

## **INTRODUCTION**

M/S Dangote Industries Limited is one of the leading business organization of Nigeria in trading having interest in wheat, rice, flour, textile and cement. Having given to understand that there are large deposits of limestone available in the States situated in central Nigeria. The Kogi State at Oyo-Iwa village is one of such deposits, which is approximately 9 kilometers north east of Obajana village. Obajana is located about 25 kilometers from the old Kabba road junction off the Lokoja-Okene high way. An Exclusive Prospecting License to an extent of 8.00 Sq.KM is granted by Federal Ministry of Solid Mineral vide order No. MSM/KG/EPL 17807/19 dated 19<sup>th</sup> March, 2002. Subsequent to this a mining lease has been granted in favour of Obajana Cement Company Limited, PMB 1085, Lokoja, Kogi State over an extent of 527.045 hectares at Oyo-Iwa village, Lokoja L.G.A of Kogi state.

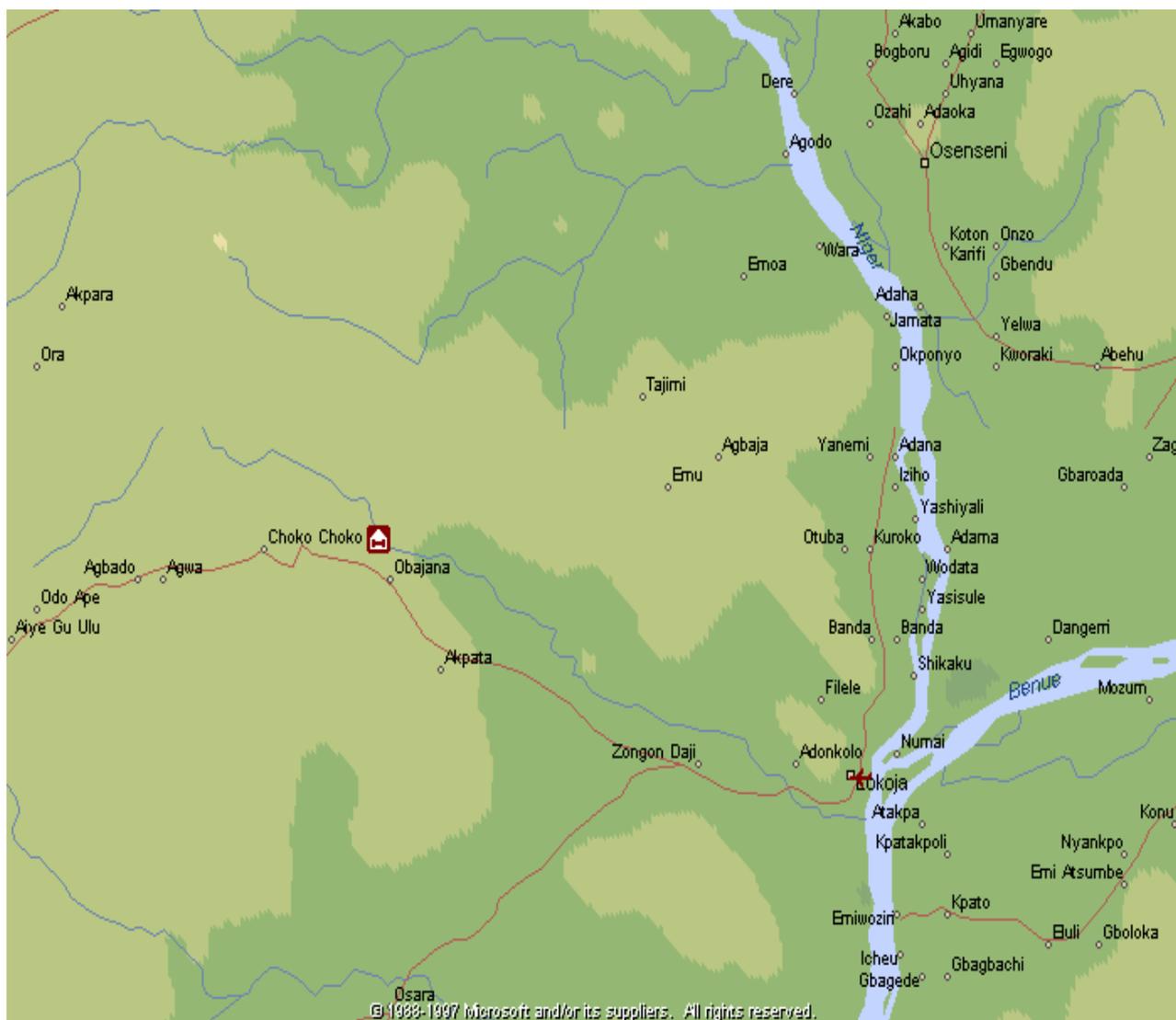
## **DESCRIPTION OF THE AREA**

### **LOCATION**

The proposed mining lease is located by grid reference longitudes  $07^{\circ} 59.816N$  and latitudes  $06^{\circ} 26.511 E$ . The deposit can be accessed through Obajana-Jakura Road.

Figure 1 shows the location map of the area. An unmetalled fair weather road leading from Obajana village, old Jakura Marble Industry and Oyo-Iwa village provide access to the area. The plant is proposed at Obajana village. The market survey indicates that cement requirement would be around 6.0 million tonnes per annum to meet with the local demand and also to cater to the neighboring countries. For meeting with the requirements a plant

capable of producing 14,000 tonnes of clinker per day is envisaged, that means the limestone major raw material requirement would be around 21000 tonnes per day. The details of the area held under mining lease is furnished in Plate No. 1A.



### **LOCATION PLAN**

### **Topography and Drainage**

The topography of the proposed mining site area is highly undulating. The highland areas are defined by hills in form of ridges, with a North South attitude. The terrain is very rugged with quartzite ridges sometimes rising as high as 100 metres above the low lands. The deposit exists in the bed of river Mimi and to the east are quartz-muscovite-schist ridges. The highest elevation is to the North Eastern part of the area, which is above 310 metres above sea level while the southern part has the lowest elevation of 255 metres above sea level. The area is drained mainly by river Mimi and its tributaries, which forms a dendritic pattern of drainage and discharge its water south wards into river Niger.

### **Climate and Vegetation**

The climate of the area is characterized with distinct wet and dry seasons. Rains falls between April and October. The dry season runs from November to March. The average rain fall is about 1200 mm. The area falls within the Ginea Savannah type vegetation, which is charecterised with low scattered trees and shrubs to tall grasses. The following photograph shows the typical savannah vegetation in the area proposed for mining.



## **GEOLOGY OF THE AREA**

The regional geological set up and local geology of the area is briefly discussed in the succeeding paragraphs in this chapter.

### **REGIONAL GEOLOGY**

The area falls within the Basement complex of the South Western part of Nigeria which consists of granite, gneisses, migmatites, schists, quartzite and pegmatite. Undifferentiated gneisses and migmatites dominate the basement complex in the area while the dominant sediments in the region include sandstones and ferruginous iron stone.

The Basement complex in the area generally consists of rocks belonging to older Granite Suite of meta igneous rocks and schists. The older granite rocks consists mainly granites, amphibolites, gneisses and migmatites, while the rocks of the schist belts consist of various schist type and pyrolites.

The concession area is generally classified within this region falls the met sedimentary Iron formation belonging to the Igarra-Kabba-Jakura formation.

### **Local Geology**

The rock type in the study area includes schist, pegmatite, quartzite, limestone, granite and granulites. The schist that outcrops extensively along the access road to the site is of two varieties. One is mica schist and the other one is quartzo feldspahitic schist. In the south, quartz/quartzite cobbles/pebbles and ferugenised quartzite boulders and cobbles occurred extensively, while north east of the area in particular migmateschist (Schist and gneiss) out cropped extensively. Granite and pegmatite outcrops were also noticed. The regional strike of the rocks in this area is N20 degree East and the dip of 45 degree towards east.

