IMPACT ASSESSMENT REPORT

SUBMITTED FOR SEEKING RECOMMENDATION OF STANDING COMMITTEE OF NBWL / SBWL

FOR

GRANITE BUILDING STONE QUARRY UNIT OF

M/s. RUDRA GRANITES

NON FOREST LAND

QUARRY LEASE AREA – 4.9531 Hectares

OBTAINED ENVIRONMENTAL CLEARANCE UNDER EIA NOTIFICATION 2006

SCHEDULE SL. NO. 1 (A): CATEGORY 'B2'

FROM

SEIAA KERALA

No. 823/SEIAA/EC1/2606/2015 Dated: 09.08.2016 for an Extent of 4.9531 Hectares

APPLICANT DETAILS

Mr. Dineshmon .N.T,

Proprietor

M/s. Rudra Granites

Neenduthalakkal House, Muttikkal, Kundukadu Post,

Thrissur District, Kerala - 680 028

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1. INTRODUCTION –

Granite Building Stone Quarry Project of M/s. Rudra Granites is a Proprietorship Firm owned by Mr, Dineshmon .N.T. The applicant obtained Environmental Clearance vide Environmental Clearance Order No. 823/SEIAA/EC1/2606/2015 Dated: 09.08.2016 for an Extent of 4.9531 Hectares in Survey No. 1244/1 of Killanur Village, Thrissur Taluk & District, Kerala State.

As per MoEF & CC Draft Notification S.O. 657 (E) Dated: 03.03.2016; Peechi – Vazhani Wildlife Sanctuary is located between the North Latitudes 10° 27' 58.13" and 10° 40' 29.4" and East Longitudes 76° 17' 35.23" and 76° 29' 34.78" in Thrissur District of the state of Kerala and is spread over an area 125 square kilometres.

As per Office Memorandum No. 1-20/2014/WL (Pt) Dated: 01.05.2015; Office Memorandum F.No. J-11013/41/2006-IA.II (I) (Part) Dated: 30.03.2015 & Office Memorandum No. J-11013/41/2006-IA.II (I) Dated: 02.12.2009 – *"While granting environmental clearance to projects involving forest land, wildlife habitat & or located within 10 km from National Park/ Wildlife Sanctuary, a specific condition shall be stipulated that environmental clearance is subject to their obtaining prior clearance from forestry and wildlife angle including clearance from the standing committee of the National Board for Wildlife as applicable."*

M/s. Rudra Granites Company proposes to obtain recommendation of Standing Committee of NBWL / SBWL for the above mine from Ministry of Environment, Forests & Climate Change (MoEF & CC), Govt. of India, New Delhi as the project falls at an distance of 6.40 km from Peechi – Vazhani Wildlife Sanctuary.

Details of the project & Identification of Project Proponent –

Address of the lessee	Mr. Dineshmon .N.T, Proprietor M/s. Rudra Granites Neenduthalakkal House, Muttikkal, Kundukadu Post, Thrissur District, Kerala - 680 028 E-Mail: rudragranitesmanager@gmail.com Phone: +91 9447813030, +91 9744766116

Address of Mine	Survey No. 1244/1 (P) Killanur Village, Thrissur Taluk & District, Kerala State Extent – 4.9531 Hectares

Project Nature, Size and Location –

Nature –

The project is mining of Granite Building Stone in the sanctioned lease area of 4.9531 ha. The method of mining is semi mechanized open cast mining method for the production of Granite Building Stone.

Size –

The proposed production of mine is 2, 28,000 tonnes per annum of Granite Building Stone. The anticipated life of mine will be 16 years as per targeted production.

Location –

The mining area is located in Killanur Village of Thrissur Taluk & District, Kerala. The area is located at a distance of 11 km SW from the district headquarters Thrissur. The mine lease area falls under the Toposheet No. 58B/6 bearing Toposheet details.

Geo-coordinates:

Sl. No.	Latitude Longitude (WGS-84)
1	10°35’11.76”N 76°15’30.17”E
2	10°35’15.00”N 76°15’36.02”E
3	10°35’12.11”N 76°15’37.63”E
4	10°35’11.48”N 76°15’37.96”E
5	10°35’07.99”N 76°15’39.29”E
6	10°35’04.69”N 76°15’33.78”E

2. PROJECT DESCRIPTION –

- The Mine Lease area over an extent of 4.9531 Hectare is located in Survey No. 1244/1 (P) at Killanur Village, Thrissur Taluk, Thrissur District and Kerala State.
- Topographically; the area is hilly with slope towards North West.
  Latitude - 10° 35’ 04.69” N to 10° 35’ 15.00” N and
  Longitude - 76° 15’ 30.17” E 76° 15’ 39.29” E
- The applied area is Patta Land
- Project has provided direct employment opportunities to 30 peoples and indirect employment opportunities within the surrounding region for about 20 peoples in the field of Mineral transport, service sector, garages, shops/canteen, etc.,
- Greenbelt development is proposed by planting native species around the lease area.
- The project does not require power supply for the mining operations, but Electricity for use in office premises and other internal infrastructure will be obtained from SEB. The Mining activity is proposed during day time only General Shift 8 AM – 5 PM (Lunch Break 1 PM – 2 PM).
- The Project Site is well connected to
  - National Highway– (NH-47) Salem – Kochi – Kanyakumari which is about 5.6 km South East
  - State Highway – (SH-22) Thrissur - Shoranur Road which is about 4.9 km Western side
  - Railway Station – Mulagunnathukavu Railway Station at 5.8 km North West
  - Airport – Cochin International Airport at 50.3 km South East
- There is No Critically Polluted Areas as identified by the Central Pollution Control Board constituted, Interstate boundaries and International Boundaries, besides there are No National Parks, Reserve forest, Biosphere Reserves, Elephant Corridors, Mangrove Forest, Archeological Monuments, Heritage Site etc. within 10 km Radius from Project Site.
- The Nearest water bodies Peechi Irrigation Project RBMC Canal (150 meters West), Poomala Dam (2.1 km North East) & Thanikkudam River (1.22 km South East)
- **Peechi-Vazhani Wildlife Sanctuary at 6.4 km North East**

