A Case Study of Mine Land Reclamation
Sankhali iron ore Mine, Goa
Sesa Sterlite Ltd.,
Workshop on “Environmental Assessment
capacity building in South East Asia
February 18-20th 2015
Overview

Leading Iron ore Producer

- India’s largest private sector producer exporter of Iron Ore (prior to mining ban)
- +60 years of existence
- Sesa is well placed to capitalise the global seaborne demand due to favourable logistics
- Operations spread across India and in Africa (next iron ore hub)
- Over 3,850 employees, incl. +1,000 professionals

Our Operations

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<th>Goa</th>
<th>Karnataka</th>
<th>Liberia</th>
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<td>Proximity to Port</td>
<td>Proximity to domestic steel market</td>
<td>Large Resource base</td>
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<td>Low cost River transportation</td>
<td>Logistics infrastructure in place</td>
<td>All three deposits within 70-140 kms from Sea</td>
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<td>Road Transport ( Mine to Jetty ~16 kms)</td>
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LOCATION MAP

MAP OF GOA SHOWING THE LOCATION OF MINE

KARNATAKA STATE

GOA

SANDEELIM GROUP OF
IRON ORE MINE

MODERNISATION STATE

INDIA
Maps showing the Eco Sensitive Zones and mining belt in Goa
Mine Layout

Proposed Mining Area

Proposed Pit Backfilling Area
Traditional approach for Mine land reclamation

- Waste dump stabilization using laterite cover, garland drain, etc

- Planting hardy plants species like Eucalyptus, acacia with the sole aim to green the area and create a biomass without consideration to Biodiversity or community use

- No consideration for post mine closure land use
Mine Closure Case study - Reclamation of Sanquelim Mine

• Scientific approach for reclamation: Association with various organisations like FRI, NIO, State Agriculture Department, State Forest department, Goa University to name a few

• Management plan Approved by State Dept of Forest – conversion of Exhausted mine to Eco-tourist Spot

• Regular scientific studies to assess the reclamation status
  - Horti – Silvi culture approach
  - Spice plantation
  - Bamboo Arboretum
  - Medicinal garden
    • Nakshatra Vruksh Devta Udyam
    • Charak Vatika
  - Aromatic garden
  - Butterfly park

Exhausted Mine pits -
  • Rain water harvesting
  • Pisciculture pond

Bamboo Pavilion – Centre for excellence

Sesa technical school and Sesa Football academy
Waste Dump Management

- Detailed survey of the area is carried out for preparing dump design and systematic drainage plan before the commencement of dumping.
- Dumping is planned in stages and covered with lateritic material to prevent surface wash off.
- Critical dump slopes are stabilized by using Geo-textiles and Vetiver grass.

Systematic multilayer step dumping

Dump laid with geo-textile

Systematic dumping before stabilisation

Stage wise stabilisation of dumps
Land Reclamation:

GEOTEXTILES - A NEW APPROACH FOR WASTE DUMP MANAGEMENT

• CONTROL SOIL EROSION
• DUMP STABILIZATION
• CONTROL WATER POLLUTION
Land Reclamation

PLANTATION GROWING ON A GEOTEXTILES LADEN DUMP

- Ensures green ground cover for erosion control as well as for soil enrichment
- Higher survival rate for tree species
Geotextile for Stabilisation of Waste Dump

Newly laid Geotextiles

Geotextile laid areas after 3 years
Afforestation

Native species grown in Root Trainers

- Inhouse RootTrainer Nursery catering 2 lakhs sapling/annum
- Root trainers for growing healthy saplings with developed root system.

R & D Efforts

- Biotechnological Approach for improving the survival rate of native spp on the mine rejects – Research project with NEERI & In house replication of same
- Research project with Goa University for mass culture growth of Ectomycorrhizae for improving the survival of native species
Biotechnologically Reclaimed Mine site

Biotechnologically Reclaimed site – fresh plantation- Original Dump Site

Biotechnologically reclaimed site – same dump after 10 years
Ectomychorhiza Project

- Company sponsored project with Goa university namely “Ectomychorhizal fungi & mass cultivation of this fungi for reclamation of mine dumps with native species.
- Ectomychorhiza forms mutual interaction with roots of plants & take up the function of feeder roots.
- Ectomychorhizal fungal strains have been isolated from dump sites and Pot culture experiments are completed.
- Mass cultivation of the fungi is carried out and is applied to native species on the experimental site.
Horticulture plantation on mine road sides
Reclaimed mine site
Medicinal Garden/ Nakshatra Van
Reclaimed Mine Pit –
Pisciculture Pond at Sanquelim


- One of the worked out pits (Lisboa) was terraced with loose soil to facilitate afforestation, and the pit is used for Pisciculture.