The limestone having roughly NE-SW trend and thinning out in the south-western direction. The limestone is of gray to white in colour, medium to coarse grained in nature with few mica specks. In some places mica schist and granulite intrude the limestone. The limestone is overlain by 2 metres 8 metres thick overburden soil. As revealed from the boreholes drilled in this area the limestone occurrence is upto 70 metres (NMC 22) from the surface. The minimum and maximum values of major oxides with reference to CaO as determined from the core samples is as under:

	CaO %	MgO %	SiO <sub>2</sub> %	Al <sub>2</sub> O <sub>3</sub> %	Fe <sub>2</sub> O <sub>3</sub> %
Minimum	39.15	0.00	0.01	0.75	0.30
Maximum	55.40	9.80	17.4	3.34	2.60

The following photographs shows the limestone deposit in this area is extensively out cropped along River Mimi channels and some of its streams.



**MASSIVE LIMESTONE OUT CROP ALONG RIVER MIMI**



**PHOTOGRAPHS SHOWING THE SCHIST OUTCROP ALONG THE ROAD**



**TRIAL PIT SHOWS THE OCCURANCE OF LATERITIC SOIL IN EPL AREA**

**Stratigraphic Succession**

The Stratigraphic succession of the area consists of magmatic intrusion of older granite series, folded metasediments of Igarra-Kabba-Jakura formation and gneissic complex.

**PREVIOUS WORK**

The area initially prospected by M/s CEE-TEE Mega Ventures Nig.Ltd, Lokoja during year 2000 for the then proposed Kogi Cement Company. During this prospecting work M/s CEE-TEE Mega Ventures Nig.Ltd, have carried out Topographical Survey, Geological traversing, Geophysical investigation using Electrical Resistibility (VES and Electrical profiling) technique. A total of 21 X 41 spot heights on 100 m grid pattern were established, 41 Geophysical measurements were taken and 15 boreholes were drilled during this period.

## **PRESENT WORK**

Subsequent to this, M/s Dangote Industries Limited has engaged M/s Julius Berger Nigeria PLC Foundation to evaluate the extension of this limestone deposit adjoining to the known deposit for its proposed Obajana Cement PIC during 2002.

A total of sixty five (65) Vertical Electrical Sounding and thirteen (13) Magnetic profiles were undertaken across the concession and three (3) pilot boreholes were geophysically logged.

A total of forty six (46) boreholes were sunk across the concession in 2003

M/s Dangote Industries Limited entrusted M/s Nigerian Mining Corporation to carry out exploration drilling in the proposed mining lease area from November 2002 . According M/s Nigerian Mining Corporation has drilled around 32 boreholes. The borehole logs are enclosed as ANX-1

## ***PHOTOGRAPH SHOWING THE PROGRESS OF EXPLORATION***



The following statement shows number of boreholes drilled by different agencies.

**Boreholes drilled by M/s CEE-TEE Mega Ventures Nig.Ltd, Lokoja**

Hole Name	Y-Coordinate (Northing)	X-Coordinate (Easting)	Z- Coordinate (Top elevation)	Max depth of hole
BAT 001	884460.992	217373.359	260.507	32.00
BAT 002	884375.502	217387.739	261.747	20.00
BAT 003	884693.682	217028.679	257.357	24.00
BAT 004	885439.172	216694.729	286.837	14.00
BAT 005	885175.282	217181.689	277.647	15.00
BAT 006	884508.562	217729.499	259.677	11.09
BAT 007	884792.542	217553.299	256.107	16.80
BAT 008	884572.532	217558.699	258.277	3.00
BAT 009	884963.562	217361.989	261.927	12.00
BAT 010	884984.292	216972.999	265.327	15.00
BAT 011	884386.382	217914.759	266.137	16.70
BAT 012	884916.102	217165.029	258.847	24.50
BAT 013	884177.762	217513.619	266.467	15.00
BAT 014	884356.982	217131.799	262.027	21.90
BAT 015	885485.309	217978.942	261.500	23.00
<b>Total</b>				<b>263.99</b>

**BOREHOLES DRILLED BY M/S JULIUS BERGER NIGERIA PLC  
FOUNDATION**

Hole Name	Y-Coordinate (Northing)	X-Coordinate (Easting)	Z-Coordinate (Top elevation)	Max depth of hole
JB1	883793.492	216844.059	271.007	N.A
JB2	883715.712	216086.789	292.347	N.A
JB3	883834.412	217268.929	287.007	20.00
JB4	883813.062	217038.849	273.337	50.40
JB5	883820.982	217154.809	281.857	50.00
JB6	883752.362	216429.489	278.187	61.30
JB7	883803.732	216944.739	275.187	50.00
JB8	884500.572	217980.929	257.597	50.10
JB9	883733.862	216227.929	290.717	N.A
JB10	883618.372	217046.669	282.917	23.70
JB11	883744.002	216329.609	283.817	50.20
JB12	883598.082	216847.689	276.597	17.20
JB13	883590.902	216413.859	279.597	51.20
JB14	883592.182	216648.479	280.397	27.75
JB15	883354.432	216387.559	284.677	16.30
JB16	883329.332	216621.809	289.637	50.00
JB17	883535.952	216260.569	284.767	50.00
JB18	883355.112	216241.479	285.417	50.00
JB19	883684.932	216521.559	278.527	41.00
JB20	883486.222	216557.289	281.357	50.20
JB21	883615.372	216650.509	278.377	49.85
JB22	883967.171	216605.853	284.540	27.05
JB23	883765.042	216530.119	278.837	50.20
JB24	884165.202	216627.579	271.507	17.55
JB25	884364.612	216644.439	271.747	38.85
JB26	883940.292	216399.409	278.937	40.80
JB27	884271.262	216632.669	269.0677	11.70
JB28	884139.246	216425.71	275.157	18.50
JB29	884165.202	216627.579	269.677	16.50
JB30	884564.402	216664.879	267.217	20.00
JB31	884526.292	216857.099	266.857	45.70
JB32	884643.942	216864.299	265.517	11.20
JB33	883588.342	216293.956	281.627	50.00
JB34	883608.072	216228.479	290.617	32.00

Hole Name	Y-Coordinate (Northing)	X-Coordinate (Easting)	Z-Coordinate (Top elevation)	Max depth of hole
JB36	883870.752	216594.169	285.847	29.20
JB37	883976.152	216702.439	290.467	49.50
JB38	883874.342	216689.569	288.897	18.40
JB39	884074.872	216714.149	280.537	42.10
JB40	883763.252	217208.989	292.687	20.70
JB41	883766.212	217237.749	292.157	13.20
JB42	883768.322	217295.189	294.947	16.00
JB43	883613.592	217621.159	288.817	23.80
JB44	883665.342	217702.099	278.037	9.90
JB45	884082.782	217530.639	268.847	13.30
JB46	884725.512	217250.289	254.877	50.00
		<b>Total</b>	<b>1175.55</b>	