- The proponent has been carrying out CSR Activities in various fields for social welfare around the project site and will continue to do.
- The Seismic Sensitivity of the project area is categorized as Zone III, Moderate Risk Zone as per BMTPC, Vulnerability Atlas of Seismic Zone of India IS: 1893 – 2002.

Existing Land Use Pattern –

Sl.No.	Particular	Before Mining Plan Period (in ha)	Mining Plan Period (in ha)	Conceptual Period (in ha)
1	Area Under Quarrying	1.1151	2.3797	4.3108
2	Infrastructure	0.0000	0.0000	0.0000
3	Greenbelt Development	0.0000	0.6423	0.6423
4	Unutilized Area	3.8380	1.9311	0.0000
Total		**4.9531**	**4.9531**	**4.9531**

Details of Post Mining Land Use –

Sl.No.	Activity	Extent in ha	Post Mining Land Use Type	Extent in ha
1	Area under Quarrying	4.3108	Water Storage Pond	0.4953
			Backfilling	3.8155
2	Greenbelt Development	0.6423	Greenbelt development	0.6423
Total		**4.9531**	**Total**	**4.9531**

3. DESCRIPTION OF THE ENVIRONMENT –

Baseline data generation forms a part of the Environment Impact Assessment Study, which helps to evaluate the predicted impacts on the various environmental attributes and helps in preparing an Environmental Management Plan (EMP) outlining the measures for improving the environmental quality and scope of future expansions for environmentally sustainable development.

Baseline data was generated for various environmental parameters including air, water (surface and ground water), land and soil, ecology and socio-economic status to determine quality of the prevailing environmental settings. The Base Line Study was conducted during summer season on 28.05.2015 & Monitoring Study was carried out again during summer season on 20.04.2019 and continuous 6 monthly compliance monitoring is been carried out for the stipulated Environmental Clearance Conditions.

3.1 Land Environment

Land environment is a significant criterion which gets degraded due to mining activity. The extent of degradation varies with respect to the topography of the area, soil texture, geology of the terrain and the method of mining. The degraded lands have significant effect in the watershed and drainage pattern vegetation and ecology of the area.

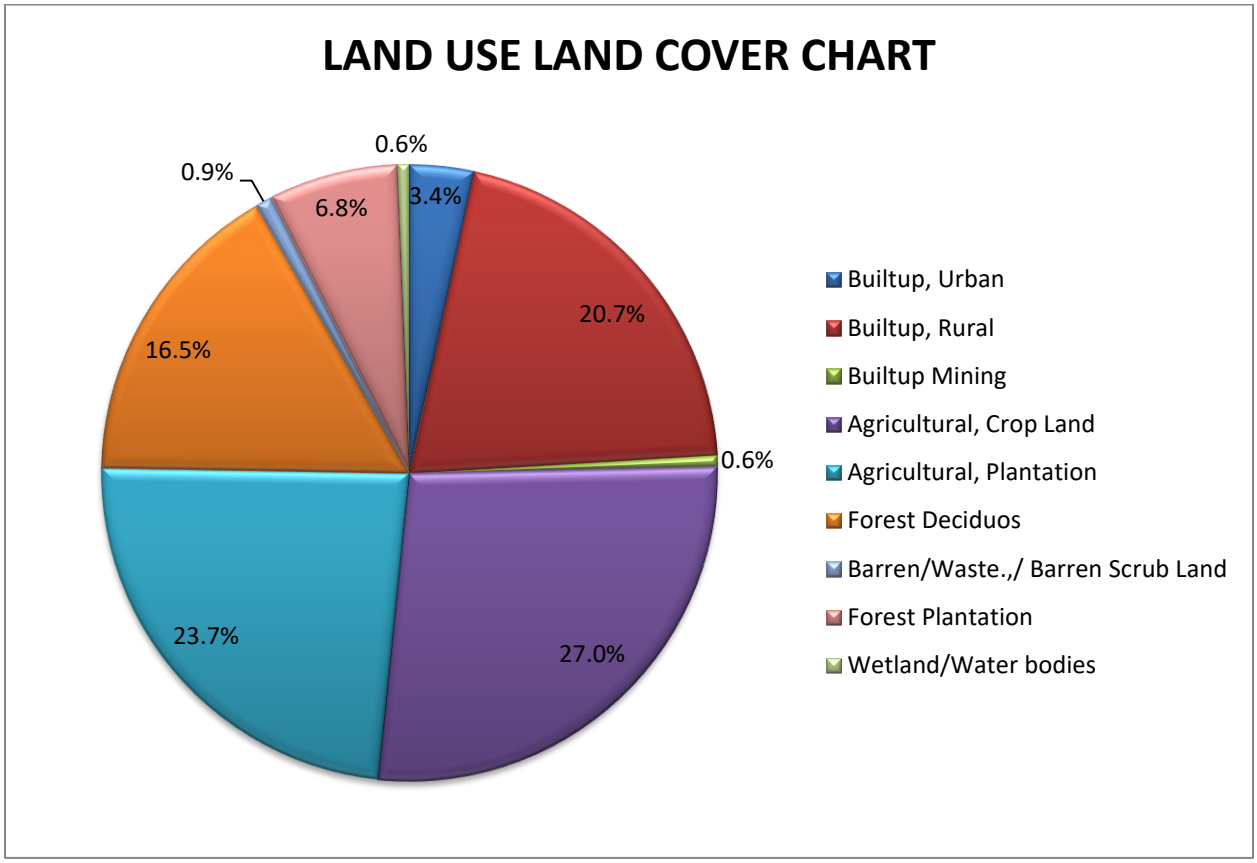
A visual interpretation technique has been adopted for land use classification based on the keys suggested in the chapter – V of the guidelines issued by NNRMS Bangalore. Level III classification with 1:50,000 scale for the preparation of land use mapping.

