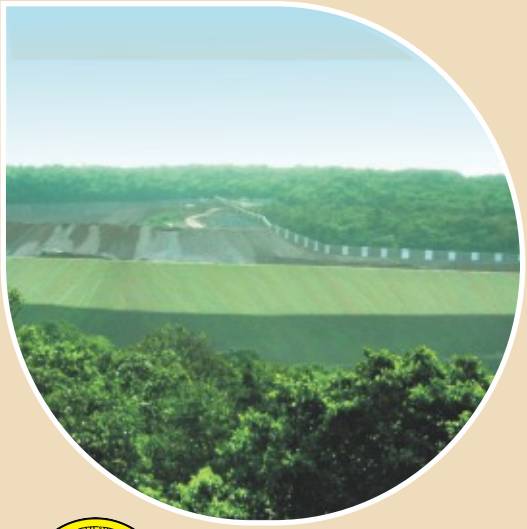
OPEN CAST IRON ORE MINE RECLAMATION & REHABILITATION IN KARNATAKA

THE CHALLENGES & PROSPECTS



INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION

(An Autonomous Body of Ministry of Environment, Forest and Climate Change, Government of India)

Reclamation & Rehabilitation
Is Central To The Environmental Sustainability of Mining

Legitimacy and Salience

The MCDR, 1988 promulgated Mine Closure Planning and Reclamation & Rehabilitation as mandatory.

The Reclamation & Rehabilitation technique and strategy has been introduced by IBM in the year 2000.

As per the EIA Notification, 2006, it is mandatory that the environmental regulations are complied and the mined land including the surroundings is made safe, stable and free from pollution.


Unscientific narrow mine benches


Unscientific mining pit


Unstabilised dumps


Sliding steep dump

Returning Mined land to ...

Reclamation & Rehabilitation (R&R) is an integral component of sustainable mining industry. It is invariably a key performance indicator against which companies' performance is judged. Poorly rehabilitated mines cause significant environmental, socio-economical and legal problems to all the stakeholders including the communities and governments. In essence, R&R is considered at every stage of mine development and production so as to re-establish a safe and stable land use/land cover that commensurate with agreed post-mining land use planning objectives and completion criteria of sustainable development.

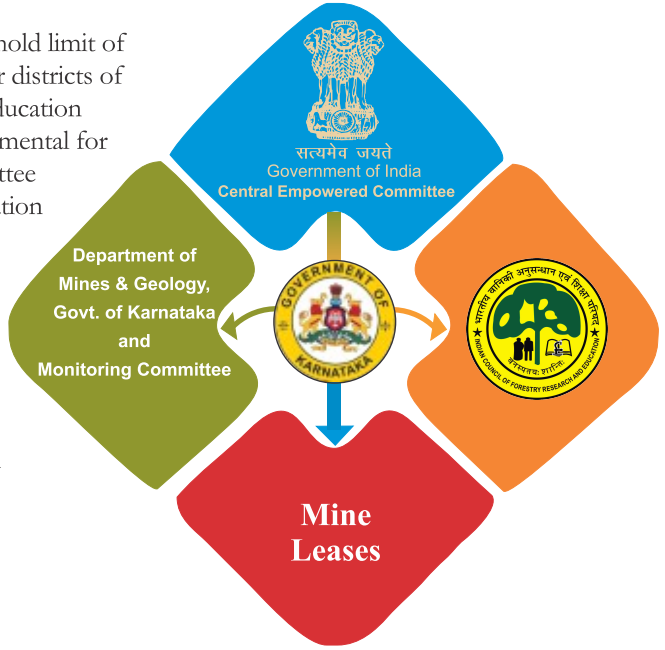
> *Key objectives in reclamation and rehabilitation activities are to implement site specific measures that reduce potential damage and prevent negative impacts on the natural environment in and around the mined areas.*