## BOREHOLES DRILLED BY M/S NIGERIAN MINING CORPORATION

Hole Name	Y-Coordinate (Northing)	X-Coordinate (Easting)	Z-Coordinate (Top elevation)	Max depth of hole
NMC-1	884735.442	217942.839	249.947	50.35
NMC-2	884510.342	217727.399	259.837	43.56
NMC-3	884386.712	217917.439	263.257	52.56
NMC-4	884567.182	217556.229	258.177	52.59
NMC-5	885134.142	217957.139	255.697	50.95
NMC-6	884942.872	217547.539	260.487	54.45
NMC-7	885150.842	217541.699	265.807	43.01
NMC-8	884070.832	217149.769	268.727	50.31
NMC-9	883954.232	216938.029	271.597	52.15
NMC-10	883772.812	216647.289	280.057	52.36
NMC-11	883785.832	216768.949	271.907	50.14
NMC-12	884059.392	217416.599	288.457	51.35
NMC-13	883990.372	216801.929	278.007	52.30
NMC-14	884186.232	216828.648	267.207	52.43
NMC-15	884179.182	217509.489	265.757	50.03
NMC-16	884385.342	216846.349	267.347	50.16
NMC-17	884122.062	217304.159	273.227	45.96
NMC-18	884540.822	217030.679	265.237	50.54
NMC-19	884003.822	217306.029	282.877	51.38
NMC-20	884018.842	217198.919	271.647	52.68
NMC-21	884563.66	217248.009	262.557	52.85
NMC-22	884410.252	217499.639	261.807	70.12
NMC-23	884414.922	217755.349	261.267	45.80
NMC-24	884481.952	217832.349	261.467	35.84
NMC-25	884308.392	217499.499	262.087	44.78
NMC-26	884680.382	218012.599	254.497	39.86
NMC-27	884717.953	218120.502	253.897	47.31
NMC-28	884742.193	218206.342	252.587	43.77
NMC-29	884569.183	217902.472	247.457	45.69
NMC-30	884497.491	217623.034	255.047	57.85
			<b>Total</b>	<b>1493.13</b>

## **LOGGING AND SAMPLING**

Samples collected during the present investigation involved only core samples that were systematically processed to yield a representative powder for carrying out chemical analysis. The length of core obtained for every two metres in limestone was measured for calculating the core recovery percentage. The core was then split longitudinally and logged by examining its colour, grain size, texture, compactness and minerals present. One half of the core was packed systematically in numbered bags and kept as counter sample for any future reference.

The other half of the split core was crushed to about 10-mm size, coned and quartered to yield a representative sample of about 200 gms. This sample was then ground and passed through 100 mesh BSS sieve to obtain a representative powdered sample for chemical analysis.

## **CHEMICAL ANALYSIS**

A total of 804 samples were generated from drilling of the 91 borehole cores as mentioned in the foregoing were analyzed for determination of major oxides by X-ray analyzer.

## **BOREHOLE LOGS AND DATA STATEMENTS**

The borehole core samples were logged for every 2.0 m length of core and depending on the lithology. The borehole data was also consolidated in the form of a statement " Borehole Data Statement" appended as Appendix.1. This statement shows the details of each borehole like location, surface reduced level and length and bottom reduced level, apart from the thickness of Limestone and clay encountered if any, details of analysis & megascopic descriptions were incorporated. The location of all the boreholes is marked on Surface Plans and Geological sections.

### **Exploration proposed to be carried out**

The holes drilled for proving the extension of limestone deposit were shallow and most of them did not reach the contact zone of foot wall. Hence, to be very sure about the total thickness about 16 core drill holes are proposed. In addition to the above 46 DTH holes are proposed to get the information for day to grade of the production level and as a first phase holes placed south of River Mimi, where immediate mining operations are taken up.

For additional limestone and additives 6 nos. of EPLs were applied. Permission from Federal Solid Mineral Ministry is awaited to entering into the area and starting the regular prospecting work.

As far, additives are concerned Laterite bearing areas are located within 15 Kms radius from the plant site and are ready for quarry lease applications. The grab samples collected from various locations are analysed for their chemical content and they are to be tested for their hardness and abrasiveness.

### **RESERVES**

#### **ESTIMATION OF GROSS GEOLOGICAL RESERVES**

The geological sections constructed based on the boreholes drilled were utilized to estimate 'Gross Geological Reserves'. For this purpose the total area of Limestone along each section line viz., cross sectional area in square metres was calculated. The cross sectional area obtained along two consecutive section lines was averaged and multiplied by the average distance between the section lines. The insitu volume in cubic metres was then converted in to tonnage by applying tonnage conversion to get 'Gross Geological Reserves'.

### **Reserves in the Mining Lease Area**

Since the boreholes drilled in this area to prove the limestone persistence upto +220 (Upto 45 metres depth). Based on the details obtained from these holes, it is estimated that the geological reserves of this deposit upto the RL +220 (for three levels) is around 119 million tonnes. Out of the 91 holes drilled, the BH NMC 21 has reached the maximum depth of 70 metres that shows the persistence of limestone below +220 RL. The limestone reserves beyond this depth will be proved after drilling few more holes upto the bottom of limestone contact and this will further enhance the limestone reserves. Apart from the above limestone reserves, it is estimated around 29 million tonnes of additive materials like Fe Clay, Laterite and Mica Schist in this area.

### **Reserves estimated in the EPL area**

M/s Dangote Industries Ltd., has preferred 6 more EPL for limestone in the area adjacent to the present ML area, each covering an area of 20 Sq.K.M. Based on the preliminary investigation carried out in all these area, the inferred reserves of limestone will be around 450 million tonnes and 90 million tonnes of additives are estimated. Systematic detailed prospecting will be carried out to convert the present inferred reserves to the measured category.

	<b>Quantity in million tons</b>			
<b>Items</b>	<b>Proven</b>	<b>Indicated</b>	<b>Inferred</b>	<b>Total</b>
Lime Stone	119	200	250	569
<b>Clay</b>	6.5	22.5	90	119

### **Anticipated Life of the deposit**

The present available limestone reserves of both inferred and measured category would be around 568 million tonnes. For the proposed rate the available reserves as of today will last for around 98 years.

### **Quality.**

The average quality of limestone and additives are estimated based on the prospecting operations viz core drilling and trial pits carried out on this deposit are as follows.

<b>Material</b>	<b>SiO<sub>2</sub> %</b>	<b>Al<sub>2</sub>O<sub>3</sub> %</b>	<b>Fe<sub>2</sub>O<sub>3</sub> %</b>	<b>CaO %</b>	<b>MgO %</b>	<b>Mn<sub>2</sub>O<sub>3</sub> %</b>	<b>K<sub>2</sub>O %</b>	<b>Na<sub>2</sub>O %</b>	<b>LOI</b>
Limestone	1.96	0.42	0.20	53.5	0.87	0	0.09	0.03	42.4
Mica Schist	73.20	13.20	4.76	0.23	1.00	0.04	3.62	0.04	3.30
Red soil	67.40	14.50	8.98	0.12	0.15	0.09	1.18	0.00	6.44
Fe-Clay	68.90	17.40	4.20	0.09	0.20	0.03	1.37	0.00	6.79
Marl	73.30	12.70	5.47	0.17	0.25	0.10	2.32	0.10	4.86
Laterite	40.00	17.20	28.30	0.07	0.03	0.11	0.28	0.00	9.95

### **Mining Lease/Permit**

A mining lease has been granted over an extent of 527.045 hectares of lands in Oyo-Iwa village, Lokoja L.G.A area of Kogi State for a period 21 years vide Lease No.23312 dated 23<sup>rd</sup> June,2004. Copy of the mining lease is enclosed as **Annexure I**. Apart from the above mining lease the company has preferred 6 more Exclusive Prospecting License each of 20 Sq.Km around this mining lease. The copy of the acknowledgement letter issued towards receipt of all these 6 EPL applications is enclosed as **Annexure II**.