Land use pattern of the area was studied through LISS III imagery of Bhuvan (ISRO). The 10 km radius map of study area was taken for analysis of Land use cover.

Since the mining is carried out by opencast mechanized mining method, studies on land environment of eco-system play an imperative role in identifying susceptible issues and taking appropriate action to uphold ecological equilibrium in the region. The main objective of this section is to provide a baseline status of the study area covering 10 km radius around the mine site so that temporal changes due to the mining activities on the surroundings can be assessed in future.

LAND USE COVER TABLE 10 km RADIUS

Sl.No.	Classification	Area In Ha	Area in %
1	Builtup, Urban	1090	3.4
2	Builtup, Rural	6690	20.7
3	Builtup Mining	180	0.6
4	Agricultural, Crop Land	8708	27.0
5	Agricultural, Plantation	7637	23.7
7	Forest Deciduos	5315	16.5
8	Barren/Waste.,/ Barren Scrub Land	280	0.9
9	Forest Plantation	2190	6.8
11	Wetland/Water bodies	200	0.6
	Total	32,290.00	100.00



Interpretation

Land use pattern of the area was studied through the Bhuvan (ISRO) by covering 10 KM radius from the periphery of the project site. Majority of the land covered in the study area is Agriculture & Commercial Plantation Land – 27.0% & Mining Area – 0.6% from this Total Mining area the project area covers 0.55%. Existing land use pattern of the project area is Patta Land & No Forest Land is involved.

Soil Environment

To assess the impact due to mining activity on soil, in and around the study area, the effect on agricultural field, baseline soil quality of the area has been estimated with respect to physical and chemical parameters, the physical properties of soil, which are important for plant growth and agricultural productivity is – texture, bulk density, moisture content and water holding capacity. The chemical parameter, which governs growth performance of crops and plant, are pH, EC, N, P, K and organic carbon.

In the view of above, efforts were made to collect the samples in such a way that it is fully representative of the whole field. Only one to ten gram of soil is used for each chemical determination and represents as accurately as possible the entire surface 0-22 cm of soil.

Sampling and Analytical Techniques –

2 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features. At each location, soil samples were collected from 3 different depths viz., 0-30 cm, 30-60 cm and 60-100 cm below the surface and are homogenized. The homogenized samples were analyzed for physical and chemical characteristics. The samples were collected and analyzed once during summer season in the month of April, 2019.

The samples have been analyzed as per the established scientific methods for physicochemical parameters of soil prescribed by agricultural institution. The methodology adopted for each parameter is described in below –

Analytical Techniques for Soil Analysis

Parameter Studied	Method Adopted & Instruments Used
Preparation of dry soil samples for various tests	IS:2720 (Part1) 1983 Re-1995
Textural classification	Sieve Shaker Sieve analysis through sieve shaker IS:2720 (Part4) 1985 Re 1995
Water holding capacity (WHC)	IS:14765
Bulk Density (BD)	IS:2720 Part XXIX (1975)
pH	pH meter IS:2720 (Part XXVI) 1987 Re.1997
Electrical conductivity	Conductivity meter IS: 14767
Organic Carbon (OC)	IS: 2720 Part XXII (1972)
Available Nitrogen	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Available Phosphorus	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Available Potassium	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Zinc (Zn)	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Iron (Fe)	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Manganese (Mn)	Pharo 300 Spectroquant UV/VIS Spectrophotometer
Copper (Cu)	Pharo 300 Spectroquant UV/VIS Spectrophotometer

