
	Jhingurda OC	Jhingurda	Running	1200.0	566.7	47.2
	Kakri OC	Kakri	Running	828.0	354.3	42.8
SECL	Jainagar UG	Bisrampur	Closed	313.4	252.0	80.4
	Baiga OC	Sohagpur	Closed	50.0	39.1	78.2
	Jamuna OC	Jamuna Kotma	Closed	1052.5	729.0	69.3
WCL	Rawanwara OC	Pench	Closed	35.6	27.0	75.8
	Haranbhata OC	Pench	Closed	61.3	35.0	57.1
	Shobhapur UG	Pathakhera	Closed	343.2	160.1	46.6
NLCIL	Lignite Mine – I	-	Running	3635.4	1556.5	42.8
	Barasingsar Lignite Mine	-	Running	971.0	163.58	16.9
	Lignite Mine IA	-	Running	2005.8	268.7	13.4
SCCL	Goleti 1 & 1A Incline	BPA	Closed	658.3	594.2	90.3
	VK-7 Incline	Kothagudam	Closed	580.2	468.7	80.8
	Dorli OC - I	BPA	Closed	510.1	357.8	70.1

As can be seen above, these mines have set an exemplary example through their plantation and reclamation progress. The plantation strategies, challenges and solutions adopted by these mines may be further studies by coal companies for replication of success at other sites.

10.4 Areas amenable for future plantation

As summarized earlier, majority of project area (almost 47.2%) is reported under undisturbed areas (47.7%), whereas areas lacking surface rights and under other non-mining uses account for 5.9% of the total project area. Certain areas are earmarked for expansion or planned infrastructure, having infrastructure / mine voids, etc. and are thus not amenable for plantation at present – these account for 9.8% of the total project area.

Coal companies may review the end use for such patches and chalk out patches which may be used for plantation to increase the overall green cover and complement with other sustainability initiatives like development of eco-parks, mine water tourism sites, etc. W.r.t closed mines, given the latest guidelines from MoC[53] w.r.t management of mines discontinued / abandoned / closed before 2009, some portion under these areas may become amenable in the future subject to feasibility and in line with revision / approval of mine closure plans.

In addition, sites already identified as available for plantation include areas over which technical and biological reclamation is ongoing/to be taken up (36,100.41 ha) & other areas which are amenable for future plantation (13,040.43 ha).

Table 10.4: Areas with scope for future plantation – company wise

PSU	Project area, in ha	Areas with scope for future plantation (ha)[54]
BCCL	27287.25	1885.09
CCL	25969.61	5256.12
ECL	55194.35	3353.80
MCL	27378.36	5014.13
NCL	18877.07	5561.06
SECL	63958.95	8058.87
WCL	56980.71	6952.34
NEC	907.96	547.79
CIL	276554.26	36629.20
NLCIL	15720.24	2225.24
SCCL	34998.65	10286.40
TOTAL	327273.15	49140.84

MoC also has an ambitious plantation roadmap from FY 2019-20 till FY 2030 with a goal to achieve bio-reclamation and plantation over 30,000 ha of land in coalfields by 2030. The plantation undertaken by coal companies since 2019-20 and the proposed roadmap for plantation for the upcoming period (i.e. from FY 24-25 to FY 29-30) is provided in the table below:

[53] Source: Guidelines for the Management of Mines discontinued / abandoned / closed before the year 2009 issued by MoC vide order dated 28.10.2022

[54] Sum of areas with ongoing technical & biological reclamation and balance areas amenable for future plantation

Table 10.5: Plantation during the decade & proposed roadmap for future plantation till 2030

Coal co.	Plantation undertaken so far (2019-20 till 2023-24)					Proposed roadmap – FY 24-25 to FY 29-30						Total plantation achievable over 10 years (in ha)	% contribution to overall target by MoC
	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10	Y-11		
	19-20	20-21	21-22	22-23	23-24*	24-25	25-26	26-27	27-28	28-29	29-30		
BCCL	54	56	107	64	86	100	105	110	120	125	125	20938	69.78
CCL	45	58	157	179	222	240	250	260	270	300	320		
ECL	127	133	168	104	159	160	170	180	190	200	205		
MCL	45	90	136	183	277	270	280	290	310	320	350		
NCL	214	188	325	549	757	480	490	510	540	600	620		
SECL	272	270	352	333	449	475	490	510	540	600	620		
WCL	54	66	221	200	200	230	360	400	430	430	450		
NEC	2	1	3	1	0	1	1	1	1	1	1		
CIL	813	862	1469	1613	2150	1956	2146	2261	2401	2576	2691		
NLCIL	169	183	138	206	139	225	250	250	250	250	250	2310	7.7
SCCL	652	809	580	558	562	575	600	600	600	600	620	6756	22.52
TOTAL	1634	1854	2187	2377	2851	2756	2996	3111	3251	3426	3561	30004	100
MoC's Plantation Roadmap upto 2030	1600	1800	2000	2200	2400	2700	2950	3200	3450	3700	4000	30000	

*Provisional data for FY 23-24

10.5 Post plantation care and monitoring

The success and consistency of plantation efforts can be gauged only after a time span of minimum 3 years to assuage the growth and self-sustenance of planted species given the site- specific micro climates. Usually, survivability of saplings is considered as 80% as a thumb-rule and hence, supplementary plantation programmes / gap plantation initiatives are required periodically. Coal companies need to have periodic internal reviews to plan and monitor plantation programmes and their success at area levels. It is suggested to have periodic ground truth surveys for sites where plantation has been undertaken to gauge the survivability and self-sustenance of the species and plan necessary remedial actions, if necessary.