## **MINING**

It is proposed to mine the deposit by the method of deep hole drilling and blasting with deployment of Heavy Earth Moving Machineries. The mineralized area south of river Mimi is selected for I Phase of mining operations. Accordingly, bushes were cleared over an extent of about 900,000/- square metres on south side of river Mimi. Based on the geological information as gathered from prospecting operation carried out so far, the deposit is proposed to be mined up to a maximum depth of 45 metres. It is estimated that quantity of Over burden/additive material will have to be handled to win the entire limestone upto the economical depth of + 220 RL (Max 45 Metres depth), would be around 13.09 million tonnes. Based on the topography of the limestone on mineralized area, it is proposed that the bottom RL of I Bench will be +250 RL and then followed by two benches of each 15 metres high. In the bush cleared area, the top arable soil of 0.3 metre thick will be scrapped and stored separately and then followed by removal of other top soil of around 1.5 metres height will be removed and stored separately for future afforestation purpose. After this, an approach ramp will be formed to reach the floor of I Bench (+250 RL). After landing the ramp in this level, all the overburden along with some limestone will be mined above this level. The limestone mined during this period will be stacked separately for future use. After developing sufficient area in this level, the ramp will be further deepen to reach floor of next bench and the same system will be continued for formation next bench. The benches will be formed in such a way that it will have minimum berm width of 15 metres including shift and over all pit slope does not exceed 45 degree.

The stream courses, which run through the proposed mining area are diverted along the periphery of the ultimate pit limits of the proposed mining pit. We have taken up this diversion and the same is under progress. The reserves estimated in the south block is around 61 million

tonnes will last about 10.5 years. After exhausting the entire mineral in this area, the mining activities will be shifted towards north of River Mimi.

### **Diversion of River Mimi**

We have identified a suitable course for diversion of river Mimi. The diverted course will have the length of around 1.52 K.M. The proposed diverted course was surveyed and cross sections has been prepared. The estimated quantity of cutting will be about 619000 Cu.M. Please refer Plate No.4 for detailed engineering.

After the proposed diversion of 1.5 KM it will join another big stream which runs in the direction of North-North East of our mining lease boundary and ultimately joins River Niger. No villages and settlements are observed all along the above mentioned stream.

The above proposed diversion will not have any effect on the villages or settlement as the only existing Oyo-Iwa village and settlement has been already decided to relocate to new location also it will not have any bearing on irrigation or agriculture since water from River Mimi is not used for any irrigation purpose. This diversion will not have any impact on the community and quality of the water. However detailed impact assessment will be carried out regarding new stream course in future and required steps will be taken to mitigate if any impacts are observed. It is observed from last 10 years rainfall data and our monitoring of water levels at Mimi for last two seasons indicates that the proposed dimensions of the diversion will sufficient to accommodate the maximum quantity of water flow on any given day.

Prior to the diversion of River Mimi required permission from various Government agencies and local authorities will be obtained.

### **Diversion of streams**

Apart from River Mimi there are other two small seasonal streams are passing in the eastern and western part of the mineralized zone. Plan has been made to divert these streams away from mineralized zone and the same is shown in the conceptual Plan. The stream which is passing in eastern part is named as Stream 1 and the other stream at western part is named as Stream 2. Please refer Plate No. 1A to 1E.

#### **Stream 1 Diversion**

The diversion of this stream will be carried out at the end of the first five year plan period. This involves diversion of 855.0metres length and estimated earth cutting of 66,500 Cu.M. The stream diversion will flow in the same lithological horizon and hence it will not have any adverse effect on quality of water and also the diverted course will merge with the same River Mimi. For detailed engineering please refer Plate No.4.

#### **Stream 2 Diversion**

The diversion of this stream will be carried out in the initial period of first five year plan period. This involves diversion of 495.0 metres length and estimated earth cutting of 31,100 Cu.M. The stream diversion will flow in the same lithological horizon and hence it will not have any adverse effect on quality of water and also the diverted course will merge with the same River Mimi.

**Drilling:**

The company has already acquired 2 Nos. of self propelled crawler mounted Atlas Copco make ROC L8 DTH drill for blast hole drilling which is capable of drilling upto a depth of 54 metres and the facility of optional Interchangeable will allow to drill hole dia of either 150 mm or 115 mm as per the requirement. The machine is equipped with sophisticated in build electronic system which will provide better accuracy of drilling configuration such as drilling depth, inclination etc will aid to obtain better blasting and to maintain uniform bench floor. The airborne dust generated during drilling operation will be completely eliminated as the drill is equipped with dust extraction and collecting system. Apart from this a inbuilt water tanker having the capacity of 220 liters of water will enable us to carry out wet drilling where ever it is required. The above combination will help to maintain clean working environment. An audio visual alarm is provided in the machine to warn the people in the vicinity while reversing of the machine. All the operations are controlled from a fully air conditioned and sound proof operator's cabin, so the drill operator will not expose to any occupational hazards like dust and noise.

**SURFACE WATER**

A seasonal River Mimi and few seasonal streams are flowing adjacent to this area. Both the river and streams are not perennial and are mainly rain fed and remain dry for most of the year.

## **GROUND WATER CONDITIONS**

The general ground water level of the area varies from 12 metres during rainy days and upto 36 metres during dry season. The normally the limestone is an impervious layer and poor transmissibility. We expected only small amount of seepage water through the minor cracks and joints. A detailed ground water study is under progress to find out ground water flow direction, porosity and permeability and the same will be submitted in due course.

## **GROUNDWATER RECHARGE**

The principal source of recharge to the groundwater in this area is rainfall. Other sources include seepages from nearby River Mimi. Due to the absence of perennial water source in these area, agricultural practices are mostly dependent on monsoonal precipitation.

The ground water available with in the mining area is expected to provide adequate water supply for the use of mines and the excess water will be pumped out to natural water course after desiltation.

### **Loading:**

The company has purchased four hydraulic excavators of 7.8 Cu.M and two hydraulic excavators of 5.7 Cu.M capacity for limestone and additive/reject handling respectively. Apart from the above machineries wheel loader having a bucket capacity of 8.6 Cu.M will be used to load the raw materials from stock.

All the additives like clay, schist and laterite have inherent moisture hence it may not generate any airborne dust during loading operation. In case of the limestone water spraying on the blasted muck may required only during

summer to suppress generation of airborne dust. However final conclusion will be arrived after monitoring of the actual mining operations.

All the excavators and wheel loader are provided with well insulated and air conditioned cabin to prevent operators being exposed any dust or noise hazard during operation and also all the fast moving assemblies like engines have been well covered to reduce noise generation.

### **WATER REQUIREMENTS FOR THE MINES**

<b>Activity</b>	<b>Water Requirement</b>
Sprinkling	4000 litres/day*
Washing equipment	5000 litres/week
Afforestation	4000 litres/day*
Drinking water and utility	1000 litres/day
Lavatories	1000 litres/day
Others	1000 litres/day

- Required only during summer

#### **Hauling/Transport:**

The company has purchased 10 nos. of 90 tonnes dumpers and 8 Nos. of 40 tonnes dump trucks for limestone, additive and reject handling. For the operation of this equipment a well laid road will be formed and maintained as mentioned earlier.

Apart from the well maintained road, all the equipments are provided with well insulated and air conditioned cabin to prevent operators being exposed any dust or noise hazard during operation and also all the fast moving assemblies like engines have been well covered to reduce noise generation.

## Equipment maintenance

It is very important in any open cast mine to have a well equipped work shop with all the facilities for maintenance of equipments, besides this also adequately staffed with well experienced Engineers and Technicians for maintenance of all the equipments and to train local technicians. Also care will be taken to collect used materials like oil, filters, tires etc and transporting them to the cement factory at regular intervals for its further proper disposal.

## Mining Machineries

To meet out the targeted per day production of 21000 tonnes limestone and around 5000 tonnes of additive material, the following mining machineries are finalized for purchase.

