PRE- FEASIBILITY REPORT

(In terms of provision of EIA Notification 2006)

For

Expansion of Lead-Zinc Ore Underground Mine from 1.08 million TPA to 2.0 million TPA (ROM) & Lead Zinc Ore Beneficiation from 1.2 to 2.5 million TPA

At

RAJPURA DARIBA MINE, DISTRICT – RAJSAMAND (RAJASTHAN)

By
Hindustan Zinc Limited
Rajasthan

Submitted to
Ministry of Environment & Forests (MoEF)
New Delhi

July-2018

TABLE OF CONTENT

1. EXECUTIVE SUMMARY

- Hindustan Zinc Limited (HZL) is Asia's largest non-ferrous metal producer of Zinc and Lead and has Head office at Udaipur, Rajasthan. HZL is world's second largest integrated producer of Zinc with a global share of approximately 6.0%
- HZL has its operations in exploration, mining, ore processing, smelting and refining of Zinc, Lead and Silver. It is also a major producer of sulphuric acid, as a by-product of lead-zinc metal processing. HZL also has interest in wind and thermal power generation.
- The Rajpura Dariba deposit is located in Relmagra Tehsil of Dist Rajsamand.
- Environment Clearance was granted by MoEF, New Delhi for 1.08 million TPA ore production vide letter No: J-11015/380/2008-IA.II(M) dated 26.07.2018 & 1.2million TPA ore beneficiation for Rajpura Dariba underground mine vide letter no. J-11011/380/2008-IA II(I) dated 4.11.2009. Consent to Operate is obtained from Rajasthan State Pollution Control Board (RSPCB), Jaipur for carrying Mining & Beneficiation activities vide letter no. F(Mines)/Rajsamand(Railmagra)/1(1)/2008- 2009/278-282 dated 23.04.2015, valid till 28th Feb.'2018. Application has been submitted for the renewal of Consent to Operate on 26.10.2017.
- The present proposal is for the Expansion of Lead-Zinc Ore Underground Mine from 1.08 million TPA to 2.0 million TPA (ROM) and additional Lead Zinc ore beneficiation Plant of capacity 1.5 million TPA. The ore concentrate produced shall be processed by the existing HZL smelters for refining of Lead & Zinc metal.
- The mine is approachable by nearest airport, Dabok (Udaipur) at 58km and nearest railway station is Fatehnagar about 17 km on Chittorgarh-Udaipur broad gauge railway line and 4 Lane state highway.
- The deposit forms a part of the southern extremity of Rajpura-Dariba-Bethumni metallogenic belt. A spectacular zone of in situ Gossan is capping the ridge over the deposit at surface. Mining Lease is demarcated on part plan of Survey of India Topo sheet no. 45K/4 & 45L/1. It lies between Latitudes 24°55'40.8"N-24°57'49.0"N and Longitudes 74°06"57.7"E-74°08'41.4"E.

2.0 INTRODUCTION OF PROJECT

2.1 Identification of Project and Project Proponent:

2.1.1 Identification of Project

Zinc is a very versatile non-ferrous metal. Zinc's different applications rank it as the 4th most common metal in use after iron, aluminum and copper. In India, zinc demand growth continues to remain strong at about 8%, and is expected to leverage support from the automotive and the white goods sectors. Other major uses for Zinc include its utility in brass and bronze among many alloys; die casting, batteries, chemical compounds such as paints, ceramics, pharmaceuticals and fertilizers.

Over the medium term, growth in consumption is projected to average 5 per cent a year which is also likely to remain stable till Year 2020. Global zinc demand continues to be driven mainly by galvanizing sector in the emerging economies of Asia and Africa. The reported increase in Chinese manufacturing activities and US automotive sales along with emerging signs of stability in Europe's manufacturing and services sector are expected to support zinc demand.

The reason for an enhancement of production capacity of Rajpura Dariba Mine from 1.08 mtpa to 2.0 mtpa is the availability of reserves and resources estimated at around 60 million tons with grades of 6.38% zinc and 1.91% lead.

2.1.2 Project Proponent

Hindustan Zinc Limited (HZL) is the only integrated Lead & Zinc manufacturer in India and owns captive lead and zinc mines at Rampura Agucha, Rajpura Dariba, Kayad, Sindesar Khurd and Zawar Mines that cater to the requirement of lead and zinc concentrate for its smelters located at Chanderiya, Dariba & Debari. All the mining & smelting operations are based at Rajasthan.

2.2 Brief Description of Nature of Project

2.2.1 Nature of the Project

The projects is a mechanised underground Lead-Zinc mine project and is classified as **"Category-A"** by Ministry of Environment & Forests, New Delhi as per EIA notification dated on 14th September 2006.

2.2.2 Size of the Project

Rajpura Dariba deposit extends over a lease area of 1142.20 ha with estimated insitu ore reserves & resources of around 60 million tons with grades of 6.38% zinc and 1.91% lead. The proposed expansion of mine is from 1.08 to 2.0 mtpa of Lead-Zinc Ore Production. Total cost of the proposed expansion is estimated to be Rs. 960crores.

2.2.3 Location of the Project

The mine is approachable from by nearest airport, Dabok (Udaipur) at 58 km and nearest railway station is Fatehnagar about 17 km on Chittorgarh-Udaipur broad gauge railway line and 4 Lane state highway. Mining Lease is demarcated on part plan of Survey of India Topo sheet no. 45K/4 & 45L/1. It lies between Latitudes 24°55'40.8"N-24°57'49.0"N and Longitudes 74°06"57.7"E-74°08'41.4"E.

2.2.4 Mining Method

Currently, the mining method is BHS (blast hole stoping) & VRM (Vertical Retreat Method) with filling and it is planned to follow the same in the proposed mining blocks.

2.2.5 Importance to the Country & Region

Mining this Lead-Zinc deposit is critically important for the country's long-term economic growth. By mining the deposit, HZL will provide the country with increased revenue earnings. This will transform the region's economy from predominantly agricultural to significantly industrial, and accelerate the pace of industrial development in the region.

2.2.6 Supply and Demand Details

In the post liberalization era Indian lead zinc industry has taken a "U" turn from a protected administered price cushy scenario to a globally competitive industry. The rising trend of Indian economy has increased growth and also the continuing boom in manufacturing and in steel production coupled with the growth in automobile industries and infrastructure in particular has raised demand for lead and zinc metals considerably.

2.3 Need for the Project and its Importance to the Country& Region

As India is one of the fastest growing economies in the world, sufficient support from metal sectors is essential for infrastructure development so as to sustain the growth rate. Galvanized iron products play key role in infrastructure development and therefore the requirement of zinc metal is also essential. Thus the proposed project shall augment the supply of zinc to the domestic market for industrial growth and shall also bring revenue through exports.

2.4 Import Vs Indigenous Production

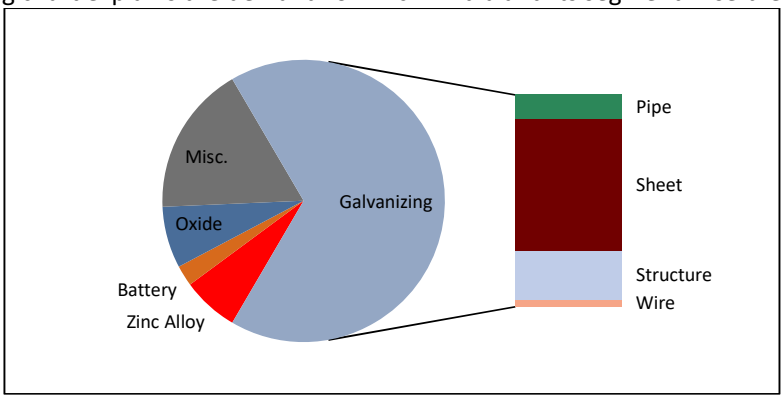
The present production capacities of Zinc in India are sufficient to meet the domestic requirements. However, the demand for zinc in India is expected to grow at a rate of 8% which makes it viable for the expansion of the zinc production capacities. Further the deficit in international market during the upcoming years provides opportunity for export.