- The pit is 150m x 30m with an average 6m depth of water.

- Water was treated so as to make it favourable and improve nutrient status and pH

- The fingerlings of Rahu, Mrugal and Carp were released.

- The temperature was monitored daily at 1m depth and accordingly the feed was adjusted.

- The results were very encouraging, and now the pond is full of fish.
Corporate Social Responsibility

Proactive approach to community development

Sesa Community Development Foundation

- Established Sesa Technical School at Sanquelim Mine (Renovated Mine workshop)
- Established Sesa Football Academy (By renovating Employee quarters on exhausted Sanquelim mine)
- Football ground on Mine rejects dump
Environmentally, technically and scientific reclamation of mined out areas enabling sustainable post closure of land uses

- In Our business it is an accepted fact that the impact we leave on the environment has a long term, negative impact.
- Which is why our efforts to preserve and protect, while we simultaneously grow are of immense importance and integral to the way we do the business.
- With the same objective Sesa has reclaimed the worked mine and converted it to a garden and productive asset.
- Sesa has also constructed a technical School and Football academy at the reclaimed site.
- Pit has been converted to a Pisciculture pond,
- A nakshatra garden, fruit bearing trees and butterfly park is set up in the Garden.
- The need for a convention centre for visits by school children, delegates, nature lovers etc at the Sanquelim mine, led to concept of a Bamboo pavilion as no other solution suited the requirement better than bamboo as the medium for building the pavilion.
Biodiversity Management Related Studies Conducted at Sesa

Studies have been conducted in the past by various agencies to assess and ascertain the bio-diversity related aspects within and around the mines.

1. Dept. of Botany Goa University in the year 1994, carried out Botanical survey of vegetation planted by the company for reclamation at Sanquelim mine for assessing the biodiversity spectrum

2. Centre for studies in rural economy appropriate technology and environment (create) st. Joseph’s college, North point, Darjeeling, with the support of FIMI conducted the studies on “Impact on Biophysical status of Mined area and its Periphery” in the year 2006.

3. Canopy, a private organization based in Goa, working on promoting nature tourism conducted the studies on assessment of Fauna in reclaimed Sanquelim mine of Sesa Goa during the year 2009-10.

4. Goa University, Goa carried out a research project on “Developing Ectomycorrhizae on mine rejects” for envisaging effect of inoculation of the fungus on bio-diversity plants grown on mine dumps.

5. NEERI carried out a research project “Rehabilitation of mined out areas with bio-diversity plantation” at Codli mines during 1999.
1. Studies by Dept. of Botany Goa University, Goa

The recommendations/outcome of studies carried out by Dept. of Botany Goa University, Goa are as under;

- Conducted botanical survey of vegetation at reclaimed Sanquelim mine for assessing the biodiversity spectrum
- Identified plant species that can be grown without any artificial aid such as fertilizers and manure etc.
- The species found were varieties of herbs (including grasses and legumes), shrubs and trees
- The no of families identified were 302, genera 612 and no. of species 716.
3. Faunal Study of Sanquelim Mine carried out by CANOPY, GOA

The objectives and outcomes of studies carried out by CANOPY;

- A three season data for Sanquelim mine was collected.
- Non samples survey technique was used to conduct the survey
- To infer the success of the restoration efforts based on the findings the site was divided in four zones:
  - Zone I: The water body (pit) and its surrounding areas
  - Zone II: The area with plantation of fruit crops including the butterfly garden
  - Zone III: The Nakshatra Van
  - Zone IV: The area leading to and around the pump-house

**Results:** The following diversity of various faunal components was observed

- 3 species of mammals
- 70 species of birds
- 42 species of butterflies
- 14 species of odonates
- 12 reptiles
- 10 amphibians
THANK YOU