Guidelines

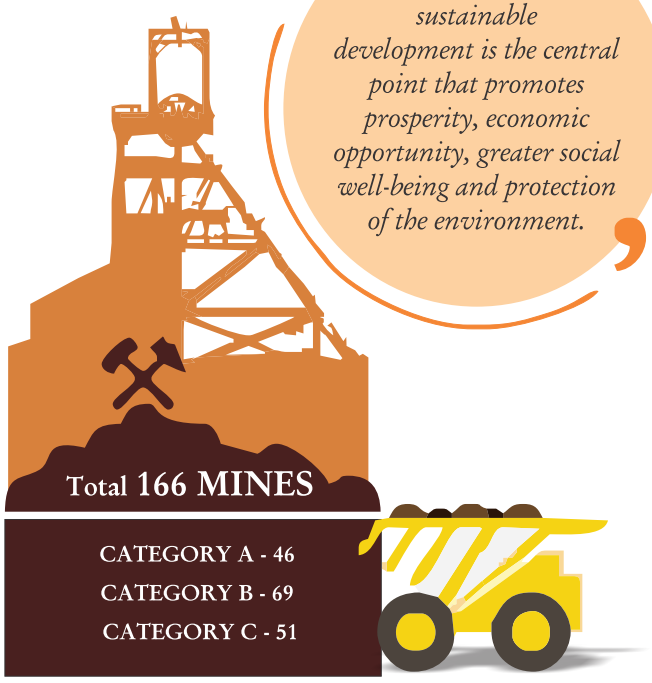
There are no clear-cut guidelines for R&R of mined out areas in India. The 'threshold limit of production' from the open cast iron ore mines in Bellary, Chitradurga and Tumkur districts of Karnakata duly recommended by the Indian Council of Forestry Research and Education (ICFRE) based on the Macro-level EIA studies conducted during 2011 was instrumental for the Hon'ble Supreme Court of India in directing the Central Empowered Committee (CEC) to formulate the R&R Plan guidelines during 2013 for the planned exploitation of mineral resources for sustainable development of the area.

Based on the direction from the Hon'ble Supreme Court, the CEC issued guidelines to the Government of Karnataka (GoK) to get the R&R Plans for the individual open cast iron ore mine leases of the area prepared by the ICFRE.

ICFRE has prepared scientific R&R Plans for 129 out of 166 open cast iron ore mines in Bellary, Chitradurga and Tumkur districts of Karnataka in association with the CEC, Department of Mines & Geology (DMG), GoK and Monitoring Committee duly constituted by the CEC.



"The concept of sustainable development is the central point that promotes prosperity, economic opportunity, greater social well-being and protection of the environment."




Steep sub-grade ore stack

Linkage between ICFRE and Stakeholders


Haphazard dumping


Unstabilised dump

RECLAMATION

It is defined as an intentional activity that initiates or accelerates the recovery of a degraded, damaged, or destroyed ecosystem with respect to its health, integrity, services and sustainability or otherwise physical stabilization of the terrain, landscaping, restoring topsoil, and the return of the land to a useful purpose.