2.5 Export Possibility

Indian exports majorly catered to South East Asian and African nations. In India, since, Hindustan Zinc is the largest producer of primary zinc, export of zinc is highly feasible and shall bring value addition.

2.6 Domestic Market

Zinc is having primary application in galvanization, a range of galvanized products are produced to meet various industrial and consumer demands. Galvanized sheets (corrugated and plain), galvanized pipes, galvanized structures, galvanized wires are used for various applications. Galvanizing Segment accounts for 75% share of the overall zinc demand in India while Non-Galvanizing accounts for 25% share. Among the major customer segments, Galvanized Sheets accounts for major share of the zinc consumption followed by structures and Alloys. The following chart explains the demand for zinc in India and its segment wise break-up.



2.7 Export Market

India has the potential for exporting zinc profitably as global zinc demand continues to be high & driven mainly by galvanizing sector in the emerging economies of Asia and Africa. The reported increase in Chinese manufacturing activities and US automotive sales along with emerging signs of stability in Europe's manufacturing and services sector are expected to support zinc demand

2.8 Employment Generation (Direct & Indirect)

The existing operation has direct employment of about 1000 persons and proposed expansion will provide additional employment of about 250 persons. There is an ample opportunity for increase in indirect employment due to mining related activities like transport, small workshops, garages, and due to development of local area.

3.0 PROJECT DESCRIPTION

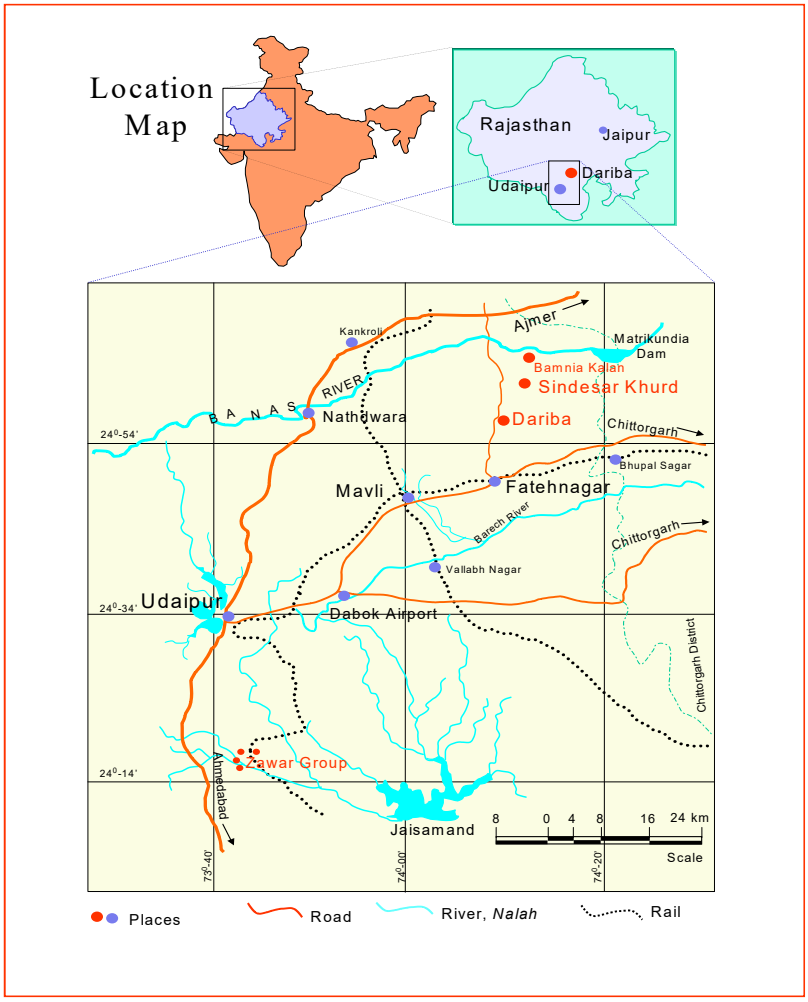
3.1 Type of Project

The proposed project is a mechanized underground lead-zinc mining & beneficiation project.

3.2 Location

The mine is approachable by nearest airport, Dabok (Udaipur) at 58 km and nearest railway station is Fatehnagar about 17 km on Chittorgarh-Udaipur broad gauge railway line and 4 Lane state highway.

The deposit forms a part of the southern extremity of Rajpura-Dariba-Bethumni metallogenic belt. A spectacular zone of in situ Gossan is capping the ridge over the deposit at surface. Mining Lease is demarcated on part plan of Survey of India Toposheet no. 45K/4 & 45L/1. It lies between Latitudes 24°55'40.8"N-24°57'49.0"N and Longitudes 74°06"57.7"E-74°08'41.4"E.



3.3 Alternate Sites Considered

No alternate site is applicable since it is a brown field expansion.

3.4 Size of Operation

The project has been planned to produce 2.0 MTPA Lead - Zinc Ore production & 2.5 MTPA Lead – Zinc ore treatment from the underground mine by expanding from the present 1.08 MTPA ore production & 1.2 MTPA ore treatment. The salient features of the proposed project are given in Table3.2

3.5 Project description with Process details:

TABLE-3.2

SALIENT FEATURES OF THE PROJECT

S. No.	Description	Existing	Proposed
1.	Mine lease area	1142.20ha	1142.20ha
2.	Land Requirement	554.19ha	554.19ha
3.	Ore mineral	Sphalerite & Galena	Sphalerite & Galena
4.	Established Depth	About 700m	About 1500m
5.	Reserves & Resources	60.05 million tons, 6.38 % Zn, 1.91 % Pb	
6.	Mode of Entry	By 2 Shafts & 1 Ramp	
7.	Method of Mining	Vertical Retreat Method Blast hole Stoping with filling	
8.	Ore Production	1.08 mtpa	2.0 mtpa
9.	Ore Beneficiation	1.2 mtpa	2.5 mtpa
10.	Waste Rock Generation	35000 tpa	480,000 tpa
11.	Waste dump area	3.0	5.0 Ha
12.	Power requirement & Source	12.0 MW	25.0 MW, Captive generation/ AVVNL/ Solar Power
13.	Water requirement & Source	5800 m^3/day, Matrikundia + STP+ Mansi Wakal	8000m^3/day, Matrikundia + STP+Mansi Wakal
14.	Manpower requirement (Nos.)	1000	1250
15	Project Cost	Rs. 300 crores	Rs. 960 crores
16	Environment Protection Cost	Rs. 14 crores	Rs. 110 crores

3.5.1 Mine Description&Introduction:

The deposit forms a part of the southern extremity of Rajpura-Dariba-Bethumni metallogenic belt. A spectacular zone of in situ Gossan is capping the ridge over the deposit at surface. Mining Lease is demarcated on part plan of Survey of India Toposheet no. 45K/4 & 45L/1. It lies between Latitudes 24°55’40.8”N-24°57’49.0”N and Longitudes 74°06”57.7”E-74°08’41.4”E.