SOIL QUALITY MONITORING DATA

Sl. No.	PARAMETERS	UNITS	S1 North Side of Project Area	S2 Killanur Village
1	Soil Colour	-	Light Brown	Light Brown
2	Soil Texture	-	Silty Clay	Silty Clay
3	Clay	%	28	32
	Slit		35	36
	Sand		37	32
	Moisture		45	48
4	Water Holding Capacity	-	Medium	Medium
5	Porosity	%	22	24
6	Bulk Density	gm/cc	1.26	1.29
7	pH @ 25^{o}C	-	6.94	7.10
8	Electrical Conductivity @ 25^{o}C	µS/cm	159	168
9	Total Kjeldahl Nitrogen	kg/ha	128	136
10	Available Phosphorous	kg/ha	1.32	1.38
11	Soluble Potassium as K	mg/kg	68.48	66.94
12	Organic Carbon	%	1.05	1.15
13	Organic Matter	%	1.85	1.90
14	Chloride as Cl^-	gm/100g	4.75	4.95
15	Sodium Absorption Ratio	-	1.19	1.05
16	Soluble Calcium & Magnesium	gm/100g	13.60	13.18
17	Soluble Sodium as Na	gm/100g	1.07	0.95
18	Sulphate as SO_4^-	gm/100g	6.90	7.05
19	Calcium	gm/100g	4.80	5.80
20	Calcium Carbonate as $CaCO_3$	gm/100g	16.34	16.90
21	Nitrate	gm/100g	5.99	4.18
22	Iron	gm/100g	0.22	0.35
23	Zinc	gm/100g	2.74	2.19
24	Copper	gm/100g	0.20	0.22
25	Nickel	gm/100g	0.07	0.05
26	Cadmium	gm/100g	0.06	BDL (DL: 0.01)
27	Chromium	gm/100g	0.15	0.28
28	Lead	gm/100g	0.08	0.09

Standard Soil Classification –

Bulk density –

Soil Texture	Ideal bulk densities for plant growth (grams/cm^3)	Bulk densities that affect root growth (grams/cm3)	Bulk densities that restrict root growth (grams/cm3)
Sands, loamy sands	< 1.60	1.69	>1.80
Sandy loams, loams	<1.40	1.63	>1.80
Sandy clay loams, clay Loams	<1.40	1.60	>1.75
Silts, silt loams	<1.40	1.60	>1.75
Silt loams, sily clay loams	<1.40	1.55	>1.65
Sandy clays, silty clays, clay loams	<1.10	1.49	>1.58
Clays (>45% clay)	<1.10	1.39	>1.47

Source: Guide for Educator, USDA-NRCS

Water holding capacity (WHC) in soil –

LOW (<45%) Medium (45-60%) High (>60%)

pH

Sl.No.	pH	Soil alkalinity class
1	6.5-7.5	Neutral
2	7.5-8.0	Mildly alkaline
3	8.0-8.5	Moderately alkaline
4	>8.5	Strongly alkaline
(Brady, 2001)		

Nutrients –

Sl. No.	Nutrient	Low	Medium	High	Limits Proposed by
1	Organic carbon (%)	<0.5	0.5-0.75	>0.75	Ramamurthy & Bajaj 1969
2	Available N (kg ha -1)	<280	280-560	>560	
3	Available P2O5 (kg ha-1)	<22.4	22.4-56	>56	Muhr et al., 1965
4	Available K2O (kg ha-1)	<168	168-336	>336	

Electrical Conductivity-

Sl. No.	EC (dSm-1)	Soil salinity class
1	0-2	Non-saline
2	2-4	Slightly saline
3	4-8	Moderately saline
4	8-16	Strongly saline
5	>16	Very strongly saline
(Soil Survey Division Staff, 1995)		

Parameter	Low	Medium	High
Cu	<0.2	0.2-1.0	>1.0
Fe	<4.5	4.5-10.0	>10.0
Mn	<5	5-10	>10
Zn	<0.8	0.8-2.0	>2.0

Interpretation –

Soil sampling locations were selected and analysed. The physical properties of the soil samples were examined for texture, bulk density, porosity and water holding capacity. The predominant soil type in the study area is "Silty Clay", the soil was observed moderately alkaline with pH 6.94 to 7.10 & moisture content of the soil is 45 to 48%. The fertility of the soil in the area is medium and commercial plantation activities are carried out in the study area.

3.2 Water Environment –

The water resources, both surface and groundwater play a significant role in the development of the area. Selected water quality parameters of surface and ground water resources in the study area have been studied for assessing the water environment and evaluate anticipated impact on continuation of the mining project. Understanding the water quality is essential in preparation of Environmental Impact Assessment Report and to identify critical issues with a view to suggest appropriate mitigation measures for implementation. The purpose of this study is to assess the water quality characteristics for critical parameters and evaluate the impacts on agricultural productivity, domestic community usage, recreational resources and aesthetics in the vicinity. The water samples were collected and transported as per the norms in pre-treated sampling cans to laboratory for analysis.

Standard Operating Procedures (SOP) For Water Sampling

Parameter	Sample Collection	Sample Size	Storage/ Preservation
pH	Grab sampling Plastic /glass container	50 ml	On site analysis
Electrical Conductivity	Grab sampling Plastic /glass container	50 ml	On site analysis
Total suspended solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
Total Dissolved Solids	Grab sampling Plastic /glass container	100 ml	Refrigeration, can be stored for 7 days
BOD	Grab sampling Plastic /glass container	500 ml	Refrigeration, 48 hrs
Hardness	Grab sampling Plastic /glass container	100 ml	Add HNO3 to pH<2, refrigeration; 6 months
Chlorides	Grab sampling Plastic /glass container	50 ml	Not required; 28 days
Sulphates	Grab sampling Plastic /glass container	100 ml	Refrigeration; 28 days
Nitrates	Plastic containers	100 ml	Refrigeration; 48 hrs
Fluorides	Plastic containers only	100 ml	Not required; 28 days
Alkalinity	Plastic/ glass containers	100 ml	Refrigeration; 14 days
Ammonia	Plastic/ glass containers	100 ml	Add H2SO4 to pH>2, refrigeration, 28 days
Heavy Metals (As, Cd, Mn, Cu, Fe, Zn, Pb etc.)	Plastic/ Glass rinse with 1+1 HNO3	500 ml	Filter, add HNO3 to pH>2; Grab sample; 6 months