S.No	Description	Capacity	Unit
1	O&K RH 40E Face Shovels with Automatic controls	7.8 Cu.M	4 Nos
2	Hydraulic Excavator Face Shovel Model 5090 B	5.7 Cu.M	1 No
3	Hydraulic Excavator Back hoe Model 385 BL	5.7 Cu.M	1 No
4	Hydraulic Excavator Model 320 C	1.1 Cu.M	1 No
	Hydraulic Excavator w/Hammer & Backhoe bucket of 1.9 cum Model 330 C	1.9 Cu.M	1 No
6	Front End Wheel Loader Model 980 G II	5.7 Cu.M	1 No
7	Wheel Loader Model 990 II	8.6 Cu.M	1 No
8	Terex Model TR-45 Quarry Dump Truck of 40 Ton Capacity	40 tonnes	8 Nos
9	Terex Model TR-100 Quarry Dump Truck of 91 Ton Capacity	91 tonnes	10 Nos
10	Atlas Copco- ROC L8 Hydraulic crawler drilling Equipment	115 and 152 MM dia	2 Nos
11	Tractor Model D6R II	-	1 No
12	Tractor with Ripper Model D8R	-	1 No
13	Soil Compactor Model CS 563 E	-	1 No
14	Fork Lift Model DP 50 K	-	1 No

15	Motor Grader 140 H	-	1 No
17	Bedford Diesel Bowser	-	1 No
18	Bedford Water Bowser	-	1 No
19	Bedford Explosive carrier	-	1 No
20	Bedford ANFO Mixer	-	1 No

**BLASTING:**

**Broad blasting parameters:**

Since the mine is going to be fully mechanized, to meet huge raw material requirement a system of deep hole drilling and blasting will be adopted to loosen the limestone. It is proposed to maintain a bench height of about 15 metres, for which 16.0 metres deep holes will be drilled including sub grade drilling. The proposed burden for these holes will vary from 2.5 to 3.0 metres and spacing from 3.0 to 4.5 metres depending upon the strata conditions. However favorable burden and spacing dimensions will be arrived after conducting few trial blasts.

The blasting practices which are proposed to be adopted are explained below. Each blast hole will be loaded with suitable size explosive cartridges, which include cap sensitive explosives (primer) and non-cap sensitive explosives (column). In dry holes, ANFO will be used in place of or in addition to non-cap sensitive explosives. Deck charging system will be adopted, when the strata exhibits variation in rock hardness, thereby reduce the explosive charges per hole and top of the hole for about 1.75 metres will be stemmed with suitable stemming material which will prevent generation of fly rocks, noise and vibrations . A powder factor of around 6.00 – 8.00 tonnes per kg of explosive in limestone is expected.

### **TYPE OF EXPLOSIVES USED:**

The following explosives and accessories are proposed to be used in the mine:

1. Slurry : Cap sensitive and non cap- sensitive from various explosive manufacturers.
2. ANFO : Ammonium Nitrate and fuel oil mixture.
3. Detonating card/  
Safety fuse : 10 GPM
4. Non Electric delay : from 400 to 500 milli seconds  
detonators with Trunk : 17,42,75 &100 Milli seconds  
Delays

For the purpose of mixing ammonium nitrate with fuel oil, we have proposed to use ANFO Master Mixing Machine, Model BLAST MASTER 3000, which will facilitates uniform mixing of ammonium nitrate and fuel oil mechanically, thus avoiding manual mixing.

### **STORAGE OF EXPLOSIVES:**

It is proposed to establish a 100 tonnes magazine to store the various explosives. The proposed location for the magazine is situated away from danger zone i.e., around 1000 metres away from the proposed mining pit. It is also proposed to establish a storage shed to store around 100 tonnes of Ammonium nitrate. The explosives will be transported from and to the magazine by an explosive van meant for the purpose.

### **Advantages of storing explosive close to quarry**

The proposed site for the magazine is selected in consultation with The Federal Ministry of Solid Mineral in an approved design. The storage shed should be constructed according to the design and plans given to us by the same Ministry. The magazine building should have a safety distance of at least 1000 meters from any dwelling house or a factory by international

standard, public roads, like places where public moves about. Such a big area near plant site is a cumbersome to be allotted for this purpose. In normal practice the store or magazine for this purpose is located very near to the Mining lease or within the lease itself because the magazine has to be constructed in the land fully under the control of the owner and transporting of the explosive from one place to another involving public roads, requires a additional security from police department with a BOMB DISPOSING SQUAD, under Nigerian law, which becomes more cumbersome for the mines dept to get the Bomb squad when ever needed from the Govt. officials. To avoid this, magazines are preferred to be constructed on the periphery of the mining lease or within the lease itself. The security for the guarding of the magazine building in any case is essential whether it is in the plant site or in the mining site. Having the magazine nearer or within the ML is advantages of reducing the transport distance and the cumbersome escort. Hence, the proposals were made to construct a magazine on a approved site with a approved design on the periphery of the existing mining lease hold. It is also proposed to construct an ammonium nitrate storage shed near to explosive magazine to utilize same security and also to facilitate easy handling.

**Precautions to be observed during drilling and blasting:-**

Adequate safety precautions will be taken while drilling and blasting. Drill sites will be cleaned before drilling commences. Adequate care will be taken in handling the drilling and compressor equipments. As explained in the previous chapter the ROC L8 drill have all the required facility for safe operation.

While blasting, adequate measures will be taken right from storage of explosives, transport, charging of hole, blasting and return of explosives. A safety distance of 500 meters all around the blasting site will be kept. Optimum spacing and burden of boreholes, explosive charge and stemming

will be maintained to avoid flying fragments. Ground vibrations will be minimized using millisecond non electric delay detonators. Noise will be controlled by using less amount of DF and avoiding plaster shooting. Proper sentries will be posted to clear men from the blasting zone. The blasting will be done during the interval between shifts. Charging of blast holes and blasting will be avoided whenever the atmosphere is overcast. A rock breaker mounted on hydraulic excavator will be used for down sizing bigger boulders for avoiding secondary blasting, which is one of the major cause for generating fly rocks and air blast.

#### **Mine drainage:**

The main source of water in the area is surface water and ground water. As observed in the borehole drilled during prospecting work and the subsequent measurement taken in some of the boreholes, the water table of this area varying between 12 metres during monsoon and upto the maximum of 36 metres during summer. Due to the monolithic and impervious nature of limestone and also free from geological disturbances like intrusion, joints etc, the ground water seepage is expected to be minimum. A suitable size of sump will be made available to accommodate any increase in seepage water during monsoon period. Two separate power lines will be provided shall be ensured for pumping wherever possible diesel pump will be used. A suitable size bund and garland drainage will be made on entire periphery of the mine and sides of the stream and River Mimi to avoid inrush of surface water during rainy season. The rain and seepage water will be collected in mine sumps for settlement of suspended solids. From this mine sump, water will be pumped to the settling tank, which is provided on the top of the mine for the desiltation. The pure water after desiltation will be discharged to stream. The location

of mine sump, settling tanks are shown in the conceptual plan. Please refer Plate No. 1A to 1E.

### **Disposal of waste:**

#### **Nature of waste:**

As stated earlier, the area is covered by 3 to 10 metres thick overburden material of marly clay and other clayey material. It is necessary to remove the overburden to expose the limestone band. Totally it is proposed to handle a maximum of about 13.8 million tonnes of waste material will have to be removed, of which around 6.9 million tonnes will be utilized as additive and the remaining 6.8 million tonnes will have be dumped out in the form of dumps. Quantity of reject generated, stored and used at five yearly interval is discussed under conceptual mining plan chapter.