The area is undulating with altitude varying from 486-520mRL. The highest point is at 568mRL. The area is mostly soil covered with weathered rock. No prominent landmark is present within project site.

3.5.2 Geology

3.5.2.1 Topography

The topography of the area is marked by N-S trending linear ridge with highest elevation of 561mRL. This ridge is flanked on either side by gently undulating surface having an average elevation between 490-500mRL. Main shaft is at 501mRL.

The area within leasehold does not include any major streams or river across it, hence not prone to any kind of flood. The drainage is mainly sheet flow. The surface water bodies in the area are characterized by the existence of tanks. The Mataji-Ka-Khera is the main tank located southwest of the Rajpura Dariba Mine. The main source of drainage is River Banas, which is ephemeral and flows at a distance of 12-km north of the deposit.

3.5.2.2 Regional Geology

Dariba-Bethumni metallogenic belt comprises of an assemblage of medium to high-grade metamorphic equivalents of Ortho-Quartzites, Carbonates and Carbonaceous facies rocks belonging to Bhilwara Super-Group (3.5-2.5 Ga) of Archaen age and extends for about 19 km in north-south direction. This cover sequence is underlain by basement rocks (Gneisses and Schist) of Mangalwar Complex. The geology of the area is mainly composed of thin alluvial cover, belonging to Sub-Recent to Recent period of Quaternary era underlain by Rajpura - Dariba group of Bhilwara Super Group of Archaeans.

Table: Summarized Geological Succession

Era	Age	Super Group	Group /Formations	Rock Types
Quaternary	Sub-Recent to Recent	Fluvial & Colluviums	Alluvium	Sand, Silt, Clay, Gravel etc.
Unconformity				
Intrusive				Pegmatite, Quartz veins
Archaeans		Bhilwara Super Group	Rajpura-Dariba group	Dolomitic Marble/ Calc Silicate (host rock), Graphitic Kyanite/ Mica Schists (host rock), Quartzites
			Mangalwar Complex	Migmatites, Gneiss, Mica Schists, Quartzites
			Banded Gneissic Complex	Gneisses, Schists, etc.

Structure

The structure of the belt is as an isoclinal fold (GSI, 1990) having a synformal closure at Dariba in south and an antiformal closure at Bethumni in north. The synformal closure exhibits steep plunge (55°-60°) towards ENE and the antiformal closure shows shallow plunge (15°-20°) towards NE. The rocks have suffered at least three phases of deformation. The earliest folds (F1) are preserved in the form of recumbent folds having N30°E-S30°W axial trend. Another set of appressed isoclinal F1 folds are represented by intrafolial folds with moderate plunge towards NNE to ENE. The last deformation F3 is represented by broad and open warps resulting

in culminations and depressions. The regional trend of the formations veers from N-S between Dariba and Rajpura in the south, to N15°E-S15°W between Sindesar Khurd and Sindesar Kalan in the middle and finally to N50°E-S50°W around Bethumni in the north. The rocks generally show moderate to steep dips towards E/SE.

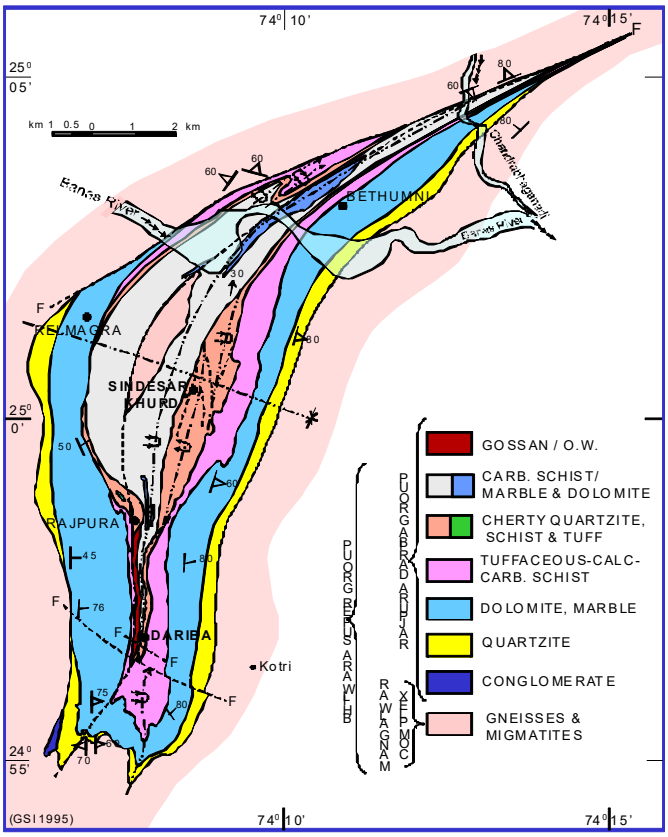
Mineralization

Base metal deposits of various sizes and grades occur throughout the belt in Calc-Silicate bearing Dolomite and Graphite Mica Schist horizons, the latter in general containing low grade disseminated sulphides of large volumes. At the south end of the belt in particular, contains multi-metallic sulpho-salt association. Mineralisation exhibits lithological, stratigraphic and structural controls and occurs in the form of fracture-filling veins, stringers, and disseminations forming tabular to lenticular ore bodies.

Metamorphism

The assemblage of metamorphic minerals suggests that the area has undergone medium to high grade regional metamorphism up to amphibolite facies.

Regional Geological Map (GSI) of Dariba-Bethumni Mineralized Belt



3.5.2.3 Geology of the Deposit

Dariba Mine is located at the southern extremity of the Dariba – Bethumni belt. The ore bodies are designated as South Lode, Main Lode, North Lode, and East Lode.

Shape and size of the mineral/ore deposit

The Main Ore body extends over a strike length of 2550m and intermediate barren patches into three lodes viz. South, Main and North Lode. The South Lode, striking N-S and dipping 60° to 70° towards east, has a strike length of 500m. The North Lode has a strike length of 900m. It strikes N-S and dips 70° to 75° towards east. The Main Lode has a strike length of 500m. It also strikes N-S and dips 70° to 65° towards east. The East Lode, with a length of 600m, also strikes N-S and dips easterly at 60° to 70°. It is located about 150m away from the hang wall side of the South Lode. The average widths of South, North and East Lodes are about 24m, 18m and 18m respectively and tend to decrease with depth.

Disposition

Disposition of various lenses is shown in the figure below.

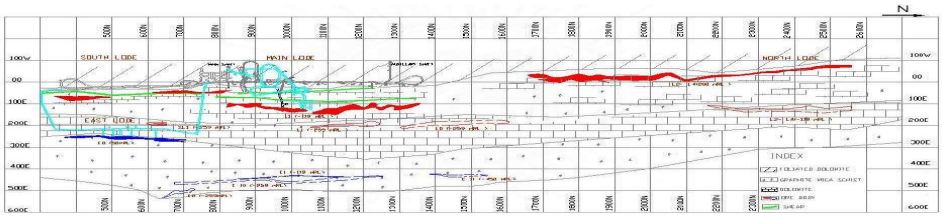


Figure: Disposition of various lenses

Litho-units

The mine area is constituted mainly by a sequence of meta-sedimentary sequence consisting of Quartz Mica Schist, Calcareous Biotite Schist and Graphite Mica Schist (from footwall to hanging wall). Calc-Silicate bearing Dolomite occurs within the Graphite Mica Schist horizon towards its contact with the Calcareous Biotite Schist. The formations, in general have N-S strike with moderate to steep easterly dip. Cross-beds and laminations are observed in mineralized Schist and Dolomite bands. The area between South and North Lode (part of Main Lode) is traversed by 2-10m wide meta-basic dykes.