Source: Standard Methods for the Examination of Water and Wastewater, Published By APHA, AWWA, WEF 19th Edition, 1995

WATER SAMPLE LOCATIONS

1 groundwater samples & 2 surface water samples were collected from the study area for the monitoring and assessment of water quality

GROUND WATER SAMPLING DATA

Sl.No.	Parameter	Unit	BW1	IS 10500 : 2012	
				Acceptable Limit	Permissible Limit
			Organoleptic and Physical Parameters		
1	Color	Hazen	< 5	5.00	15
2	Odour	-	Agreeable	Agreeable	Agreeable
3	Temperature	^{o}C	29		
4	pH value	-	7.29	6.5-8.5	No relaxation
5	Electrical Conductivity	µs/cm	588.2	-	-
6	Total Suspended Solids	-	9	1	5
7	Taste	-	Agreeable	-	-
8	Total dissolved solids	mg /l	376.5	500.00	2000
			General Parameters Concerning Substances Undesirable in Excessive Amounts		
9	Sodium (as Na)	mg /l	23	-	-
10	Calcium (as Ca)	mg /l	14	75	200
11	Chloride (as Cl)	mg /l	28	250	1000
12	Copper (as Cu)	mg /l	BDL	0.05	1.5
13	Fluoride (as F)	mg /l	0.3	1.0	1.5
14	Free residual chlorine	mg /l	BDL	0.2	1
15	Iron (as Fe)	mg /l	0.3	0.3	No relaxation
16	Magnesium (as Mg)	mg /l	40	30	100
17	Manganese (as Mn)	mg /l	BDL	0.1	0.3
18	Oil & Grease	mg /l	BDL	0.5	No relaxation
19	Nitrate (as NO3)	mg /l	2.0	45	No relaxation
20	Phenolic compounds (as C6H5OH)	mg /l	Absent	0.001	0.002
21	Selenium (as Se)	mg /l	BDL	0.01	No relaxation
22	Sulphate (as SO4)	mg /l	13	200	400
23	Sulphide (as H2S)	mg /l	BDL	0.05	No relaxation
24	Total hardness (as CaCO3)	mg /l	199	300	600
25	Zinc (as Zn)	mg /l	BDL	5	15
26	Carbonate (as CO3)	mg /l	2.2	-	-
27	Bicarbonate (as HCO3)	mg /l	244	-	-
28	Potassium (as K)	mg /l	8	-	-
			Parameters Concerning Toxic Substances		
29	Cadmium (as Cd)	mg /l	BDL	0.003	No relaxation
30	Cyanide (as CN)	mg /l	Absent	0.05	No relaxation
31	Lead (as Pb)	mg /l	BDL	0.01	No relaxation
32	Mercury (as Hg)	mg /l	BDL	0.001	No relaxation
33	Nickel (as Ni)	mg /l	BDL	0.02	No relaxation
34	Total arsenic (as As)	mg /l	BDL	0.01	0.05
35	Total chromium (as Cr)	mg /l	BDL	0.05	No relaxation
			Parameters Concerning Radioactive Substances		
36	Alpha emitters	Bq/l	BDL	0.1	No relaxation
37	Beta emitters	Bq/l	BDL	1.0	No relaxation

SURFACE WATER SAMPLING DATA

Sl. No.	Parameter	Unit	SW1	SW2	CPCP Designated Best Use
1	Colour	Hazen	5	5	300
2	Total Suspended Solids	NTU	Passed	Passed	Not specified
3	pH	-	6.81	6.51	6.5-8.5
4	Conductivity	-	680.7	605.4	Not specified
5	Total Dissolve Solids	mg/l	435.7	387.5	1500
6	Total hardness (as CaCO3)	mg/l	206	183	Not specified
7	Calcium (as Ca)	mg/l	30	22	Not specified
8	Magnesium (as Mg)	mg/l	32	34	Not specified
9	Sodium (as Na)	mg/l	26	24	Not specified
10	Potassium (as K)	mg/l	12	10	Not specified
11	Carbonate (as CO3)	mg/l	12.5	13.9	Not specified
12	Bicarbonate (as HCO3)	mg/l	245	210	Not specified
13	Chloride (as Cl)	mg/l	32	38	600
14	Sulphate (as SO4)	mg/l	31	24	400
15	Nitrate (as NO3)	mg/l	14	11	50
16	Fluoride (as F)	mg/l	0.8	0.4	1.5
17	Phenolic compounds (as C6H5OH)	mg/l	Absent	Absent	0.005
18	Cyanide (as CN)	mg/l	Absent	Absent	0.05
19	Nickel (as Ni)	mg/l	BDL	BDL	Not specified
20	Total arsenic (as As)	mg/l	BDL	BDL	0.2
21	Cadmium (as Cd)	mg/l	BDL	BDL	0.01
22	Total chromium (as Cr)	mg/l	BDL	BDL	0.05
23	Iron (as Fe)	mg/l	0.4	0.2	50
24	Copper (as Cu)	mg/l	BDL	BDL	1.5
25	Lead (as Pb)	mg/l	BDL	BDL	0.1
26	Manganese (as Mn)	mg/l	BDL	BDL	Not specified
27	Mercury (as Hg)	mg/l	BDL	BDL	Not specified
28	Zinc (as Zn)	mg/l	BDL	BDL	15
29	Sulphide (as H2S)	mg/l	BDL	BDL	Not specified
30	COD	mg/l	11	24	Not specified
31	BOD, 27°C 3 days	mg/l	3	2	3
33	Oil & Grease	mg/l	BDL	BDL	0.1