Approach and Planning

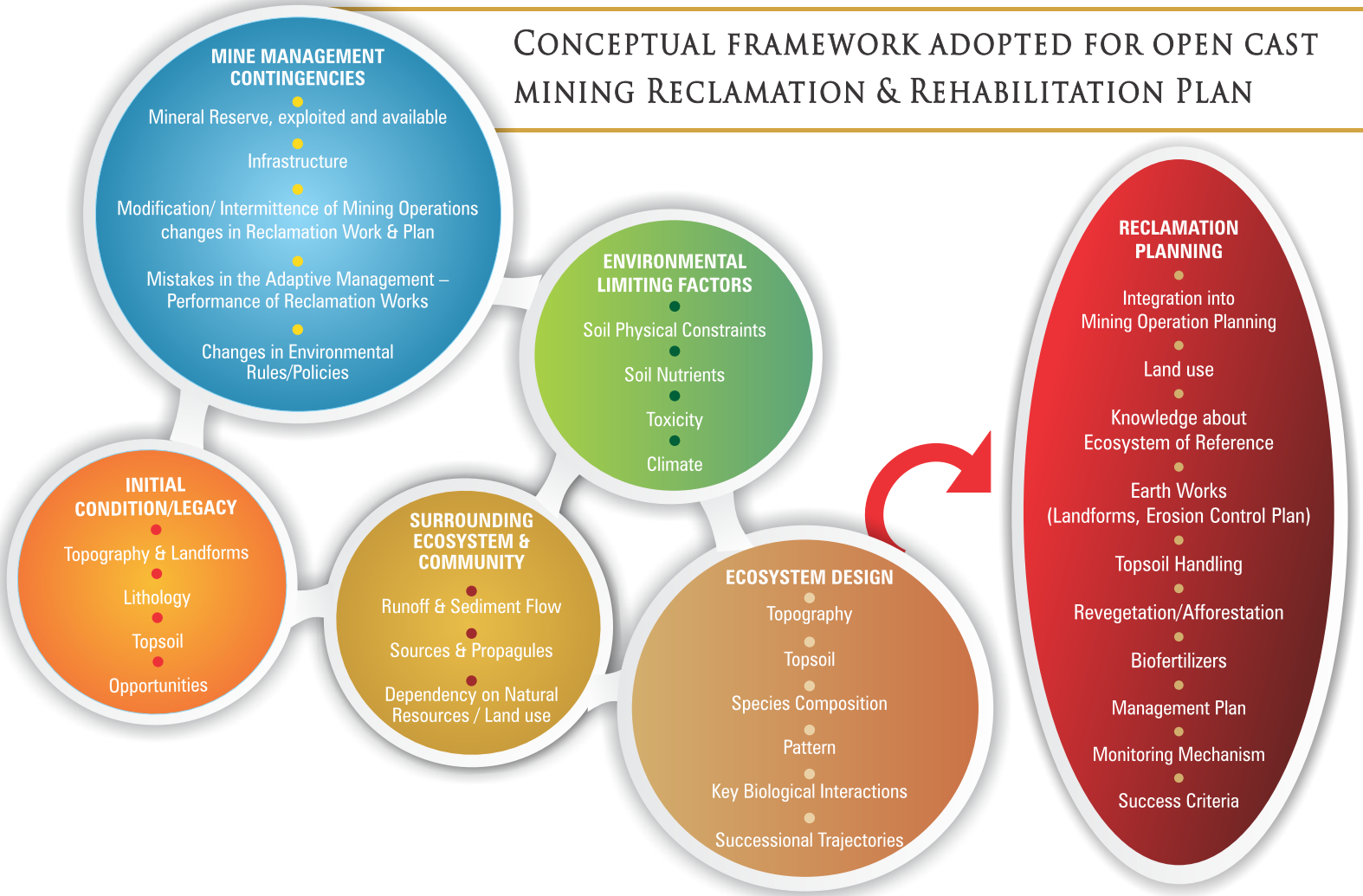
Impact of mining on land environment gets reflected in altered land use/land cover pattern, disoriented natural drainages, contaminated surface soils, air and water, partial or total loss of native flora and fauna, etc. The cumulative impacts of these changes push the land towards further degradation that lead to the formation of a different micro ecosystem over the area. The process works in a cyclical mode known as land degradation cycle.

Topographic reconstruction is challenging and critical step in the reclamation process, as the rebuilt landform is the foundation for all the reclamation practices. At the landscape level, emphasis is given to the type and arrangement of landforms, along with the nature and extent of resources/reserve as well as the respective overburden waste to be mined, processed, handled and transported. It is also very important to consider the watershed basins and drainage density, besides the biological diversity and the community to develop. All these considerations pertaining to topographic reconstruction are taken care to form a functional landscape that is likely to be near normal. Therefore, formulation of R&R Plan requires integration of multi-source data particularly related to technical and operational characteristics of the mine that are specific to the site and type of mineral.

REHABILITATION

The establishment of a stable and self-sustaining ecosystem, but not necessarily the one that existed before mining. In many cases, complete restoration may be impossible, but timely remediation, reclamation and rehabilitation can result in the successful establishment of a functional ecosystem.

Conceptual framework adopted for open cast mining Reclamation & Rehabilitation Plan



To formulate a sophisticated R&R plan and to ensure its long term success requires multidisciplinary approach together with wide range of expertise and set of skills. ICFRE has established collaboration with geologists, hydrologists, environmental chemists, plant, animal and wildlife biologists, soil scientists, agronomists, landscape developers, civil and environmental engineers, economists, etc., for facilitating the innovative conceptual framework development in R&R to minimize the methods and practices in landscape reconstruction so as to achieve the maximum ecological function and services. A detailed assessment of the land use/ land cover under mining and allied activities and their likely impacts on various aspects of the environment decides the measures to be implemented like boundary pillars for demarcation of the area, safety zone plantation for protection of the outside environment from mining impacts, stabilisation of waste dumps by implementing erosion control measures and surface water stabilisation structures that include retaining wall, garland drain, slope stabilising vegetation, geo-textile coir mat, silt settling tanks, check dams, gully plugs, etc., based on the prevailing slope stability and drainage density at site.