Structural Features

Four sets of joints have developed due to deformation. Shears are represented by narrow zones of crushing, brecciation and gouging, mostly 0.1-2.0m wide. These are highly persistent along strike and dip and occur at the contacts and within the ore bodies. Faults are of reverse type with low south-easterly dipping planes striking N40°-60°E.

3.5.2.4 Exploration:

Surface Exploration

Pre-1980 historical surface exploration data comprises some 31,146 m of drilling information. The majority of drilling was focused towards underground drilling to target the Main Lode and the East Lode, to provide better resolution for mine-planning. The surface exploration has been undertaken using conventional diamond drilling methodologies.

During FY 2017-18, a total 6019.1m of drilling was completed in 18 Boreholes. Surface exploration drilling was primarily focused on delineating extensions of the ore bodies both along-strike and down-dip and also up-gradation of resource to reserve. Main focus of the

exploration was on adding Inferred Mineral Resource in the South Lode, Main Lode and in E10 lens.

In future surface exploration drilling will be carried out in order to increase the exploration density to upgrade the ore resources to reserves category. Also it is planned to carry out further exploration in any new lens occurring within the lease.

Underground Exploration

Contemporary to underground development, sub-surface exploration is being done by diamond drilling for precise delineation of ore body and to upgrade resources into reserves. Closed space drilling on 25X25m. grid pattern in main and north lode and 30X30m. grid pattern in east and south lode is being carried out at different levels. Geological mapping is also a part of underground exploration that's used to define the ore body geometry precisely and to design stope and extraction pattern in various lodes. Based on underground exploration all the litho-contacts and geological disturbances are also updated on geological plans and sections. Over the next five years around 40000-50000m of underground diamond drilling has been planned to upgrade resources into reserves.

3.5.2.5 Geological Reserves & Resources

Based on exploration drilling from surface and underground the ore reserves and resource computed on 01-04-2017 stands at 60.05 million tons with 1.91% Pb & 6.38% Zn. The status of category wise and level wise ore reserves and resource is given table below:

Status of Reserves & resource as on 01-04-2018

Category	Mt	%Pb	%Zn
A. Mineral Reserve			
1. Proved Mineral Reserve (111)	3.67	1.6	5.87
2. Probable Mineral Reserve (121 & 122)	7.89	1.7	4.29
B. Remaining Resources			
1. Feasibility Mineral Resource (211)	1.2	1.3	7.94
2. Prefeasibility Mineral Resource (221 & 222)	4.11	2.9	6.34
3. Measured Mineral Resource (331)	4.79	2	7.4
4. Indicated Mineral Resource (332)	10.60	2.3	6.5
5. Inferred Mineral Resource (333)	27.8	1.8	6.55
6.Reconnaissance Mineral Resource (334)	NIL	NIL	NIL
TOTAL (R&R)	**60.05**	**6.38**	**1.91**

3.5.3 Mining

3.5.3.1 Method of Mining:

Currently the mine is being worked out in different lodes in different lodes viz. North, East, Main & South Lode at different depths. Mining is being carried out with blast hole stoping method with post filling in primary-secondary sequence to maximize ore recovery. Mining in different lodes are further divided into number of blocks with crown pillars in between the blocks. The working blocks in different lodes is shown as under:

- Main Lode (-23 to -119mRL)
- South Lode (180-150mRL)
- East Lode (125-100mRL)
- North Lode (285-212mRL)

The general surface RL of RDM is around 500mRL. The existing working depth of working is varying from 300m in north lode to 620m in main lode. The mine can be approached by 3 accesses as from surface shown as under with details:

- Main Shaft (Surface to -92mRL)
  - Total Depth : 611m (501 to -110mRL)
  - Working Depth : 593m (501 to -92mRL)
  - Purpose & Capacity : Man winding (40 persons) & Ore hoisting (0.9mtpa)
- Auxiliary Shaft (Surface to 0mRL)
  - Total Depth : 509mRL (501 to -8mRL)
  - Working Depth : 501m (501 to 0mRL)
  - Purpose & Capacity : Man winding (14 persons)
- Ramp
  - Total Depth : 658m (501 to -157mRL)
  - Purpose & Capacity : Ore hauling (0.7mtpa) & transportation

Mine is having number of raises from surface for ventilation purpose:

- South Ventilation Raise (100 cum/sec exhaust fan)
- North Ventilation Raise-1 (1900N 70 cum/sec exhaust fan)
- North Ventilation Raise-2 (1340N 160 cum/sec exhaust fan)
- East Ventilation Raise-1 (445N 160cum/sec exhaust fan)

In order to achieve 2.0 Mtpa ore production rate at RDM, it is proposed to hoist around 1.3 Mtpa from shaft and 0.7 Mtpa from ramp. The ore of lower blocks of east and main lode below 0mRL will be hoisted through shaft and the ore of north lode and upper portion of east lode will be hauled through ramp. The design of existing shaft is around 1.4 Mtpa and it is proposed to maximize the hoisting capacity so as to reduce hauling through ramp.

Proposed blocks will also be brought into the production after developing them. Raises are being extended to lower levels as the access is available for extension. Ramps will be further developed to lower levels for hauling as well as material movement to the lower block. Mining of Sill/ Crown pillar is planned after due consideration studies of local & regional stability. Back filling is done in all primary/ secondary stopes to enhance ore recovery keeping in view of mineral conservation.

In the blasthole mining method, slot is opened at the widest portion of orebody and rings are retreated towards the end of the stope. The muck is then withdrawn at extraction level through

LHDs and then directly loaded mine trucks for hauling through ramps from underground to respective stock yard at surface and ore pass in underground. From stock yard, ore is fed to the primary crusher using surface dumpers after sizing with hydraulic breakers.

The mine development activity in the past three years has been mainly carried out for preparation of stoping panels of block M4 (-23 to -119mRL), E2 (100 to 50mRL, East Lode), S4 (180-100mRL, South Lode) & N2 (285-212mRL, North Lode) and the infrastructure development for block M5 (-157 to -232mRL, Main Lode), NL1 (285-212mRL, North Lode beyond 1900N), NA (180-100mRL of North Lode) & E1 (125-100mRL, East Lode).

The ore production has been from stoping operation and from ore development in blocks N1, N2, M4, E1 & S4.

3.5.3.3 Conceptual Mine Plan

It is proposed to enhance the ore production capacity of the mine from present production rate to 1.80mtpa progressively by developing current & new mining blocks and the required infrastructure.

The proposed enhancement in ore production capacity as well for sustenance, it is proposed to further develop further number of block spread over in all lodes. It is planned to expand the following blocks as shown as under:

Tentative ore blocks are shown as below:

a. Main Lode
   - M4 (-23 to -119mRL)
   - M5 (-157 to -232mRL)
   - M6 to M9
b. South Lode
   - S4 (195 to 180mRL)
   - S6 to S9
c. East Lode
   - E1 (125-100mRL)
   - EU1 (400-315mRL)
   - EU2 (285-200mRL)
   - EU3 (175-125mRL)
   - EA (30 to -12mRL)
   - EB (-32 to -87mRL)
   - E3 (-120 to -180mRL)
   - EC (0 to -180mRL)
   - E4 to E8
d. North Lode
   - N2 (285-212mRL)
   - NL1 (285-212, Beyond 1900N)
   - NA (180-100mRL)
   - NB (70 to 11mRL)
   - N3 to N6

Proposed blocks will also be brought into the production after developing them. Raises are being extended to lower levels as the access is available for extending raises for ventilation. Ramps will be further developed to lower levels for hauling as well as material movement to the lower block. Mining of Sill/ Crown pillar is planned after due consideration studies of local

& regional stability. Back filling is done in all primary/ secondary stopes to enhance ore recovery keeping in view of mineral conservation.