#### **Method of waste dumping**

The waste material and top soil generated during development will be loaded and transported to dumps by deploying three 40 tonnes capacity dumpers and one 5.7 Cu.M shovel combination. It is proposed to provide separate dumps for top soil and other waste materials generated from the mine, in the area located outside the stripping limit. During the second five years period there will be minimum developmental activity, since the exposed limestone reserves will be sufficient for that five years period. During third five year period of mining operation will be extended to north of River Mimi. The developmental reject generated during this period will be utilized to refill the part of exhausted pit in South of River Mimi. Hence there is no dumping of reject material in the form of dumps after first 5 years period. The same is discussed in detail under Conceptual mining plan chapter.

**Selection of dump site:**

The proposed dump site for both top soil and reject is located on barren non mineralized hard rock zone (Hard schist and pegmatite), outside the stripping limit which is having sufficient load bearing strength and away from active streams and river (shown on plate No.1B to 1E).

**Maximum height and spread of dumpyard:**

The dumpyards will be formed in such a way that the maximum height will not exceed 19 metres at any given time. For dumps an area of about 6.2 hectares has been allotted for overburden reject and about 2.0 hectares for stacking top soil separately. The material dumped will be allowed to take its own angle of repose which is around 37.5 degree, hence any possible collapse of dump itself is avoided.

**Precautions for confinement of dumps to prevent pollution of surface water bodies/courses.**

The top of the dump will be adequately sloped so as to prevent accumulation of water and heavy erosion. Earthen banks will be provided on the non operating side of dumps to arrest wash off. Plantation will also be made along the foot of unused slopes of active dumps, to arrest and prevent erosion and sliding of dump slopes. Garland drainage and bunds will be provided on the periphery of both top soil and overburden dumps. The water from this garland drainage will be collected in the settling tank and then water will be discharged to the stream or the water will be used for afforestation purpose.

## **CONCEPTUAL MINING PLAN:-**

The entire deposit will be worked in two blocks, namely South and North blocks. Both the block will be mined upto 220 RL. This block will be mined section by section, so that one section can be exhausted so as to get refilled by waste generated from adjacent section. As explained earlier, the initial mining operations will be at South of River Mimi and then will be extended towards north.

## **PROPOSAL FOR FIRST FIVE YEARS PLAN PERIOD ( 1ST to 5th year)**

### **Initial Mining operation**

The following preparatory work is proposed to carry out prior to starting of intensive mining operations and the same will be carried out during the first six months. Once these preparatory mining operations gets completed then full-fledged mining operation will start.

#### **1. Formation of approach ramps and mine sump.**

It is proposed to form an approach ramp from crusher top to the mine for transporting both limestone and additives. The total length of the ramp will be 440 metres and it is planned to maintain width of 30 metres at the top and at an gradient of 1:20 for easy and safe movements of heavy earth moving equipments. The quantity of the material required for formation of this ramp will be about 97000 Cu.M.

#### **Maintenance of roads**

Since the roads are the heart of the open cast mining care has been taken to maintain roads in a good condition right from initial stages itself by acquiring road formation and maintaining equipments like Dozer, Motor grader, Soil Compactor and water tanker, to withstand movements of Heavy Equipments to haul huge quantity of material every day.

The regular water spraying and compacting of the roads will suppress the airborne dust generated during vehicular movements and maintains clean environment always. Also care has been taken to provide 50 metres length platform at the landings of every bench to prevent continuous load on the engine to maintain engines in healthy condition otherwise which is one of the cause for pollution of the atmosphere.

Initially an approach ramp upto a depth of 24 metres and sump of 5 metres deep has been planned from the surface. To make this approach ramp and sump, a total quantity of 603000 tonnes of material to be handled of which 98.000 tonnes of overburden and 505,000 tonnes of limestone.

**2. Advance development.**

The requirement of limestone by the plant for the first 6 months of operation would be around 3.15 million tonnes. Which require 1.51 million tonnes over burden removal. The details are furnished below.

Mines Development (Over Burden Removal)  
 630 M (length) X 165 M (width) X 6.13 (Avg.Depth)  
 =637213.5 Cu.M or 10,51,400 tonnes

After the above said development, the exposed limestone reserves as follows.

I Bench	
600 M X 135M X 6.25 M X 2.5	= 1,265,650 tonnes
II Bench	
550 M X 105M X 15 M X 2.5	= 2,165,650 tonnes
	-----
Total	3,431,250 tonnes

Thus the total quantity to be removed for both development and ramp formation would be around 1,654,400 tonnes (1,149,300 tonnes of OB and 505,000 tonnes of limestone).

The limestone will be mined during ramp formation (505,000 tonnes) will be stocked.

## **II Infra structure development**

The following approach road will have to be formed prior to active mining operations.

1. Approach road from Mines to Obajana – Jakura Road. (750m X 30m)
2. A road from Mines to Mines office (200m X15m)
3. A road from Mines to Workshop (200m X15m)
4. A road from Mines to Explosive Magazines (1000m X15m)
5. A road from stockyard to Crusher hoppers (200m X30m)
6. A road from Mines to Dump yard (1000m X30m)

## **III Construction of buildings**

Leveling of ground has to be carried in the following areas.

1. Mines Office
2. Mines Workshop
3. Explosive Magazines
4. Ammonium Nitrate Store.

## **Production and development**

During this period we have to mine 29 million tonnes of limestone and 7.24 million tonnes of additive material like schist, laterite and clay. To raise 29.0 million tonnes of limestone we have to remove 6.72 million tonnes over burden material of which

around 3.62 million tonnes will be utilized as additive (clay) and the remaining 2.84 million tonnes will be dumped out. The approximate area covered by first 5 years mining operation would be around 68 hectares. At the end of fifth year the pit will have dimensions of 1200 M (Length) X 600 (Width) and 30 (Maximum depth). During the above said preparatory work, we have to handle 1.51 million tonnes of overburden material and 0.505 million tonnes of limestone and we will have the developed limestone reserves of around 3.43 million tonnes. Out 1.51 million tonnes of overburden material around 0.16 million tonnes will be utilized for formation of ramp for crusher and around 0.2 million tonnes will be used to form approach road to mines office, workshop, dump yard and explosives magazine. After the first six month period the overburden bench and then followed by subsequent to limestone benches (+250 RL and 250-235 RL). To meet out the requirement of laterite, the area after SL 5 will be sliced upto +280 RL. Two stream courses which passing through the mineralized zone will be suitably diverted and the proposed diversion of these streams are shown in the Plate No. 1B. All around the stream courses, sides of River Mimi and part of outer periphery of mine area will be provided by bund. The bunds will have a total length of 5.25 KM and three metres wide at the top and have 1 in 1 slope. Sump will be located at North western corner of the mine. From this sump water will be pumped to surface settling tank and discharged to water course after desiltation. The top 0.3 metre thick arable soil of around 0.34 million tonnes will be separately stacked in the form dumps. Adequate care will be taken to preserve this top soil without any contamination. To accommodate the overburden reject of 2.84 million an area of about 8.4 hectares is located in non mineralized stable ground for dump yard. The dump yard will have the maximum height of around 17 metres. Required leveling work at the toe of dump will be carried out to enable the material assumes its own angle of repose and garland drainage will be formed all along the dumps. The water collected in this drainage will be collected in a settling tank having the dimensions of 85 m X 50 M X 2 M. From this settling tank water will be drained to water course. The pit positions at the end of fifth year are shown in the Plate No. 1B and section 2B.

### **Reclamation and Afforestation**

At this stage, all the pits will be under active operation and reclamation is not possible during this period. During the first five years period an area of about 14 hectares is proposed to be afforested around mines office, work shop and adjacent to crusher area. Please refer Plate No.1B.