Planning Process

Examining the mine site

Assessing the impact of OB dump on forest

Meeting with stakeholders

Verifying the mine plans at the mine site

Team discussion

Examining the floral diversity

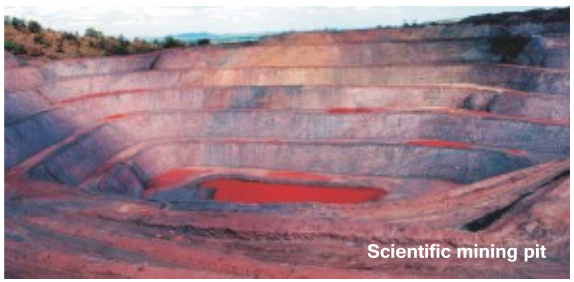
Unscientific


Severe erosion of mineral stacks


Steep mine bench


OB dump erosion into the stream

Scientific

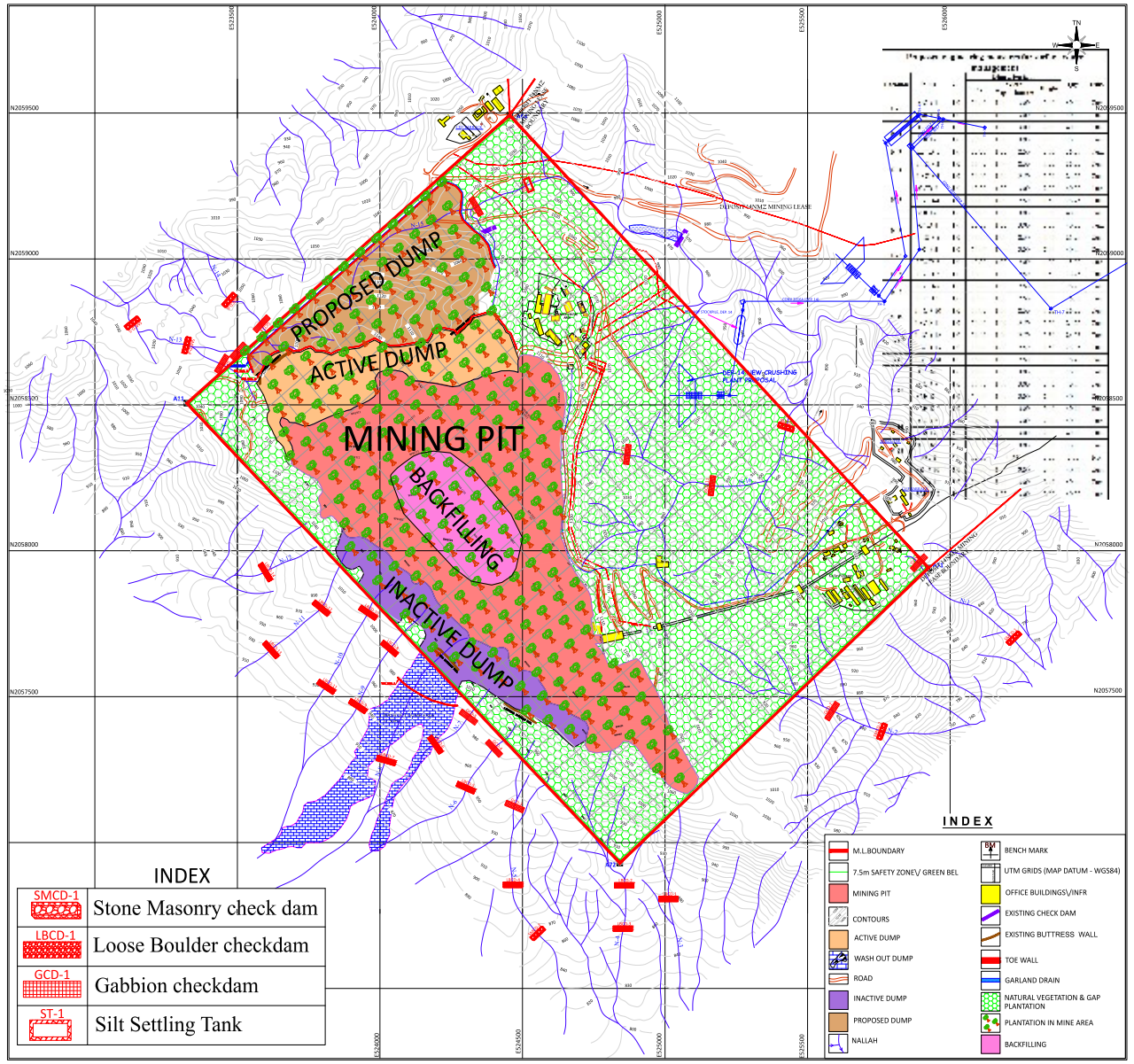

Scientific mining pit


Gully plugs to control dump waste erosion


Plantation growth at safety zone


Dump stablisation using Geo-textile coir mat

Geospatial Reclamation & Rehabilitation Plan