Change in land use is also a major concern especially if some reclaimed site is to be redesignated for other end uses like creation of infrastructure, excavation in case of mining leftover reserves, cleared for access, etc. In such cases, well net plantation figures may come down for such mining sites in the absence of compensatory plantation.

Remote sensing and mapping are key tools which can be used to supplement the efforts by coal companies by periodically mapping the reclamation status. Remote sensing based reclamation clubbed with ground truth surveys will help to arrive at clear picture of plantation and reclamation achieved by coal mining projects.

10.6 Conclusion and way forward

India is signatory to Convention of Biodiversity (CBD), Paris Agreement on Climate Change and UNCCD on Land Degradation Neutrality. The reclamation of mined out area and plantation is an important component towards creation of carbon sinks, improving ecology and biodiversity and reducing the extent of wastelands in India. With sustained efforts and monitoring, coal companies may be able to aid with India's targets towards land degradation neutrality.

Coal companies also have an added advantage in this regard that they can leverage the sites reclaimed by them under Accredited Compensatory Afforestation (ACA) scheme notified by MoEF&CC in lieu of forest land.

Given the thrust on sustainability initiatives like eco-parks and mine tourism sites, the reclaimed patches will complement the efforts undertaken by coal companies.

Use of remote sensing and drone based surveys along with ground truth drives will be beneficial in ensuring growth and self-sustenance of planted patches.

ANNEXURE-I : Consolidated company wise break-up of land reclamation status across closed mines

Coal Co.	Type of Mine (UG/ OC)	# of mines	Mine Area (Ha)	Area break-up for Quarry / Subsidence area					
				Sub-sidence Area	Surface area under any other use[1]	Other areas (areas not under subsidence, lacking surface rights, etc.)	Break-up of areas amenable for reclamation / plantation		
							Total area amenable for biological reclamation	Break-up of Total area for biological reclamation under subsided area	
								Area already Biologically reclaimed over subsided area	Balance area to be Biologically reclaimed over subsided area
BCCL	OC	0	-	-	-	-	-	-	-
	UG	0	-	-	-	-	-	-	-
	Mix	0	-	-	-	-	-	-	-
	Total	0	-	-	-	-	-	-	-
CCL	OC	2	1371.9	-	-	-	-	-	-
	UG	8	3301.8	432.7	548	716.2	526.7	526.7	0
	Mix	2	973.3	0	0	0	0	0	0
	Total	12	5647.1	432.7	548	716.2	526.7	526.7	0
ECL	OC	0	-	-	-	-	-	-	-
	UG	0	-	-	-	-	-	-	-
	Mix	0	-	-	-	-	-	-	-
	Total	0	-	-	-	-	-	-	-
MCL	OC	3	1368.72	-	-	-	-	-	-
	UG	6	5462.76	0	0	4571.1	0	0	0
	Mix	0	0	-	-	-	-	-	-
	Total	9	6831.48	0	0	4571.1	0	0	0
NCL	OC	1	459	-	-	-	-	-	-
	UG	0	-	-	-	-	-	-	-
	Mix	0	-	-	-	-	-	-	-
	Total	1	459	0	0	0	0	0	0
SECL	OC	5	3339.5	-	-	-	-	-	-
	UG	12	5954.7	868	637.9	2113.4	429.2	429.2	0
	Mix	0	-	-	-	-	-	-	-
	Total	17	9294.1	868	637.9	2113.4	429.2	429.2	0
WCL	OC	17	4136.7	-	-	-	-	-	-
	UG	22	10344.1	181	38.4	2505.2	181	181	0
	Mix	0	0	-	-	-	-	-	-
	Total	39	14480.8	181	38.4	2505.2	181	181	0
NEC	OC	0	-	-	-	-	-	-	-
	UG	0	-	-	-	-	-	-	-
	Mix	0	-	-	-	-	-	-	-
	Total	0	-	-	-	-	-	-	-
CIL	OC	28	10675.8	0	0	0	0	0	0
	UG	48	25063.4	1481.7	1224.31	9905.9	1136.9	1136.9	0
	Mix	2	973.3	0	0	0	0	0	0
	Total	78	36712.5	1481.7	1224.31	9905.9	1136.9	1136.9	0
NLCIL	OC	0	-	-	-	-	-	-	-
	UG	0	-	-	-	-	-	-	-
	Mix	0	-	-	-	-	-	-	-
	Total	0	-	-	-	-	-	-	-
SCCL	OC	2	806.56	0	0	0	0	0	0
	UG	7	3920.21	908.86	0	0	908.86	148.1	760.76
	Mix	0	-	-	-	-	-	-	-
	Total	9	4726.77	908.86	0	0	908.86	148.1	760.76
NET TOTAL	OC	30	11482.4	0	0	0	0	0	0
	UG	55	28983.6	2390.6	1224.3	9905.9	2045.8	1285	760.8
	Mix	2	973.3	0	0	0	0	0	0
	Total	87	41439.3	2390.6	1224.3	9905.9	2045.8	1285	760.8

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[1] Areas occupied by last cut or voids or water body, etc.