3.5.3.4 Development

Currently the mine is being worked out in existing levels of mine. Footwall drives are developed all these levels and are well connected either any two or more of accesses. Accesses include main shaft, auxiliary shaft & ramp and man passes at respective levels.

Development sizes of ramp & extraction levels are 5.0m x 4.0m while 4.0m x 3.5m for all other lateral developments.

3.5.3.5 Drilling& Blasting

In each stoping panel the slot is opened by drilling down holes from drill level to extraction level and blasting in vertical lifts from extraction level in stages. The drop raising technique is used for making a slot raise, which is then widened to the full width of ore body by blasting slot rings into raise. After opening of the slot, the stope is extracted by blasting the blast hole rings drilled against this slot.

3.5.3.6 Selection of Mining Equipment and Size:

Table 3.6 shows below, the proposed type and number of machinery for expansion project. However final selection of mining equipment and size may be subjected to some changes on account of variation in ore body, rock mechanics consideration affecting stope dimensions and approval of the statuary authorities.

TABLE 3.6
DETAILS OF MACHINERIES

#	Equipment	Nos.			Size /Capacity
		Existing	Proposed	Total	
1	LPDT	10	16	26	30t/ 20t payload capacity
2	LHD	13	7	20	10t/ 7t loading capacity
3	Drill Jumbo	7	5	12	38/45mm dia blasthole hole, single/ double boom
4	Production Drill	5	5	10	102/115/165mm dia production drill holes. ITH/ EHS
5	Scissors Lift	4	4	8	Platform lift upto 5-6m height
6	Personal carrier	3	4	7	16 Persons tranport
7	Light Motor Vehicle	2	6	8	For underground supervision
8	Road grader	1	1	2	For underground road maintenance
9	Explosive carrier	2	1	3	3-4t
10	Charmec	0	3	3	For mechanized charging of bulk emulsion explosive
11	Spraymec	0	2	2	For shotcreting in underground
12	Miller	0	4	3	For transportation of shotcrete/ concrete materials
13	Utility Vehicles	3	7	10	Miscellaneous Utility Vehicles
14	Mine pumps	6	6	12	50-100cum/hr with different head requirements
15	Compressor	6	4	10	1000-2500cfm
16	Ventilation fan	2	2	4	90-400 cum/sec
17	Winder	0	2	2	6t skips & 40 persons capacity cage

In the proposed expansion, following are the major technological changes being done:

S. No	Description	Benefits
1	Introduction of road grader	Road graders are being introduced to improve road conditions
2	Mechanization in diesel & explosive transportation	Mechanization is being planned in transportation of diesel dispensing & explosive transportation thereby improving safety, productivity and ergonomics.
3	Leaky feeder communication system	Communication system is being introduced for communication for any breakdown, emergency or unplanned activities in the mine
4	Top hammer drills	Top hammer drills are being introduced in underground so as to improve production drilling in lower levels of the mine and thereby reducing the dependency over compressed air. Improved productivities and ergonomics shall also count towards improved safety.
5	Long feed jumbos	In order to improve development rates, it is proposed to introduce long feed jumbo thereby improving advance per blast.
6	Bulk emulsion charging system	In order to improve development rates and mechanizing charging, bulk emulsion charging system shall be introduced. Charmec shall also be introduced for the same.
7	Mud pump	In order to strengthen mud handling system from existing manual to mechanized
8	Underground workshop	A world class underground workshop is to be introduced to improve the maintenance facility and thereby improving
9	Rock breaker & grizzly	In line with trackless mining, a rock breaker & grizzly are being proposed to be installed so as improve crusher performance.
10	High speed exploration rigs	In order to enhance exploration capacity, it is proposed to introduce high capacity exploratory drill rig of smaller dimension.
11	Raise boring	Raises are being developed with raise bores to fasted the raising and thereby improving the ventilation.
12	Advanced Mine Planning techniques	Technical cell is being strengthened to design in advanced sophisticated software helping in scientific mining of minerals.
13	Shotcrete	Shotcreting facility is under development so as to improve development rates in poor ground conditions.
14	Light motor vehicles for underground	For effective supervision, LMVs (Light Motor Vehicles) are proposed to be introduced.
15	Strengthened dewatering & reticulation system	Standardization of services with detailed engineering and dedicated crews

3.5.4 Mineral Beneficiation

Currently, run-of-mine of RD mine is treated at existing beneficiation plant. The concentrate is sent for metallurgical treatment at captive smelters for recovering final metal. The current beneficiation plant was commissioned in 1980s and is having lower recoveries & productivities as compared to proposed new plant. Therefore, it is proposed to derate the existing plant to 1.0 Mtpa treatment capacity. In addition to the existing plant, it is proposed to commission new beneficiation plant of 1.5 mtpa capacity with advanced technology & improved recovery.

Thereby total beneficiation capacity will be 2.5 Mtpa to treat ore of Rajpura Dariba and other mines. The detailed flow sheet & process of beneficiation has been given in further paragraphs:

The Plant will comprise of following major sections—

1. Surface primary crusher
2. Coarse ore Stock Pile (COSP)
3. Crushing
4. Grinding and Classification
5. Flotation Circuit
6. Concentrate Dewatering
7. Vacuum Filtration Circuit
8. Tailings Dewatering
9. Tailings Disposal
10. Back filling system

The detailed Process Description is given below:

1. **Surface primary crusher**:

   Ore big boulders from Ramp are being transported by dumpers & are being dumped into surface primary Jaw crusher & converts the boulders into -150mm size & being dumped to COSP through a belt conveyor.

2. **COSP (Course ore stock pile):**

   Ore is being fed at COSP through surface primary crusher conveyor & conveyor from main shaft hoist. There are four reciprocating feeders (with VFD drives) below this COSP to reclaim the coarse ore and discharge the same on a conveying system (45 KW) for feeding the crushing circuit.

3. **CRUSHING and conveying to FOSP:**

   a. From COSP ore is pushed on to the four no. Of reciprocating feeders then by conveyor is ore is fed to scalping vibrating screen of 50 mm aperture
   b. Under size from 50mm scalping vibrating screen is sent to next double deck screen of lower deck 16mm and upper deck 25mm.
   c. Over size of the 50 mm scalping vibrating screen is fed to secondary crusher which is gyratory cone crusher with 160 kw motor.
   d. Secondary crushed ore which is most likely less than 50 mm is then fed to 16 mm screen.
   e. 16 mm screen over size in conveyed in the storage silo
   f. From storage silo ore is fed to either of the two tertiary crusher which is gyratory cone crusher with 184 kw motor each by conveyor belt feeder which is VFD driven.
   g. Tertiary crusher product again fed to 16 mm scalping vibrating screen.
   h. 16 mm screen under size conveyed to FOSP (fine ore stock pile) through conveyors and tripper system.
   i. Two dust collectors are installed which are started as soon crusher plant starts and stopped after plant stoppage.