* IS: 10500:2012-Drinking Water Standards; # within the permissible limit as per the WHO Standard. The water can be used for drinking purpose in the absence of alternate sources. Note: SW- Surface water, GW – Ground water.

Interpretation:

Surface Water Quality –

The surface waters were monitored with neutral pH in the range 6.51 to 6.81 with agreeable colour, the TDS values were monitored in the range of 387.5 to 435.7 mg/l, the Chloride values ranging from 32 to 38 mg/l, the iron content was found to be in the range of 0.2 to 0.4 mg/l and the hardness varies from 183 to 206 mg/l.

The Oil & Grease, Cyanides, Sulphide and insecticides were found to be absent. Trace metals were found to be below the detectable limits.

The COD level ranges from 11 to 24 mg/l and BOD 2 to 3 mg/l which clearly indicates that the surface water has not been polluted due to the mining activity. On the whole it is inferred that the surface water were found within the prescribed CPCB norms for surface water. The designated best use classification – can be categorized as class C (Drinking water source with conventional treatment followed by disinfection)

Ground Water Quality –

At present the mining operations is carried out above the ground water table. The pH is 7.29 and the Electric Conductivity is 588.2 µs/cm; The Total Dissolved Solids ranged is 376.5 mg/l; Chloride were found to be 28 mg/l; the iron content was found to be 0.3 mg/l and the hardness is 199 mg/l. All the water sample were observed to be well within the limits as per IS-10500:2012.

The heavy metal content has been found to be well within the limit. The physio-chemical and biological analysis revealed that these waters are well within the prescribed limits as per CPCB standard.

3.3 Air Environment –

Meteorology (Climate) –

Thrissur's climate is classified as tropical. Most months of the year are marked by significant rainfall. The short dry season has little impact. This climate is considered to be Am according to the Köppen-Geiger climate classification. The average annual temperature is 27.6 °C in Thrissur. About 3001 mm of precipitation falls annually. Precipitation is the lowest in January, with an average of 2 mm. The greatest amount of precipitation occurs in July, with an average of 760 mm. At an average temperature of 29.9 °C, April is the hottest month of the year. The lowest average temperatures in the year occur in July, when it is around 25.7 °C. Between the driest and wettest months, the difference in precipitation is 758 mm. The variation in temperatures throughout the year is 4.2 °C.

Air quality Monitoring -

Ambient Air quality Stations were selected based on the Predominant downwind direction in respect to the project site. Ambient Air Quality Monitoring (AAQM) Station were selected by considering the wind rose pattern for pre-monsoon season and the accessibility of the selected sites.

METHODOLOGY AND INSTRUMENT USED FOR AIR QUALITY ANALYSIS

Parameter	Method	Instrument
$PM_{2.5}$	Gravimetric Method Beta attenuation Method	Particulate Sampler
PM_{10}	Gravimetric Method Beta attenuation Method	Particulate Sampler
SO_2	IS-5182 Part II (Improved West & Gaeke method)	Particulate Sampler with gaseous attachment
NO_x	IS-5182 Part II (Jacob & Hochheiser modified method)	Particulate Sampler with gaseous attachment
Free Silica	NIOSH – 7601	Visible Spectrophotometry

Season Non monsoon – (March 2019)

Total No of locations – 2

Total No of Samples – 2 (24 hourly)

PM_{10} Values in $\mu g/m^3$ –

	AAQ1	AAQ2
Min	33.5	30.5
Max	60.5	56.8

$PM_{2.5}$ Values in $\mu g/m^3$ –

	AAQ1	AAQ2
Min	28.2	20.4
Max	36.9	32.1

SO_2 Values in $\mu g/m^3$ –

	AAQ1	AAQ2
Min	4.2	4.1
Max	8.3	9.0

NO_x Values in $\mu g/m^3$ –

	AAQ1	AAQ2
Min	12.6	9.8
Max	19.6	20.8

Note: Free Silica was also monitored at all locations during the study period and was found Below Detectable Limit (BDL).

The concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are observed to be well within the NAAQ standards prescribed by Central Pollution Control Board (CPCB) for industrial, residential, rural & other areas.

Interpretations:

While comparing with the **National Ambient Air Quality (NAAQ) Standards revised as per GSR 826(E) Dated: 16.11.2009**, all monitored values were found to be well within the prescribed limit values for 24-hourly periods for Industrial, Residential, Rural and other Areas.

3.4 Noise Environment –

Noise level monitoring in the study area was carried out 60 minutes during over a period of 24 Hours as per the Ambient Noise quality standards under environmental (protection) Act 1986.

Instrument Used for Monitoring

Noise levels were measured using a sound level meter (LUTRON/ SL - 4030). The sound level meter measures the Sound Pressure Level (SPL), the Maximum Sound Pressure Level (max) and the equivalent continuous noise level (Leq) by switching on the corresponding functional modes.