Area break-up for OB dumps					Plantation in remaining mine area				
Total area of external OB Dump	Break-up of OB dump area				Balance mine area (Ha)	Break-up of balance mine area			
	Area pending technical reclamation	Area tech-nically reclaimed	Break-up of technically reclaimed area			Areas not amenable for planta-tion*	Areas where plantation can be done	Break-up of areas where plantation can be done	
			Area biologically reclaimed	Balance area to be biologically reclaimed				Area already under plantation	Area where plantation may be taken up in future
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
586.8	190	396.8	326	70.8	785.2	590.3	194.9	0	194.9
0	0	0	0	0	1604.9	1041.7	563.3	223.5	339.6
262.5	0	262.5	240.5	22	710.8	586.8	124	124	0
849.3	190	659.3	566.5	92.8	3100.9	2218.8	882	347.5	534.5
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
349	54	295	241	54	1019.7	985.3	34.4	16.5	17.9
0	0	0	0	0	891.7	865.3	26.3	16.5	9.8
-	-	-	-	-	-	-	-	-	-
349	54	295	241	54	1911.4	1850.7	60.7	32.9	27.8
126	0	126	126	0	333	146	187	187	0
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
126	0	126	126	0	333	146	187	187	0
1323.5	6.5	1317	994.5	322.55	2015.9	1034.5	981.5	873.1	108.4
		0			2335.4	2198.9	136.5	136.5	0
-	-	-	-	-	-	-	-	-	-
1323.5	6.5	1317	994.5	322.55	4351.3	3233.4	1117.9	1009.6	108.4
1351.5	505.1	846.4	600.7	245.7	2785.1	2340.18	444.9	131.25	313.7
		0			7619.5	7349	270.5	260.9	9.6
-	-	-	-	-	-	-	-	-	-
1351.5	505.1	846.4	600.7	245.7	10404.6	9689.2	715.4	392.1	323.3
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
3736.9	755.6	2981.3	2288.2	693.1	6939	5096.3	1842.7	1207.8	634.9
0	0	0	0	0	12451.4	11455	996.5	637.4	359.1
262.5	0	262.5	240.5	22	710.8	586.8	124	124	0
3999.4	755.6	3243.8	2528.7	715.1	20101.2	17138	2963.2	1969.2	994
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
371.41	0	371.41	371.41	0	435.15	200.22	234.93	178.95	55.98
0	0	0	0	0	3011.35	1422.11	1589.24	1487.89	101.35
-	-	-	-	-	-	-	-	-	-
371.41	0	371.41	371.41	0	3446.5	1622.33	1824.17	1666.84	157.33
4108.3	755.6	3352.7	2659.6	693.1	7374.2	5296.5	2077.7	1386.7	690.9
0	0	0	0	0	15462.7	12877.1	2585.7	2125.3	460.4
262.5	0	262.5	240.5	22	710.8	586.8	124	124	0
4370.8	755.6	3615.2	2900.1	715.1	23547.7	18760.4	4787.4	3636	1151.3

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*(eg. occupied by road, infra, water body etc.)

ANNEXURE-II : Consolidated company wise break-up of land reclamation status across running mines