4. **GRINDING & CLASSIFICATION:**

   The fine Ore from FOSP through 4 Reciprocating Feeders will be conveyed to four Grinding Circuit, comprising of a Ball Mill, cyclone feed sump and pumps, Conveyor BC-4 will carry the reclaimed ore to mill. The same will be weighed by a Belt load cell to control the throughput. The Cyclone

feed pumps, attached to Mill Discharge sump, will feed the slurry to PRE GRAPHITE CELL. The overflow from same will report to Lead & Zinc circuit

4. FLOTATION CIRCUIT:

- The lead & Zinc flotation stream shall comprise of conditioning, roughing, scavenging and 3-stages of cleaning.
- Reagent Addition: -
  a. Sodium iso Propyl Xanthate(Collector)
  b. Methyl iso-butyl Carbinol (Frother)
  c. Sodium Cyanide & Zinc Sulphate (Pyrite & Zinc sulphide Depressant)
  d. Copper Sulphate (Activator for zinc)
- For lead and Zinc Rougher and Scavenger we are using 6.6 M3 flotation machine and for cleaner 2.7m3 flotation machine. Flotation process is monitored by froth camera installed over flotation machine based on the output from froth camera parameters (air, level reagent addition) is controlled by ISA (In stream analyzer) system installed.
  a. Feed to Flotation (Lead Conditioning)
  b. Reagent Addition
  c. Lead Flotation
  d. Zinc Conditioning (Reagent Addition)
  e. Zinc Flotation
  f. Transfer to thickener

5. CONCENTRATE DEWATERING:

- The lead concentrate from Lead Flotation circuit shall be pumped to Lead Concentrate Thickener (10m ø). The filtrate from Lead Filtration Plant shall also report to the same. Adequate flocculent dozing system shall be installed along with the thickener.
- The thickener overflow will gravitate to Lead Circuit water tank. Lead thickener underflow shall be pumped to Lead vacuum drum filter. The same can also be recirculate back to thickener in case of inadequate density in underflow slurry.
- The zinc concentrate from Zinc Flotation circuit shall be pumped to Zinc Concentrate Thickener (21 m ø). The filtrate from Zinc Filtration Plant shall also report to the same. Adequate flocculent dozing system shall be installed along with the thickener.
- The thickener overflow will gravitate to Zinc Circuit water tank. Zinc thickener underflow shall be pumped to vacuum drum filter. The same can also be recirculated back to thickener in case of inadequate density in underflow slurry.
- The Bulk concentrate from Bulk Flotation circuit shall be pumped to Bulk Concentrate High Rate Thickener. The filtrate from Lead Filtration Plant shall also report to the same. Adequate flocculent dozing system shall be installed along with the thickener.
- All the thickeners will be fitted with following instruments:
  1. Torque Transducer: For measuring torque imparted on rake arms
  2. Bed level detector: it measures the interface of solid & liquid. The interface level sensing is used to control the speed of flocculent dosing pump.
- Generally, the thickener underflow pumps (VFD driven) are run in closed loop of density controller with a provision of overriding by bed mass when the latter goes very high.
- Each of Lead & Zinc thickeners will have catch pit for storage of concentrate, in the event of any breakdown of downstream filter operation and/or Thickener.
- There will be Spillage Pumps in Pb & Zn thickener area for spillage collection. Except spillage pumps, all pumps will be in 1 operating and 1 standby mode. Pb & Zn thickener underflow Pump shall have VFD control.

6. **VACUUM DRUM FILTRATION:**
   - Concentrate will be pumped from thickeners to respective Vacuum Drum Filters. There will be two Zn, one Pb & one Bulk Vacuum Drum filters.
   - There is drum in vacuum filter in which vacuum created inside drum & concentrate cake deposited on drum due to vacuum and cake discharged by low pressure air to chute & further conveyed to respective stockpile by conveyor.
   - There shall be filtrate sumps for both Pb, Zn & Bulk filter systems along with the filtrate pumps. The filtrate shall be pumped to respective thickeners.
   - The Pb concentrate cake shall be conveyed via Belt Conveyor to Pb concentrate stockpile, having 1000 T storage capacity. The Zn concentrate cake shall be conveyed via Belt Conveyor Zn concentrate stockpile, having 5000 T storage capacity. The Bulk concentrate cake shall be conveyed via Belt Conveyor to Bulk concentrate stockpile, having 500 T storage capacity All the concentrate stockpiles is covered.
   - Blower air for discharging cake from drum is supplied from blower which is also used for flotation.
   - There shall be separate 5 T EOT Pendant type crane to service Filter Building.
   - There will be Spillage Pumps in Filter area for spillage collection and pumped to respective thickners via SPV pump.
   - Pb, Zn & Bulk Filter Feed Pumps shall have VFD control.

7. **TAILINGS DEWATERING:**
   - The Final Tailings from Zn flotation circuit is pumped to desliming hydro cyclones, of which the Overflow shall be fed to Tailings Thickener (50 mø) and underflow shall gravitate to either of two Fill storage Tanks of capacity 750MT and 650MT.
   - The Tailings Thickener overflow is connected to plant water line or pump house water storage of 900cum.
   - The tailing thickeners is be fitted with following instruments:
   - Level sensor for water sump level control which provides reference to sump water pump.
   - Proximity sensor which senses the movement of drive arm which provides indication alarm in the plant if rack is stopped.
   - Telephone dialing system which senses the rake moment and if rack stops this system calls at the provided list of numbers.

8. **TAILINGS DISPOSAL:**
   - Tailing thickener under flow_is maintained at 1.4 g/cc density and through tailing thickener underflow cone tailing flows to tail pump sump by gravity.
   - Four no. Of thickener underflow pumps (three VFD driven) are installed and run in closed loop of pump sump level sensor and density meter is also installed in feed line to the pump sump.
   - There will be Spillage Pumps in Tailings thickener area for spillage collection two spillage pumps are installed,1 operating and 1 standby mode.
   - Dry disposal of tailing will be done, after commissioning of new plant.

9. **Backfilling system:**
   - Cyclone underflow accumulates in fill storage tanks.
   - Classified tails comes to mixing tanks (mixing tank level is controlled via pneumatic valve working in close loop with level sensor).
   - Back pressure water line is provided for FST cone jamming removal.
   - One agitator is provided in mixing tank.
   - In mixing tank 5% or 10% cement is added as per mining requirement.

- Cement is added with help of belt feeders which are VFD driven, VFD is controlled by PLC system(PLC creates output on the basis of pulp density and flow being pumped by filling battery of pumps).
- From mixing tank Fill is being pumped to mining bore hole.
- Density meter and Flow meters are fixed in the pump delivery lines.
- Cement tankers are being emptied into silo with the help of compressed air

List of Major Equipment

S. No.	Particulars	Existing	Addition	Total
1.	Secondary crusher Tertiary crusher	1 2	1 2	2 4
2.	Ball Mill	4	2	6
4.	Flotation Streams	4	2	6
5.	Drum Filters	4	4	8
6.	Air Blower	3	2	5
7.	Air Compressors	3	3	6
8.	Thickeners	3	3	6

3.8 Water & Power Requirement & Sources

3.8.1 Water Availability

For 2.0 mtpa mining & existing beneficiation capacity, additional water of 2200 m^3/d is required for proposed expansion over existing 5800m^3/d requirement. Mine dewatering due to intersection will also be consumed in the process. The main source of water will be from Sewage Treatment Plant at Udaipur, Mansi Wakal, and Matrikundia Dam.

3.8.2 Power Availability

For 2.0 mtpa mining & beneficiation capacity, additional power of 13mW is required for proposed expansion over existing 12.0 MW requirement and shall be met out from Captive Power Plant, Ajmer Vidhyut Vitran Nigam Limited and Solar Plant.