Method of Monitoring

Sound Pressure Level (SPL) measurements were taken at the specified locations, with an interval of 60 minutes over a period of 24 hours as per the Ambient Noise quality standards notified under Environmental (Protection) Act 1986. The noise levels during day time have been monitored between 6 am to 10 pm and night noise levels during 10 pm to 6 am at all the locations covered in the study area. To obtain noise levels at 8 AM, noise readings, with setting at 'A' response - slow mode, were recorded continuously for every 1 hour. All the readings were obtained for 24 hours.

Parameters Measured During Monitoring

For noise levels measured over a given period of time interval, it is possible to derive important features of noise using statistical methods.

L_{day} Average noise levels between 6.00 hours to 22.00 hours.

L_{night} Average noise levels between 22.00 hours to 6.00 hours.

Presentation of Results

Core Zone –

- The day equivalents during the study period 51.9 dB (A).
- The night equivalents 47.7 dB (A).

Buffer Zone –

- The day equivalents during the study period 50.5 dB (A).
- The night equivalents 43.9 dB (A).

From the results, it can be seen that the Day equivalents and the Night equivalents were within the Ambient Noise Standards of Industrial / Commercial / Residential Area.

3.5 Biological Environment –

Peechi – Vazhani Wildlife Sanctuary is located at a distance of 6.40 km North east.

Location: 76º 18’ and 76º 28’ East Longitude and 10º 28’ and 10º 38’ North Latitude.

Area: 125 sq. km.

Year of formation: 1958(GO(MS)871/58/06.08.1958)

Climate: Temperature varies from 15º to 38º C. Hottest period is March – April and coolest period is Dec- January.

Topography: Altitude ranging from 45 to 900m . Highest Peak is Ponmudi (923m)

Rainfall: Annual average rainfall is 3000mm.

Drainage: There are numerous streams, flowing over the entire PA, which join the three main rivers Kurumali, Manali, and Wadakkanchery. There are three vayals in the sanctuary viz, Paingottupadam (10ha), Pathrakkandam (1ha) and Pothiyadukky (5ha). There are two reservoirs, Peechi and Vazhani formed by construction of two dams across the Manalippuzha and Vadakkancheripuzha. The total area of the two reservoirs is 14.793 sq. km.

Forest Types: Forest Types include Tropical Ever green Forests, Tropical Semi-evergreen forests, Moist Deciduous forests etc.

Bio diversity: Common tree species are Erythrina indica, Eugenia hemispheria,Dalbergia latifolia, palanquium ellipticum, Mesua ferrea, Cullenia excelsa, Dipterocarpus indicus, Hopea parviflora, Dysoxylum malabaricum, Cedrella toona, Bombax ceiba, Syzygium cumini, Largerstroemia lanceolata, Adina cordifolia, Albizzia procera, alstonia scholaris Dalbergia latifolia, Xylia xylocarpa etc

Newly described flora in the sanctuary are Aglalia malabarica, Phaeanthus malabaricus, Tarenna trichurensis, Cotton pedunculata, amomum microstephanum, and Orophea uniflora.

There are 39 species of mammals, 176 sp. of birds, 30 species of reptiles, 17 species of amphibians and 40 species of fishes are reported from the sanctuary.

Tiger, Leopard, sloth bear, Elephant, sambar, barkingdeer, bonnet macaque, Nilgiri langur, slender loris porcupine etc. are found here.

Socio Economics –

Sample survey was carried out to collect qualitative information about the socio-economic environment of the area. The Study area has all basic amenities such as roads, drinking water facilities, township, education institution, temples, medical facilities and electricity facilities and was evident during the site visit.

Though agriculture is the main occupation in the surrounding villages, it has provided employment opportunities to only 50-60% of the families. The remaining population is depended on the other type of employment opportunities mainly as laborers.

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES –

4.1 Land Environment:

In the Opencast Mining method the major impact is Land Environment, The existing land use pattern of the area is rubber plantation and existing pit, No forest land is involved in this project. Total extent of 4.9531 ha is proposed for Mining activity which will have the impact during the mining activity. After end of the mine the mined out pit will be allowed to store the rain water which act as a temporary reservoir.

There is no vegetation found in the project area at present, after the completion of the mining operation the rate of the green belt development will be increased in the project site.

4.2 Water Environment

The proposed depth for the mining operation is well above the water table, there is no intersection of surface water (streams, Canal, Odai etc.,) within the project area.

Mitigation Measures –

- Construction of garland drains to divert surface run – off in to the mining area
- Construction of check dams / gully plugs at strategic places to arrest silt wash off from broken up area.

4.3 Air Environment–

The air borne particulate matter generated by mining operations and transportation is the main air pollutant. The emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_2) contributed by vehicles plying on haul roads will be marginal.

The Predicted maximum Ground level concentration of 24 Hour average of particulate matter concentration is superimposed on the maximum baseline concentration obtained during the study period to estimate the post project scenario, which would prevail at the post operational phase.

The maximum incremental ground level concentration of PM_{10} is 20 $\mu g/m^3$. This shows that the adverse impact of mining outside the ML area is marginal and has no adverse effect on health of human and animals and also on the flora of the area.