Coal Company	Type of Mine	# of mines	Mine Area (Ha)	Approved EC Capacity	UG Mines Area Break-up					OC Mines Area Break-up					
					Subsidence Area	Infrastructure area[2]	Un- disturbed area	Plantation in mine area (in ha)	Other Areas[3]	Area Excavated	Area under external OB Dump	Infrastructure area[2]	Un- disturbed area	Break-up of excavated area	
														Areas not backfilled[4]	Area pending technical reclamation
BCCL	OC	22	7633.53		0	0	0	0	0	1689.25	561.6	860.91	4521.77	625.28	782.78
	UG	36	11535.32	93.04	865.17	1713.65	8536.5	420	0	0	0	0	0	0	0
	Mixed	33	8118.4		82.72	584.63	2007.01	241.32	0	1640.66	283.94	508.29	2769.83	824.64	346.3
	Total	91	27287.25	93.045	947.89	2298.28	10543.51	661.32	0	3329.91	845.54	1369.2	7291.6	1449.92	1129.08
CCL	OC	36	17840.59	140.42	0	0	0	0	0	5803.19	1742.42	2964.16	7330.85	2018.77	1409.41
	UG	4	1571.78	1.16	118.66	450.85	717.13	92.62	192.56	0	0	0	0	0	0
	Mixed	1	910.16	2.05	0	56.92	5.1	70	0	142.5	170	260.08	205.56	140	0
	Total	41	20322.53	143.63	118.66	507.77	722.23	162.62	192.56	5945.69	1912.42	3224.24	7536.41	2158.77	1409.41
ECL	OC	13	11318.38	56.18	0	0	0	0	0	2639.9	726.53	635.18	7316.77	272.31	1857.28
	UG	32	18266.27	16.09	937.59	1811.59	14578.43	938.66	0	0	0	0	0	0	0
	Mixed	46	25609.7	35.23	406.14	1592.28	18260.97	869.7	0	855.84	201.6	177.28	3245.69	167.18	305.41
	Total	91	55194.35	107.5	1343.73	3403.87	32839.4	1808.36	0	3495.74	928.13	812.46	10562.46	439.49	2162.69
MCL[6]	OC	15	16179.88	228.1	0	0	0	0	0	6213.55	807.29	1493.85	7665.18	2219.05	2236.8
	UG	3	2683.5	2.15	0	94.68	2538.95	49.87	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	18	18863.38	230.25	0	94.68	2538.95	49.87		6213.55	807.29	1493.85	7665.18	2219.05	2236.8
NCL	OC	10	18418.07	130.97	0	0	0	0	0	6172.28	2304.59	3886.27	6054.93	1092.88	3243.85
	UG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	10	18418.07	130.97	0	0	0	0	0	6172.28	2304.59	3886.27	6054.93	1092.88	3243.85
SECL[7]	OC	22	19777.08	197.66	0	0	0	0	0	7460.74	1578.53	2833.13	7904.66	1367.15	2139.29
	UG	42	34887.74	25.79	1407.72	1866.55	24308.13	1839.89	5465.48	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	64	54664.82	223.45	1407.72	1866.55	24308.13	1839.89	5465.48	7460.74	1578.53	2833.13	7904.66	1367.15	2139.29
WCL	OC	35	27463.31	81.33	0	0	0	0	0	5991.2	6385.74	965.09	14121.29	3612.15	1858.38
	UG	22	15036.6	11.81	546.69	460.55	10032.92	354.2	3642.47	0	0	0	0	0	0
	Mixed	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	57	42499.91	93.14	546.69	460.55	10032.92	354.2	3642.47	5991.2	6385.74	965.09	14121.29	3612.15	1858.38
NEC	OC	3	771.44	0.95	0	0	0	0	0	188.08	138.31	41.17	403.88	13.18	109.12
	UG	1	136.52	0.2	126.42	10.1	0	0	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	4	907.96	1.15	126.42	10.1	0	0	0	188.08	138.31	41.17	403.88	13.18	109.12
CIL	OC	156	119402.28	928.65	0	0	0	0	0	36158.19	14245.01	13679.76	55319.33	11220.77	13636.91
	UG	142	84117.73	57.196	4002.25	6407.97	60708.31	3698.99	9300.51	0	0	0	0	0	0
	Mixed	80	34638.26	37.28	488.86	2233.83	20273.08	1181.02	0	2639	655.54	945.65	6221.08	1131.82	651.71
	Total	378	238158.27	1023.126	4491.11	8641.8	80981.39	4880.01	9300.51	38797.19	14900.55	14625.41	61540.41	12352.59	14288.62
NLCIL	OC	5	15720.24	57.6	0	0	0	0	0	6080.71	2061.31	456.51	7121.71	3525.55	340.09
	UG	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	15720.24	57.6	0	0	0	0		6080.71	2061.31	456.51	7121.71	3525.55	340.09
SCCL	OC	19	19593.4	67.25	0	0	0	0	0	6729.12	5503.7	2357.29	5003.29	208.54	4057.26
	UG	21	9341.84	15.7	1042.27	484.89	6198.19	1616.48	0	0	0	0	0	0	0
	Mixed	1	1336.64	4.23	0	0	0	0	0	678.21	382.04	266.71	9.68	0	678.21
	Total	41	30271.88	87.18	1042.27	484.89	6198.19	1616.48	0	7407.33	5885.74	2624	5012.97	208.54	4735.47
NET TOTAL	OC	180	154715.92	1053.5	0	0	0	0	0	48968.02	21810.02	16493.56	67444.33	14954.86	18034.26
	UG	163	93459.57	72.896	5044.52	6892.86	66906.5	5315.47	9300.51	0	0	0	0	0	0
	Mixed	81	35974.9	41.51	488.86	2233.83	20273.08	1181.02	0	3317.21	1037.58	1212.36	6230.76	1131.82	1329.92
	Total	424	284150.39	1167.906	5533.38	9126.69	87179.58	6496.49	9300.51	52285.23	22847.6	17705.92	73675.09	16086.68	19364.18

(Continued horizontally over the next page)

[2]Buildings, Roads, Sidings, etc.

[3]Areas occupied by last cut or voids or water body, not under surface rights, etc

[4]Quarry area under active mining, not reclaimed for ensuring clear space for safe operation of mines

[5]Net EC capacity of BCCL is taken as 93.04 MTPA, as the EC has been obtained on cluster basis and peak production for the mines of a cluster differs at a given period

[6]Considering project area for running mines in MCL as 20546.88 ha, of which leasehold area is 18863.38 ha, which excludes external area earmarked for colonies & project office, etc. from project area (1683.50 ha). Break-up is provided w.r.t leasehold area.