### **PROPOSAL FOR SECOND FIVE YEARS PLAN PERIOD ( 5th to 10th year)**

#### **Production and development**

In this period only the production will be carried out with out any overburden removal. The developmental activities carried out during the pervious five years period sufficient enough to raise the 5.79 million tonnes of limestone which is required for this five years period. For additive requirement, the area after SL 5 will be mined upto +265 RL. The limestone will be mined from 2 levels viz 250-235 RL and 235-220 RL. The approach ramp formed during the pervious period will be extended upto +220 RL and then the face will be pushed in all direction upto the ultimate pit limit. At the end of 10<sup>th</sup> year the south block will reach its ultimate level and part of the pit will be ready for refilling with the reject generated during next plan period. The pit limit end of 10<sup>th</sup> year is shown in the plan (Plate No. 1C) and Section (Plate No. 2C). During end of this period diversion of River Mimi will be taken up.

#### **Reclamation and Afforestation**

At this stage, the south block will attain its ultimate limits and ready for refilling and hence no reclamation will be carried out during this plan period. During the second five years period an area of about 10 hectares is proposed to be afforested between SL 4 and 5 on foot wall side. Please refer Plate No.2B.

## **PROPOSAL FOR THIRD FIVE YEARS PERIOD (10th to 15th year)**

### **Production and development**

In this period, the area lies north of River Mimi will be taken up for mining. During this period a new set of approach ramps will be formed towards NE east direction. The requirement limestone for this five years period would be around 5.79 million tonnes. To mine 5.79 million tonnes of limestone, overburden material above the limestone which is about 7.0 million tonnes will have to be removed upto the ultimate pit limit. The top soil (arable soil of first 0.3 m) will be sliced first and will be spread in the overburden dump for Afforestation and followed by removal of rest of the soil and other over burden. After removing the overburden material to the sufficient length the existing limestone benches of +250 RL will moved upto the ultimate level and then 250-235 RL will be moved towards NE direction. Out of the 7.0 million tonnes of overburden material around 3.62 million tonnes will be utilized as corrective material and the remaining 3.38 million tonnes will be used to refill the exhausted portion south block and to form the bund along the diverted course of River Mimi. An area about 13 hectares at south eastern corner of the pit will be refilled upto +265 RL. The top soil removed during this period will be stored separately. The pit limit at the end of 15<sup>th</sup> year is shown in the plan (Plate No. 1D) and Section (Plate No. 2D).

### **Reclamation and Afforestation**

An area about 13 hectares at south eastern corner of the pit will be refilled upto +265. The top arable soil stored during the first five years period will be spread over the refilled area and then afforested. This will be carried out during the next plan period.

### **Afforestation**

During this period, the reject dump which is located in south block, will be taken up for afforestation. An area about 13 hectares will be afforested during this period. Please refer Plate No.1D.

## **PROPOSAL FOR FOURTH FIVE YEARS PERIOD (15<sup>th</sup> to 20<sup>th</sup> year)**

### **Production and development**

In this period, the approach ramp formed on North eastern direction will be deepened upto +220 RL and the limestone bench 250-235 RL will be moved upto the ultimate level and then followed by 235-220 RL bench. Since the overburden is removed upto the conceptual limit there will not be any developmental activity during this plan period. At end of this period the entire limestone upto the economic level will be mined and the pit will attain its conceptual limit. The top arable soil stored during the first five years period will be spread over the refilled area and then afforested. Please refer Plate No.1E.

### **Reclamation and Afforestation**

No developmental activity during this period and hence no reclamation is proposed.

### **Afforestation**

The refilled portion of the pit around 13 hectares will be afforested during this period. Please refer Plate No.1E.

### **Reclamation and rehabilitation programme**

#### **LAND MANAGEMENT**

The main intention of land reclamation is to restore the pristine ecological condition in the region that is prevailing because of mining.

The salient features of conceptual plan for the lease hold are given in the following table and in Plate No. 1E.

Activity	Extent in Hectares	Remarks
Lease hold area	527.045	Please refer the plate conceptual mining plan (Plate No.1E)
Area occupied by open cast workings	127.000	
Dump	6.550	
Refilled and afforested	13.000	
Afforested	37.000	
Crusher and other Building	5.000	
Water Reservoir (Part of Open cast workings)	98.000	
Others (Road etc.)	5.000	
Remaining undisturbed area	333.495	

### **POST LAND RECLAMATION**

The first step in a successful reclamation program is to decide the post reclamation land use. In case of this mine, it would be appropriate to restore the land after mechanical reclamation for plantation for forest growth to the extent possible.

- The mining and associated operations will disturb about 200 hectares of agricultural and forest lands. The ultimate mine boundary will occupy by an area about 130 hectares after exhausting all the limestone upto a depth of 50 metres.
- In the first year, removal of topsoil and formation of approach ramp will take place. During this initial period, only small quantity of limestone will be mined. The active limestone excavation will be carried out from second year onwards. Based on the available limestone reserves and the annual consumption, the life of the mine would be around 20 years. The average thickness of overburden is around 6 metres. It is estimated that around 13 million tonnes of overburden will have to be handled to win the entire limestone reserves. Out of this, about 50% of the material will be utilized as corrective material to obtain the desired raw mix. Hence sufficient waste material will not be available to refill the deposit after exploiting the limestone. However around 13 hectares in part south pit will be refilled upto +265 RL and the remaining mined out area will be used as water reservoir. To avoid slope failure of benches, the ultimate overall pit slope will be maintained around  $45^{\circ}$ . The water bodies will be used for afforestation. It will also act as source of water for surrounding population. Since large area is going to be used as reservoir, it will promote effective rainwater harvesting and groundwater recharge. In future by nature it may develop into a bird sanctuary and migratory animals may fulfill its water requirements. However the area exploited only for additive on non mineralized area will be refilled with the reject generated from the limestone area.

**Soil conservation measures:****TOP SOIL MANAGEMENT :**

Proper handling and spreading of topsoil is required for better vegetation and preservation of soil microorganisms. The topsoil of 30 cm depth is carefully removed with the help of wheel loader. The topsoil is transported to a separate dumpsite and soil shall be covered by some organic mulch(es) such as crop residues, straw, tree bark, composed organic residue, or even saw-mill waste. Alternatively the topsoil can be enriched through inoculating soil microorganisms. The topsoil dump is wetted occasionally and the moisture shall be maintained to preserve the organisms.

The preserved topsoil shall be spread over the reclaimed areas and along with contours for raising vegetation cover through scientifically designed greenbelt. The topsoil at no account shall be mixed with other dumps. Re-spreading of soil shall be undertaken in dry weather and the machinery shall be selected for minimum compaction.

**Biological Reclamation:**

Biological reclamation of a distributed land means the establishment and maintenance of vegetation on it, for it is only this medium that can achieve rapid visual reintegration and surface stabilization, besides helping to control air and water pollution.

The following control measures to prevent soil erosion and wash off of fines from freshly excavated benches and dumps will be adopted. The bench levels will be provided with water gradient against the slope to decrease the speed of storm water and prevent its uncontrolled descent. The peripheral bund and the external dumps will be biologically reclaimed in order to check soil erosion.

The preserved topsoil shall be spread over the reclaimed areas and along with contours for raising vegetation cover through scientifically designed greenbelt. The topsoil at no account shall be mixed with other dumps. Re-spreading of soil shall be undertaken in dry weather and the machinery shall be selected for minimum compaction.

### **Management of Solid Waste Dump**

The waste generated during the mining operations will be used to construct the peripheral bund around the mine lease area. After the completion of the embankment, the reject will be dumped in the form of dump yard. The dump yard will be located in stable ground in non mineralized area.

The solid waste bund so created will be of trapezoidal cross section with a height of around 19 m without disturbing the natural angle of slope (37.5°).