Landscape view of R & R measures for individual Mine

Implementation of R & R Measures

Before and After

Dump Stabilization

Before and After

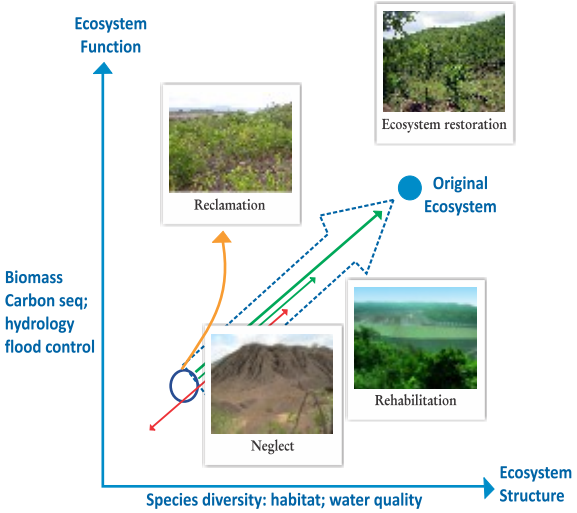
Silt Settling Tank

Stone Masonry Check Dam

Toe Wall

Ecosystem Recovery

Quality R&R Plan gives an opportunity to adopt good practices, reduce expensive rework and lower residual risk. The R&R plan prepared by ICFRE are under implementation at various stages in the mining areas of Bellary, Chitradurga and Tumkur Districts of Karnataka.

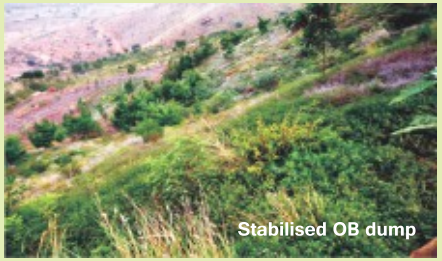


Source : Bradshaw (1987)