[7]Gare Pelma IV/1 mine was handed over by SECL on 07.07.21, thus the plantation area of 204.85 ha under Gare Pelma is reduced

OC Mines Area Break-up								Plantation in remaining mine area				
Break-up of excavated area			Break-up of external OB dump area					Balance mine area (Ha)	Break-up of balance mine area			
Area technically reclaimed	Break-up of technically reclaimed area		Active External dump area[4]	Area pending technical reclamation	Area technically reclaimed	Break-up of technically reclaimed area			Areas not amenable for plantation*	Areas where plantation can be done	Break-up of areas where plantation can be done	
	Area biologically reclaimed	Balance area to be biologically reclaimed				Area biologically reclaimed	Balance area to be biologically reclaimed				Area already under plantation	Area where plantation may be taken up in future
281.19	82.26	198.93	308.47	127.51	125.62	85.22	40.41	5382.68	5069.19	313.5	294.365	19.13
0	0	0	0	0	0	0	0	0	0	0	0	0
469.72	268.3	201.42	50.96	130.81	102.17	82.87	19.3	5869.76	5851.26	18.5	0	18.5
750.91	350.56	400.35	359.43	258.32	227.79	168.09	59.71	11252.44	8555.2	1739.81	232.53	1507.2
2375.01	1405.52	969.48	536.89	216.6	988.91	738.25	250.66	10295.01	0	0	0	0
0	0	0	0	0	0	0	0	0	457.66	70	0	70
2.5	2.5	0	57.6	0	112.4	97	15.4	527.66	9012.86	1809.81	232.53	1577.2
2377.51	1408.02	969.48	594.49	216.6	1101.31	835.25	266.06	10822.67	5924.08	1777.96	216.16	1561.8
505.31	413.75	96.56	251.85	317.08	157.6	72.2	85.4	7951.95	7392.15	559.8	314.18	245.62
0	0	0	0	0	0	0	0	0	0	0	0	0
383.25	145.7	237.55	32.8	83.77	85.03	68.2	16.83	23276.22	23032	244.22	135.92	108.3
888.56	559.45	334.11	284.65	400.85	242.63	140.4	102.23	31228.17	30424.15	804.02	450.1	353.92
1757.7	946.75	810.94	171.36	131.6	504.33	360.46	143.87	9159.03	6953.32	2205.71	650.55	1555.16
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
1757.7	946.75	810.94	171.36	131.6	504.33	360.46	143.87	9159.03	6953.32	2205.71	650.55	1555.16
1835.55	1616.06	219.49	429.6	270.63	1604.36	1551.47	52.89	9941.21	5576.03	4365.18	2590.98	1774.2
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
1835.55	1616.06	219.49	429.6	270.63	1604.36	1551.47	52.89	9941.21	5576.03	4365.18	2590.98	1774.2
3954.39	1635.53	2318.85	91.55	141.56	1345.46	1220.3	125.12	10737.79	6156.92	4581.05	1684.42	2896.63
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
3954.39	1635.53	2318.85	91.55	141.56	1345.46	1220.3	125.12	10737.79	6156.92	4581.05	1684.42	2896.63
520.71	269.45	251.26	4047.41	607.01	1731.36	1385.36	346	15086.39	11157.9	3928.49	1113.01	2815.54
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
520.71	269.45	251.26	4047.41	607.01	1731.36	1385.36	346	15086.39	11157.9	3928.49	1113.01	2815.54
65.78	2.16	63.62	59.51	0	78.8	22.06	56.74	445.05	126.74	318.31	0	318.31
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
65.78	2.16	63.62	59.51	0	78.8	22.06	56.74	445.05	126.74	318.31	0	318.31
11295.64	6371.48	4929.13	5896.64	1811.99	6536.44	5435.32	1101.09	68999.11	50987.27	18011.85	6880.035	11131.79
0	0	0	0	0	0	0	0	0	0	0	0	0
855.47	416.5	438.97	141.36	214.58	299.6	248.07	51.53	29673.64	29340.92	332.72	135.92	196.8
12151.11	6787.98	5368.1	6038	2026.57	6836.04	5683.39	1152.62	98672.75	80328.19	18344.57	7015.955	11328.59
2215.06	1910.06	305	0	981.72	1079.59	808.75	270.84	7578.22	7161.79	416.43	88.87	327.59
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
2215.06	1910.06	305	0	981.72	1079.59	808.75	270.84	7578.22	7161.79	416.43	88.87	327.59
2463.32	527.61	1935.71	228.02	160.98	5114.7	3122.89	1991.81	7360.58	5333.41	2027.17	1794.21	232.91
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	382.04	70.61	311.43	276.39	137.89	138.5	138.5	0
2463.32	527.61	1935.71	228.02	160.98	5496.74	3193.5	2303.24	7636.97	5471.3	2165.67	1932.71	232.91
15974.02	8809.15	7169.84	6124.66	2954.69	12730.73	9366.96	3363.74	83937.91	63482.47	20455.45	8763.115	11692.29
0	0	0	0	0	0	0	0	0	0	0	0	0
855.47	416.5	438.97	141.36	214.58	681.64	318.68	362.96	29950.03	29478.81	471.22	274.42	196.8
16829.49	9225.65	7608.81	6266.02	3169.27	13412.37	9685.64	3726.7	113887.9	92961.28	20926.67	9037.535	11889.09

(Continued horizontally from the previous page)

*(eg. occupied by road, infra, water body etc.)