The slope of the bund will be stabilised and finally plantation will be carried out on the bund. Since the waste material dumped is allowed to assume its own angle of repose, hazards due to collapse of slopes are minimized. The dump yards are being formed such that the maximum height will not exceed 19 metres. When it exceeds 30 metres, it will be adequately benched.

## **RECLAMATION OF DUMP YARDS**

The topsoil and other waste mainly marl clay and sandy clay will be stored separately in the dumping grounds meant for them. The topsoil excavated from the mining area will be utilized for plantation/agri farming.

In the final stage of mining operations, all the dumps will be properly stabilised and afforested. Garland drainage will be provided all along its periphery.

### **Green Belt Development:**

Vegetation cover in and around the mine workings generally helps in:

1. Stabilizing slopes and preventing erosion,
2. Dust control,
3. Enhancement of aesthetic value,
4. Minimizing surface run off and
5. Reducing noise

The optimum size of green belt is usually determined on the basis of expected pollution loads from the mine, wind direction, mine surroundings, availability of land, and the economics of green belt development and maintenance.

- Plantation program should be undertaken in all available areas. This should include plantation in the mine area along the internal and external roads, on solid waste dump yards and along the mine office. It is proposed to do the plantation over an extent of 50 hectares of which 13 hectares will be refilled area.

### **After care measures**

Fencing and hedges will be provided around the area to prevent entry of cattle. Watering of the plant will be done by channeling the mine water. Wherever possible, pipes will be laid to supply water for plants. Tankers will also be used to water the plantation.

### **CRUSHING**

The ROM limestone will be transported to Crusher, which is proposed to be established just adjacent to the proposed mining area. The lead distance between the main entrance of the mine to the crusher hopper will be around 400 metres. It is proposed to establish two separate crusher having the capacity of 2000 tph and 400 tph for limestone and additive respectively. It is proposed to deploy HazeMag ModelIAPPMH-2530/GSK rotary impact crusher for limestone crushing and Bedeschi make crusher for additive crushing. The out put size of both the crushers will be around –80 mm in size. The crushed material will be conveyed by a belt and will pass through the Gamma Matrix Cross belt analyser, which analyse the bulk material which is capable of analyzing 13 different radical in both limestone and additives.

### **CROSS BELT ANALYSER**

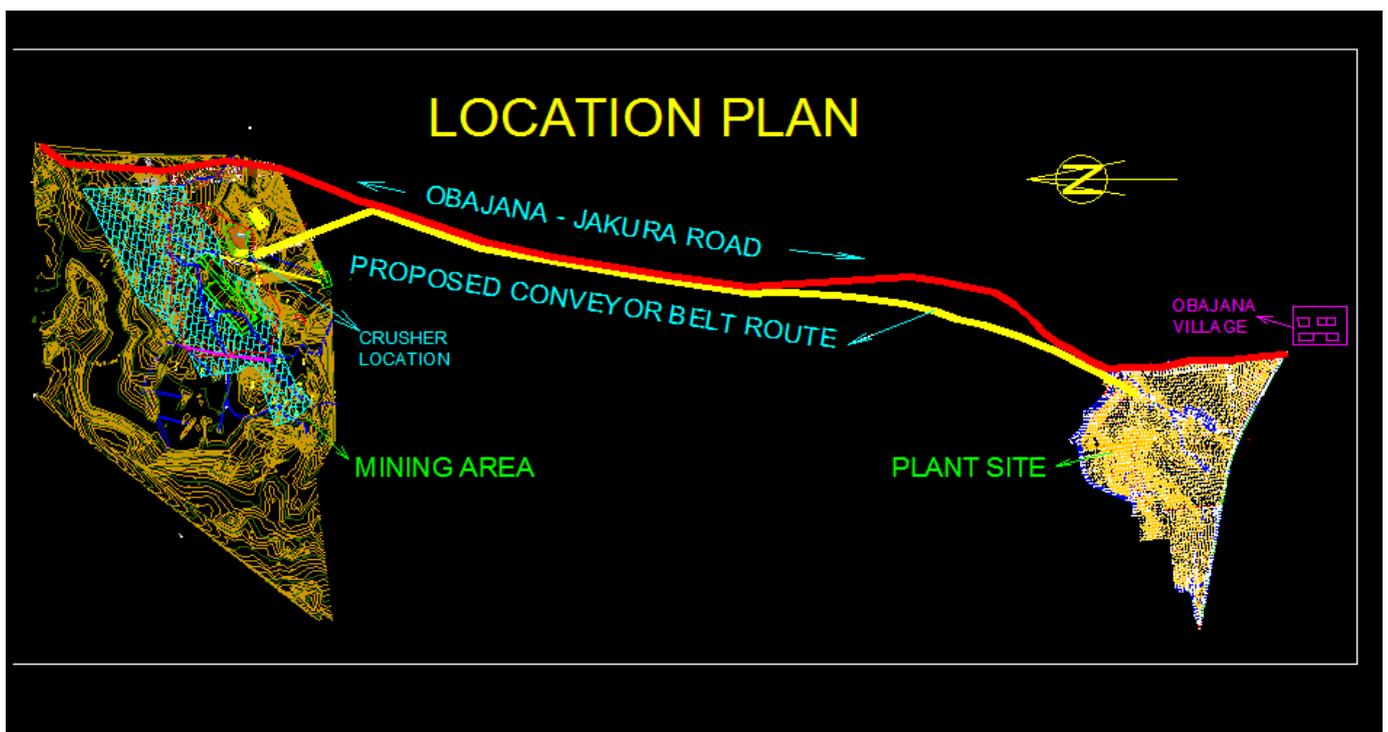
It is an on-line analyzer. It is working on the principle of PGNAA (Prompt Gamma Neutron Activation Analysis). It consists of a radioactive source, Californium 252. The source continuously emits gamma rays. As the limestone is passed through this analyzer, it is exposed to gamma rays. The Gamma rays reflected by the material varies with different elements. The intensity of the reflected rays is detected by Sodium Iodide crystal detectors. The detectors are further connected with the closed electronic circuit, which convert the analog data received from the detectors to digital data. These digital data are again fed to OPCON (Operator Console) from

where all the radical analysis is displayed on minute basis. 13 radical can be analyzed by this system.

### **LONG BELT CONVEYOR**

The crushed material of both additive and limestone will be transported from crusher after getting analysed by cross belt analyser to by along belt conveyor of nearly 7.5 km to the plant site. There after handled by Stacker Reclaimer.

Since the mining area is situated about 8.00 Km north of the plant site, a detailed topographical survey has been undertaken for proper alignment and design of the conveyor belt. The topographical map was submitted to M/s Exclusive Technical Service (Pty) Ltd., South Africa, who is supplier for designing, execution and erection of the proposed Long Belt conveyor.



## **Site service:**

### **a) Workshop**

A machinery maintenance workshop is proposed to be established just adjacent to the crusher area. All the major over hauling and regular maintenance will be carried out in this workshop. A mobile workshop van also will be put into service for on the spot repairs etc.

### **b) Power Supply**

At the mines office and workshop, required electrical power will be supplied from captive D.G sets.

### **c) Water Supply**

Required water for machineries servicing and drinking purposes will be provided at the workshop and Mines office. A water tanker will be utilised for water supply and to suppress the dust along haul roads and crusher area.

### **d) Mines Office**

An office for the General Manager (Mines), Managers and his supporting staff including shift Engineers is constructed near the mines site. First aid facilities will be provided in the office.

### **e) Stores for spares**

Essential spares for repair works will be housed in a separate room within the workshop proposed at mines site. The centralized stores at the plant site maintains the inventory and supply to the site workshop in the mines.

### **Conclusion**

The Management will take all possible efforts to keep the Environment in acceptable norms and carry out mining with safe and economical method to utilize the mineral reserves.