Unscientific mining pit


Active dump rolling into pit


Unmanaged and unstabilised dump


Stabilised OB dump


Retaining wall


Earthen check dams


Settling Pond


Check Dam


Afforestation and drip irrigation

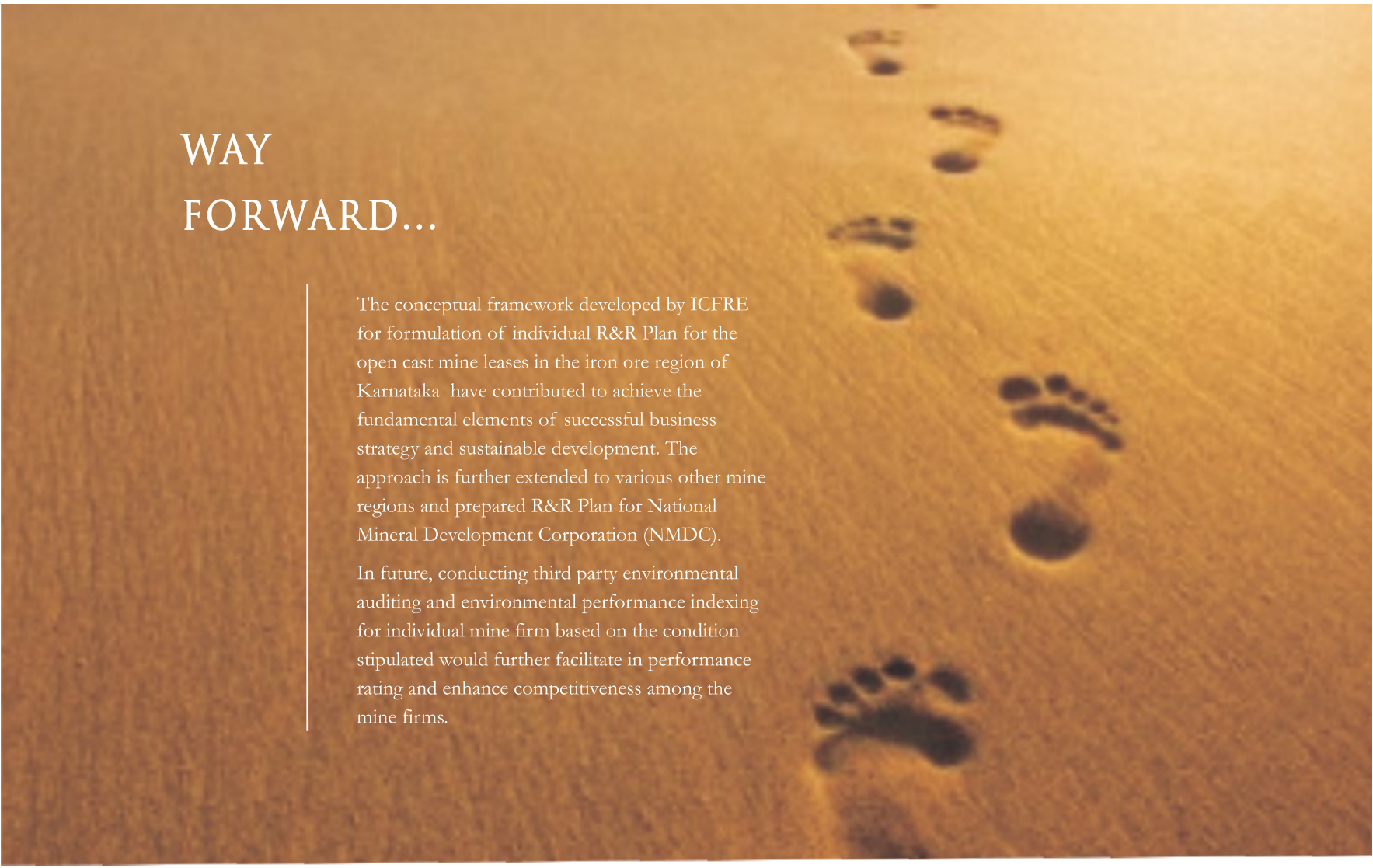

Plantation


Stabilisation of dump


Stabilisation of dump

Impact of R&R on Key Elements

Good R&R practices in mining are the national priority for sustainable development of the industry as well as conservation of the valuable mineral resources. The robust R&R Plan framework formulated for 129 mines using spatial decision support system prescribed various kinds of methods and practices for stabilisation of the degraded environment based on the suitability of the local site conditions. The detailed engineering and biological measures prescribed for stabilisation of the safety zone, waste dumps, surface water courses, etc., would contribute towards restructuring of the landforms for functional healthy ecosystem, protection of biodiversity, increase in water and food security and overall improvement in the health and well being of the human beings. Also, the R&R Plan measures envisaged complete restoration of the encroached areas outside the mine lease, which account for more than 40% of total lease area in category-C mines.



WAY FORWARD...

The conceptual framework developed by ICFRE for formulation of individual R&R Plan for the open cast mine leases in the iron ore region of Karnataka have contributed to achieve the fundamental elements of successful business strategy and sustainable development. The approach is further extended to various other mine regions and prepared R&R Plan for National Mineral Development Corporation (NMDC).

In future, conducting third party environmental auditing and environmental performance indexing for individual mine firm based on the condition stipulated would further facilitate in performance rating and enhance competitiveness among the mine firms.

CREDITS

Dr. Sudhir Kumar, ADG (EM)
Dr. V. Jeeva, Scientist-F
Shri Chandra Sharma, Scientist-B
Ms. Kumbhlesh K. Rana, Project Associate
Dr. V. Mohan, Scientist-G
Dr. C. Kunhikannan, Scientist-G
Shri Anish V. Pachu, Chief Technical Officer

Published by :

Environment Management Division

Directorate of Extension

Indian Council of Forestry Research and Education

(An Autonomous Body of Ministry of Environment, Forest and Climate Change, Government of India)

P.O. New Forest, Dehradun-248 006 (Uttarakhand)

www.icfre.gov.in

E-mail : adg_eia@icfre.org

Ph. : +91 135 2753882