ANNEXURE-III : Updated status from BCCL against list of closed/suspended mine as provided by CIL

Sl. No.	Name of Mine	Type of Mine	Status
1	Kuya	UG	Operative OC
2	Godhur	UG	Operative OC
3	Kujama	OC	Operative OC
4	Damoda	OC	Operative OC
5	Amalgamated Block-IV- Govind-pur Colliery	UG	Operative OC
6	Mudidih	UG	Operative OC
7	Amalgamated Gaslitand Katras Choitudih Colliery	OC	Operative OC
8	Dobari	OC	EC exist ,Work suspended due to non-vacation of Suhana Pahari Basti
9	Amalgamated Joyrampur Colliery	Mixed	EC exist ,Work suspended due to contract problem
10	Kenduadih	OC	EC exist ,Work suspended due to contract completion
11	Ghanoodih	OC	EC exist ,Work suspended
12	Amalgamated East Bhagatdih Simlabahal	OC	EC exist ,Work suspended due to land , NIT
13	KB 10/12 Pits	UG	EC exist ,Work suspended due to inundation
14	Bhagaband	UG	EC exist ,Work suspended due to inundation
15	P.B.Project	UG	EC exist ,Work suspended due to inundation
16	Basuriya	UG	EC exist ,Work suspended
17	Bhowrah (N)	UG	EC exist ,Work suspended
18	Murulidih 20/21	UG	EC exist ,Work suspended
19	Sudamdih (Shaft)Mine	UG	EC exist ,Work suspended due to Safety reasons
20	Jhunkundar OC (NLOC)	OC	Geological exploration underway, GR under preparation
21	Lohapatty	UG	EC exist ,Work suspended ,To be reopened under MDO
22	Madhuband	UG	EC exist ,Work suspended, To be reopened under MDO
23	Loyabad	UG	To be reopened under MDO
24	Amlabad Colliery	UG	Work suspended due to DGMS restriction (non- avail-ability of second outlet) To be reopened under MDO

Sl. No.	Name of Mine	Type of Mine	Status
25	Begunia	UG	To be reopened under MDO
26	Hantudih	UG	Geological exploration underway, GR under preparation, presently inundated and inoperative
27	Bhurungia	UG	
28	South Govindpur	UG	
29	Teturia Colliery	UG	
30	Dharmabandh Colliery	UG	
31	Bhatdih	UG	Working suspended due to Fire dump explosion , Geological exploration underway, GR under preparation,
32	Murulidih	OC	Geological exploration underway, GR under preparation FC obtained for reopening
33	Jealgora	UG	Merged in Amal Joyrampur colliery
34	Bagdigi	UG	
35	Lodna	UG	
36	KB 5/6 Pits	UG	Work suspended ,under planning to reopen
37	Pootkee	UG	Work suspended, under planning to reopen
38	Kustore	UG	Work suspended, inundated, Mining Plan being prepared for merger and reopening
39	Hurriladih	UG	
40	Burragarh	UG	
41	Laikdih	UG	Reserve exist
42	V.West	UG	Reserve exist

YOUNG CONTRIBUTORS

Ministry of Coal

Sunil. K. Bhawaria, Manager (S&JT), MoC / CMPDIL
Rohan Mishra, Young Professional (S&JT)

Coal India Limited

Danghmei A Pouganglung, Manager (Env.)

Central Mine Planning & Design Institute Limited

Dipti Mohan Pillai, Asst. Manager (Env.), HQ, Ranchi
Anand Shekhar, Chief Manager (Mining), RI-I, Asansol
Prakash Chansoriya, Chief Manager (Env.), RI-VI, Singruali
Amit Raj Mishra, Manager (Env.), RI-II, Dhanbad
Deepanshu Sahu, Manager (Env.), RI-IV, Nagpur
Manish Yadav, Manager (Env.), RI-VII, Bhubaneshwar
Sandeep Sharma, Manager (Env.), RI-IV, Nagpur
Abhisht Raj, Dy. Manager (Env.), HQ, Ranchi
Md. Muhtashim Rabbani, Dy. Manager (Env.), RI-IV, Nagpur
Amul Patwal, Assisstant Manager (Env.), RI-III
Krishnadas A. M., Asst. Manager (Env.), RI-VII, Bhubaneshwar

Bharat Coking Coal Limited

Harish Pal, Manager (Env.), HQ, Dhanbad
Harish Kumar, Dy. Manager (Env.)
Meena Kumari, Dy. Manager (Env.)
Rajesh Ranjan, Dy. Manager (Env.)
Ritesh Ranjan, Dy. Manager (Env.)
Rohit Saini, Dy. Manager (Env.)
Shrikant Kumar, Dy. Manager (Env.)
Sumit Kr Jhai, Dy. Manager (Env.)
Vikas Kumar , Dy. Manager (Env.)
Ashu Kumar Gupta, Asst. Manager (Env.)
Himanshu Jaiwal, Asst. Manager (Env.)
Sanjeev Kumar, Asst. Manager (Env.)
Uttam Kr Jha, Asst. Manager (Env.)
Vivek Sharma, Asst. Manager (Env.)