3.8.3 Emergency Power

Additional DG Sets of total 5.0 MW having acoustic enclosure is proposed for emergency power.

3.9 Qty of Waste to be generated (Solid & Liquid) Wastewater Generation and its Management

3.9.1 Solid Mine Waste

In overall mine life the details of waste generation is shown as under:

Particulars	UoM	Qty
Total waste generation over mine life	cum	42,00,000
Waste disposal planned in underground voids	cum	40,00,000
Total waste to be disposed externally	cum	2,00,000
Waste to be utilized in construction of tailing dam	cum	2,00,000
Surface area required for waste dump	ha	3
Additional area required for existing waste dump	ha	2
Total area of waste dump	ha	5

- Garland drain around the waste dump along with a pond for collection of rain water
- Plantation will be done on inactive waste dump

Presently, there is one waste dump of 3.0ha in lease area. In the proposed expansion, it is proposed to expand the existing waste dump area by additional 2.0 ha totaling to 5.0 ha. Details of waste dump are shown as under:

Particulars	**UoM**	**Qty**
Avg Width	m	220
Avg Heigth	m	228
Area	ha	5.02
Height of bench	m	6.0
Waste accommodation per bench	cum	208357
No. of benches	cum	3
Base mRL	cum	491
Maximum mRL	cum	509
Height of waste Dump	cum	18
Waste Dump Capacity	cum	625071

3.9.2 Tailing Disposal

Tailing generated will be utilized for mine backfill and balance will be disposed to tailing dam. It is also proposed to introduce pastefill which will maximize tailings to underground. The tailing from existing beneficiation plant is being pumped to tailing dam of Rajpura-Dariba Mine. Capacity of tailing dam is sufficient till mine life. Height of the existing tailing dam shall be raised, phase wise. Dry disposal of tailing will be done, after commissioning of new plant.

3.9.3 Used oil and other waste

Used oil generated shall be stored at earmarked area in drums and shall be sold to registered/ authorized recyclers, additional generated used oil will be 100 KL/ Annum. No change in other waste for the proposed expansion.

4.0 SITE ANALYSIS

4.1 Connectivity

The mine is approachable from Rajpura Dariba Mine by nearest airport, Dabok (Udaipur) at 58 km and nearest railway station is Fatehnagar about 17 km on Chittorgarh-Udaipur broad gauge railway line and 4 Lane state highway.

4.2 Land Form, Land use and Land Ownership

4.2.1 Land Form

The topography of the area is marked by N-S trending linear ridge with highest elevation of 561mRL. This ridge is flanked on either side by gently undulating surface having an average elevation between 490-500mRL. Main shaft is at 501mRL. The area within leasehold does not include any major streams or river across it, hence not prone to any kind of flood. The drainage is mainly sheet flow. The surface water bodies in the area are characterized by the existence of tanks. The Mataji-Ka-Khera is the main tank located southwest of the Rajpura Dariba Mine. The main source of drainage is River Banas, which is ephemeral and flows at a distance of 12-km north of the deposit.

4.2.2 Land Use & Ownership

Total Mine lease area is 1142.2ha, out of which 356.5 ha has been acquired within mining lease. There shall be no requirement to acquire land beyond the existing acquired land. The mine area in operational use will suffice the requirement. Breakup of land use of lease area is shown as under:

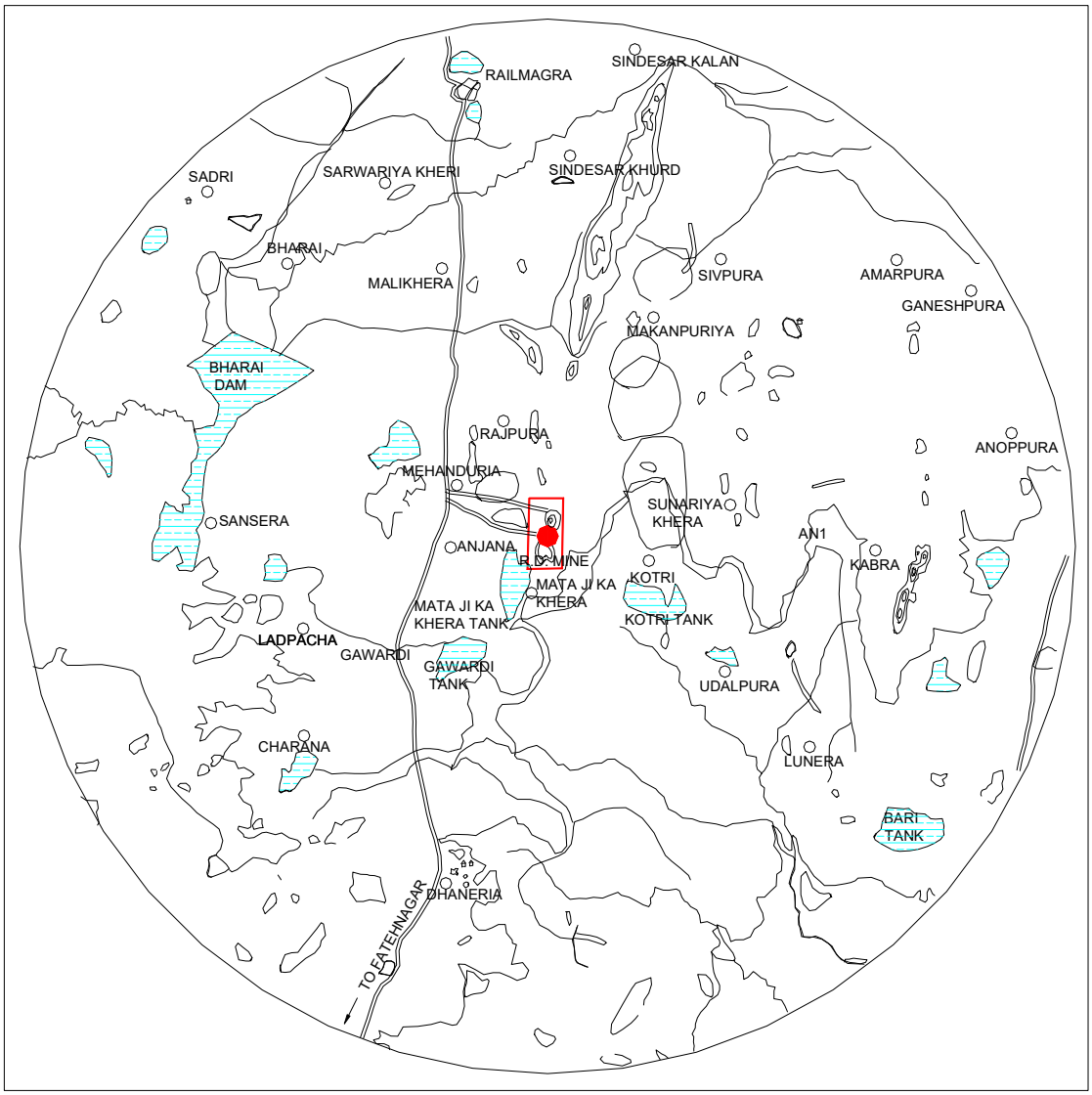
TABLE 4.1: LAND USE

Particulars	Land use (ha)
A) Mine & Smelter Operational use	171.67
B) Other Use: Residential Colony, Welfare buildings and internal roads	41.41
C)Roads and open spaces	15.58
D) Green Belt (Plantation)	134
E) Khatedari land	578.2
F) Charagah	27.33
G) Govt. Land	131.03
H) Public roads & Others	42.98
GRAND TOTAL	**1142.2**

4.3 Topography

Topography of the area is shown in attached map

TOPOGRAPHICAL FEATURES OF THE AREA WITHIN 10.0 KM RADIUS



4.4 Existing Infrastructure and Amenities

Rajpura Dariba Mine is well equipped with infrastructures like Offices, Canteen, Rest Room, Washrooms, Ambulance, First-aid facilities, Fire Tender, Road Sweeper, residential facilities, school, hospital, bank, post office, police station, shopping market, club, gym, football ground and other recreational facilities etc.