Mitigation Measures –

- Water spraying on working face to control dust emission from loading & handling operations
- Water sprinklers along the mine haulage roads to reduce dust generation during plying of HEMM
- Controlled blasting techniques will be implemented
- Periodic water sprinkling on waste dumps and haul roads to minimize dust emissions.
- Practicing wet drilling & Dust mask provision to workers
- Avoiding of overloading of tippers and covering of loaded tippers with tarpaulins during ore transportation
- Green belt development will be carried out to arrest the dust particles.
- Periodical monitoring of air quality to take steps to control the pollutants

4.4 Noise Environment

Noise pollution is mainly due to the blasting, Operation of machineries and Occasional plying of tippers in the mines.

Mitigation Measures –

- In the high noise intensity working areas, earmuffs or earplugs or any other suitable personal protective equipment will be provided to the workers.
- Regular noise level monitoring shall be done periodically for taking corrective action.
- Controlled blasting techniques will be implemented; Noise due to the blasting from the mine site not going to be significant it will be upto a few seconds in the whole day.
- Green belt development around the mine site, office buildings and all along the internal road will be practiced as to create a barrier between the source and the receiver so that the noise is absorbed and the exposure level is minimized.

4.5 Biological Environment

The impact on biodiversity is minimal due to small scale mining operation, Peechi-Vazhani Wildlife Sanctuary at 6.4 km North East which will not have significant impact due to this small scale mining activity.

The impact would be due to dust generated from drilling and blasting activities and emission of gaseous pollutant from HEMM. Adequate dust control measures will be taken to

control dust emission. Thick Greenbelt development will be carried out in the mine area and haul roads to control the dust emission. Besides the air quality standards for PM_{10}, $PM_{2.5}$, SO_2 and NO_x are within the AAQ standards.

4.6 Socio Economic Environment.

Due to this mining activity 30 numbers of skilled and unskilled workers are benefitted through direct employment. About 20 numbers of peoples will be get employment opportunities indirectly. Additional facilities such as medical, educational and infrastructural development will also take place under CSR/CER activities.

Considering the socio – economic and sociological impact it is concluded that the economic level and living standard of the people will generally increase.

5 ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

Site Alternatives –

No alternative site has been proposed as proposed project is site specific in nature and the location of the proposed project is restricted to the geology and mineral deposition of the area.

Mining Technology alternatives –

Mining will be carried out through Open cast mechanized mining method, as it is more economically viable, and preserves the conservation of minerals and environment. Unlike other industries, the project cannot be shifted to other sites.

The project will follow opencast mining method because of surface mineral deposits and to ensure higher mineral conservation. The mining by opencast method will be highly productive & economical as compared to underground method.

6 ENVIRONMENT MONITORING PROGRAM –

Usually an impact assessment study is carried over short period of time and the data cannot bring out all variations induced by natural or human activities. Hence regular monitoring program of Environmental parameters is essential to take into account the changes in the Environment. The Objective of Monitoring -

- To check or assess the efficiency of the controlling measures;
- To establish a data base for future impact assessment studies.

7 ADDITIONAL STUDIES - RISK ASSESSMENT & HAZARD –

The components associated with risk and hazard in this mining case include drilling & blasting, waste dump, heavy earth moving machinery and explosive storage. Measures to reduce and avoid any incidents occurring from the above mentioned components shall be planned and implemented accordingly; this includes measures to avoid the above discussed risk factors. Proper risk management plan will be proposed to avoid any kind of accident/ disaster.

8 PROJECT BENEFITS –

- Improvement in physical infrastructure
- Improvement in Social Infrastructure
- Employment Potential
- Proponents will carry out CSR activities like community awareness program, health camps, Medical aid, family welfare camps etc.,
- A massive plantation will be done in the mine area to mitigate the ill-effects of mining and to improve the vicinity and environment of mine and its surrounding area.

9 ENVIRONMENT MANAGEMENT PLAN –

The Environmental Management Plan (EMP) is a site specific plan developed based on the base line environmental status, mining methodology and environmental impact assessment. In each of the areas of impact, measures have to be taken to reduce potentially significant adverse impacts and where these are beneficial in nature, such impacts are to be enhanced/ augmented so that the overall adverse impacts are reduced to as low level as possible.

The proponent shall organize an Environment Monitoring Cell which is responsible for the management and implementation of the environmental control measures. Basically, this department shall supervise the monitoring of environmental pollution levels like ambient air quality, water quality, soil quality and noise level by appointing approved external agencies.

The working condition in the mines is governed by the enactments of the Director General of Mines Safety (DGMS). The proponent shall take all necessary precautions regarding health and safety of workers as per the guidelines of the Mines Act, sanitary facilities shall be provided within the lease area and periodic health check-up will be carried out to all the workers.

The proponent will carry out CSR activities for overall development of the peoples/society in the area. The activities shall include medical camps, water supply, improvement of school infrastructure, etc., the proponent has been carrying out CSR Activities in various fields for social welfare around the project site.

10 CONCLUSION –

It can be concluded from overall assessment of the impacts, in terms of positive and negative effects on various environmental components, that the mining activities will not have any adverse effect on the surrounding environment.

To mitigate any impacts due to the mining activities, a well-planned EMP and a detailed post project monitoring system is provided for continuous monitoring and immediate rectification at site. Due to the mining activities, socio economic conditions in and around the project site will be improved substantially. Since, the project is accorded with Environmental Clearance considering all the parameters, we request for recommendation from NBWL for continuing our quarrying activities.