Central Coalfields Limited

Swati Singh, Dy. Manager (Env.), HQ, Ranchi
Fazail Ahmad, Dy. Manager (Env.), Hazaribagh Area
Gaurav Kumar, Dy. Manager (Env.), Dhori Area
Nishank Prakash, Dy. Manager (Env.), North Karanpura Area
Om Prakash Ranjan, Dy. Manager (Env.), Amrapali & Chandragupta Area
Raman Nitesh, Dy. Manager (Env.), Barka Sayal Area
Satendar Kumar, Dy. Manager (Env.), Piparwar Area
Shashi Kumar Pankaj, Dy. Manager (Env.), CRS Area
Vinay Anchal, Dy. Manager (Env.), B&K Area
Vivek Dwivedi, Dy. Manager (Env.), Rajrappa Area
Abhinav Srivastava, Asst. Manager (Env.), Kuju Area
Dheeraj Kumar, Asst. Manager (Env.), Rajhara Area
Jay Prakash Sinha, Asst. Manager (Env.), Argada Area
Mohit Joon, Asst. Manager (Env.), B&K Area
Monu Kumar Rai, Asst. Manager (Env.), Amrapali & Chandragupta Area
Mrigank Shekhar, Asst. Manager (Env.), Magadh & Sanghamitra Area
Shammi Kapoor, Asst. Manager (Env.), Giridih Area
Shyam Sundar Pal, Asst. Manager (Env.), Kathara Area
Aditya Harsh, M.T. (Env.), Rajrappa Area
Amarjeet Kumar, M.T. (Env.), Magadh & Sanghamitra Area
Amod Kumar, M.T. (Env.), Argada Area
Aniruddha Roy, M.T. (Env.), Dhori Area
Ashutosh Kumar, M.T. (Env.), Kuju Area
Divya Prakash, M.T. (Env.), Piparwar Area
Palak Agarwal, M.T. (Env.), Kathara Area
Suneel Kumar, M.T. (Env.), Hazaribagh Area

Eastern Coalfields Limited

Soumabha Chakraborty, Manager (Env.), HQ, Sanctoria
Pritam Marik, Dy. Manager (Env.), HQ, Sanctoria
Anamika Masoom, Asst. Manager (Env.), HQ, Sanctoria
Abhirup Basu, Dy. Manager (Env.), Kunustoria Area
Arnab Roy Chowdhury, Dy. Manager (Env.), Kajora Area
Ashish Kumar, Dy. Manager (Env.), Kenda Area
Jhuma Sarkar Dy. Manager (Env.), Salanpur Area
Nabenita Singha, Dy. Manager (Env.), Mugma Area
Nithin Bijlee, Dy. Manager (Env.), Satgram Area
Saurab Mahanand, Dy. Manager (Env.), Pandaveswar Area
Abhinay Kr. Sharma, Asst. Manager (Env.), Sodepur Area
Arnab Pahadi, Asst. Manager (Env.), Bankola Area
Indranil Mukherjee, Asst. Manager (Env.), S.P. Mines Area
Prasun Chakraborty, Asst. Manager (Env.), Sonepur Bazari Area
Provashis Ghosh, Asst. Manager (Env.), Sripur Area
Sachin Shankar, Asst. Manager (Env.), Jhanjhra Area
Vibhanshu Kumar, Asst. Manager (Env.), Rajmahal Area

Northern Coalfields Limited

Dinesh Kumar Saini, Dy. Manager (Env.), HQ, Singrauli
Himanshu Dubey, Dy. Manager (Env.), Amlohri
Keshav Sharma, Dy. Manager (Env.), Nigahi
Mohit Gupta, Dy. Manager (Env.), Jhingurda
Omveer Singh, Dy. Manager (Env.), Krishnashila
Rakesh Dubey, Dy. Manager (Env.), Jayant
Rohit Gupta, Dy. Manager (Env.), Khadia
Sawan Khare, Asst. Manager (Env.), Dudhichua
Varun Sanwal, Asst. Manager (Env.), Block-B Area
Vivek Tiwari, Asst. Manager (Env.), Bina Area
Jitesh Jareda, M.T. (Env.), Kakri Area

YOUNG CONTRIBUTORS

South Eastern Coalfields Limited

Charu Sharma, Dy. Manager (Env.), HQ, Bilaspur
Amit Verma, Asst. Manager (Env.), HQ, Bilaspur
Vishnu Raj R, Asst. Manager (Env.), HQ, Bilaspur
Anumol Panicker, Manager (Env.), Gevra Area
Siddhartha Sharma, Manager (Env.), Kusmunda Area