4.6 Soil Classification

The texture of soil is mostly Sandy Clay in the area. The common color of the soil is brown to brownish black. The pH of the soil ranged from 6.9 to 7.7 indicating that the soils are usually neutral to slight alkaline in nature.

The electrical conductivity was observed to be in the range of 161 to 771 µmho/cm. The nitrogen values ranged between 34.3 to 153 Kg/ha indicating that the soils are very less to good quantity of nitrogen. The phosphorus values ranged between 63.8 to 104.2 Kg/ha indicating that the soils have sufficient to more than sufficient quantity of phosphorus. The potassium values range between 223.3 to 434.7 Kg/ha indicating that the soil has average to more than sufficient quantity of potassium. NPK values are very less to more than sufficient in most of the locations.

4.7 Climatic data from secondary sources

The climatic data obtained from nearest IMD station based at Dabok, Udaipur are shown as under:

ENVIRONMENTAL SETTING OF THE SITE

Sr. No.	Particulars	Details
1	Latitude	24°55’40.8”N-24°57’49.0”N
2	Longitude	74°06”57.7”E-74°08’41.4”E
3	Elevation above MSL	Varies between 486-520
4	Climatic conditions (Based on IMD Udaipur)	Maximum Temp: 47.0°C Minimum Temp: 2.0°C Average Rainfall: 570.0mm
5	Seismicity	Seismic Zone-II.

4.8 Social Infrastructure available

The existing social infrastructure includes the following:

- Hospitals
- Bank
- Post Office
- School
- Police Station
- Shopping Market
- Sports Infrastructure
- Gym
- Club House

5.0 PLANNING

5.1 Planning Concept

Considering 75% Mine Recovery, total minable reserves & resources available for mining will be about 45 million tons sufficient for +20 years of mine with progressive ramping of production from 1.08 mtpa to 2.0 mtpa.

It is proposed to enhance the ore production capacity of the mine from present production rate to 2.0 mtpa progressively by developing current & new mining blocks and the required infrastructure. However, with further sequential underground exploration, if the orebody continuity is found to extend beyond current limits (vertical & lateral extent) within lease boundary, it will be considered for stoping to maximize ore recovery keeping in point of view with mineral conservation.

It is planned to expand the mine laterally in upper mining block and develop the lower mining blocks for future mine production simultaneously along with development of deeper extension of orebody.

5.2 Population Projection

As per 2011 census, persons inhabited in 77 villages of the study area (within10 km radius). The distribution of population in the study area is shown below:

TABLE 4.3

DISTRIBUTION OF POPULATION IN STUDY AREA

Particulars	Study Area
No. of Households	20287
Male Population	48352
Female Population	47214
Total Population	95566
Average Household Size (Persons)	4.71
Sex Ratio	1:1

Source: As per the 20011 census record.

The males and females constitute to about 50.59% and 49.40% of the study area. In this area, no major industries are expected. Therefore, normal growth of population is expected.

5.3 Assessment of Infrastructure Demand

In terms of infrastructure, new beneficiation Plant, New workshop & new paste fill plant will be added.

5.4 Amenities and Facilities

i) Drinking water supply
ii) Medical Facilities
iii) Animal Husbandry Camps
iv) Support in agriculture
v) Support to Anganbadi Centers
vi) Enhancing computer literacy and providing computers.

6.0 PROPOSED INFRASTRUCTURE

6.1 Industrial Area

For the proposed project, no additional infrastructure development is required other than mining equipment.

6.2 Residential Area

Well-developed township existing at Dariba Mine. Employees are housed in this town ship with all facilities. The same township shall suffice the requirement of additional manpower for the proposed expansion. Guest house facilities also exist at RDM.

6.3 Green Belt

Thick vegetation is developed along the mine lease boundary to attenuate the noise levels generated in the mine lease area. The plantation will be carried out along the roads within the mine boundary to arrest dust. The plantation is also carried out on the waste dumps benches. At present, 33% acquired area is developed with plantation and same shall be maintained.

6.4 Connectivity

The mine is approachable from by nearest airport, Dabok (Udaipur) at 58 km and nearest railway station is Fatehnagar about 17 km on Chittorgarh-Udaipur broad gauge railway line and 4 Lane state highway.

6.5 Drinking water management

The drinking water facilities are well established in RDM which is supplying water to Rajpura Dariba Mine, Colony, Dariba Smelting Complex and Sindesar Khurd Mine. The same facility shall suffice the drinking water requirements of all employees.

6.6 Industrial Waste Water management

Mine water generated in the mining activity is suitably treated and reused in wet drilling operations, dust suppression in underground operation and in sprinkling on surface roads for dust suppression. Zero discharge is maintained from mining premises. There is no process effluent at the current beneficiation plant and no effluent is envisaged with further increased capacity. Storm water generated is allowed to flow naturally ensuring no contamination to it.

6.7 Solid Waste Management

Solid waste occurs in two forms from mine described as under:

- **Mine Rock Waste**
  Additional waste generation due to development activities is envisaged to 480,000t as compared to existing 35,000t per annum. The development waste generated shall be disposed in underground voids.
- **Mill Tailings**
  Mill tailings will be disposed off in the existing tailing dam. Height of the existing tailing dam shall be raised, phase wise.

6.8 Power requirement& supply/ source

For 2.0 mtpa mining & beneficiation capacity, additional power of 13 MW is required for proposed expansion over existing 12.0 MW requirement and shall be met out from Captive Power Plant/ Ajmer Vidhyut Vitran Nigam Limited.

7.0 REHABILITATION AND RESETTLEMENT (R&R) PLAN

No additional land needs to be acquired, therefore, no R&R is applicable.

8.0 PROJECT SCHEDULE AND COST ESTIMATES

8.1 Project Schedule: The project schedule is as follows.

- **Mine Development Activity**
  Date of start of Mine Development is Dec-18.
  Date of completion is Dec-21.
- **Beneficiation Plant**
  Date of start of mill erection is Jun-19.
  Date of completion is Jun-20.

8.2 Capital Cost Estimates

The capital cost for the project has been estimated at INR 960cr.

9 ANALYSIS OF PROPOSAL

9.1 Financial Benefit

The proposed project shall generate foreign exchange to the country by exporting Zinc thus saving of foreign exchange. This will also generate revenue to the state Government as well as central government. The people around the region will get direct and indirect employment thus improves the financial status. Currently, royalty of Rs.70 crores per annum is being paid to state exchequer which will be enhanced by another 90-100 crore per annum after expansion.

9.2 Social Benefits

The proposed project shall proactively participate in the upliftment of socio economic index of the communities around the project site by way of financial and administrative support. The project will open up employment opportunities, directly and also indirectly. There shall be opportunities for entrepreneurs to engage in many service sectors directly or indirectly associated with the project.

The CSR approach of the company shall be towards sustainable livelihood management of the community around. There shall be focus on education, health, sanitation, drinking water, agriculture, water shed management, culture identity preservation, welfare of socially weaker sections and marginalized people.