Banavath Govind, Dy. Manager (Env.), Raigarh Area
Banavathu Gowtham Dut, Dy. Manager (Env.), Bishrampur Area
Deepak Vishwakarma, Dy. Manager (Env.), Jamuna Kotma Area
Kamlesh Ahirwar, Dy. Manager (Env.), Johilla Area
Pankaj Gowtham, Dy. Manager (Env.), Sohagpur area
Rajat Jindal, Dy. Manager (Env.), Hasdeo Area
Sandeep Markam, Dy. Manager (Env.), Bhatgaon Area
Swapnil Suman, Dy. Manager (Env.), Korba Area
Vivek Krishnan, Dy. Manager (Env.), Chirimiri Area
Yamini Singh, Dy. Manager (Env.), Korba Area
Yogendra Athiya, Dy. Manager (Env.), Baikunthpur Area
Keshav Meena, Asst. Manager (Env.), Sohagpur Area
M Mohana Krishna, Asst. Manager (Env.), Chirimiri Area
Sanoj Jose, Asst. Manager (Env.), Dipka Area
Shubham Patel, Asst. Manager (Env.), Raigarh Area
Amir Khan, M.T. (Env.), Jamuna Kotma Area
Prince Prajapati, M.T. (Env.), Bishrampur Area
Rahul Jatav, M.T. (Env.), Johilla Area
Shubhojit Dey, M.T. (Env.), Hasdeo Area

Western Coalfields Limited

Anu Baby, Manager (Env.), HQ, Nagpur
Jitender Malik, Dy. Manager (Env.), Nagpur Area
Mohnish Satrawala, Dy. Manager (Env.), Patharkhera Area
Prashant Thaker, Dy. Manager (Env.), Chandrapur Area
Raviraj Meena, Dy. Manager (Env.), Pench Area
Shobhit Aggarwal, Dy. Manager (Env.), Majri Area
Suraj Poreddy, Dy. Manager (Env.), Wani Area
Ashija K., Asst. Manager (Env.), Umrer Area
Jigar G. Desai, Asst. Manager (Env.), Patharkhera Area
Pranav Bhamre, Asst. Manager (Env.), Ballarpur Area
Sajin Jayapal, Asst. Manager (Env.), Wani North Area

NLC India Limited

Dr. R. Bhoopati Prabhu Kumar, CM, HQ, Cuddalore

Mahanadi Coalfields Limited

Sujatha A. M., Dy. Manager (Env.), HQ, Sambalpur
Monjit Roy, M.T. (Env.), HQ, Sambalpur
Raji Joshua, Manager (Excavation), Basundhara Area
Biswajit Das, Dy. Manager (Env.), Kaniha Area
Chilambarasan A, Dy. Manager (Env.), Lakhanpur Area
Pravin Pintoo, Dy. Manager (Env.), Hingula Area
Ravi Vyas, Dy. Manager (Mining), Orient Area
Aditya Prasad, Asst. Manager (Env.), Bharatpur Area
Bijayashree Vivekananda, Asst. Manager (Env.), Lingaraj OC
Naresh Naik, Asst. Manager (Env.), Jagannath Area
Suraj Balraj, Asst. Manager (Env.), Talcher Area

North Eastern Coalfields

Lily Gogoi, Dy. Manager (Env.), HQ, Margherita
Naruttam Das, Dy. Manager (Env.), NEC HQ, Margherita
Shankar Prasad Yadav, Asst. Manager (Env.), NEC HQ, Margherita

Singareni Collieries Company Limited

Bollam Srinivasu, SOM (Env.), HQ, Kothagudem
Ch. Srinivas, Addl. Manager (Env.), HQ, Kothagudem
M. Prasad, Addl. Manager (Env.), HQ, Kothagudem
P. Ravi Kiran, Addl. Manager (Env.), HQ, Kothagudem
T. Poshamallu, Addl. Manager (Env.), HQ, Kothagudem
V. Thirupati, Addl. Manager (Env.), HQ, Kothagudem
A. Bhaskar Rao, Dy. Manager (Env.), HQ, Kothagudem
M. Sunil Kumar, Dy. Manager (Env.), HQ, Kothagudem
Md. Fazul Rehaman, Dy. Manager (Env.), HQ, Kothagudem
B. Krishna Prasad, SOM, BHPL Area
K. Suresh Babu, SOM, RG-II Area
Shaik Mohammed Yousuf, SOM, YLD Area
T. Satya Narayana, Addl. Manager, KGM Area
B. Hanuman Goud, Dy. Manager (Env.), SRM Area
J. Srinivasa Rao, Dy. Manager (Env.), MNG Area
P. Prabhakar, Dy. Manager (Env.), MM Area
A. Harish, Dy. S.E., BPA Area
K. Anjaneya Prasad, S.E., RG-I Area

सत्यमेव जयते

कोयला मंत्रालय
Ministry of Coal

annapurnaprinters.mc@gmail.com • 9835 778 101